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THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

B.Sc. ARTIFICIAL INTELLIGENCE

SYLLABUS

FROM THE ACADEMIC YEAR

2023 – 2024

1. Introduction

B.Sc. Artificial Intelligence

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Artificial intelligence or AI is the science that deals with the development of machines capable of thinking like a human brain. It focuses on the stimulation of human thought and behaviour in machines including learning from data, reasoning, and self-correction. With the advent of technologies and applications (apps) that can gratify our wishes and cravings at the touch of our fingertips, BSc Artificial Intelligence has become a sought after course that offers excellent opportunities in the upcoming field of artificial intelligence and machine learning.

1. Preamble

In pursuit of the Higher Education Department Policy Note 2022-23 Demand 20, Section 1.4, Tamil Nādu State Council for Higher Education took initiative to revamp the curriculum. On 27 July 2022, a meeting was convened by the Member-Secretary Dr. S. Krishnasamy enlightening the need of the hour to restructure the curriculum of both Under-graduate and Post-graduate programmes based on the speeches at the Tamil Nādu Legislative Assembly Budget meeting by the Honourable Higher Education Minister Dr K. Ponmudy and Honourable Finance Minister Dr. P. Thiagarajan. At present there are three different modes of imparting education in most of the educational institutions throughout the

globe. Outcome Based Education, Problem Based Education, and Project Based Education.

Now our Honourable Higher Education Minister announced Industry Aligned Education. During discussion, Member Secretary announced the importance of question papers and evaluation as envisaged by the Honourable Chief Secretary to Government Dr, V. IraiAnbu. This is very well imbedded in Revised Bloom's

Taxonomy forms three learning domains: the cognitive (knowledge), affective(attitude), and psychomotor (skill). This classification enables to estimate the learning capabilities of students. Briefly, it is aimed to restructure the curriculum as student-oriented, skill-based, and institution-industry- interaction curriculum with the various courses under "Outcome Based Education with Problem Based Courses, Project Based Courses, and Industry Aligned Programmes" having revised Bloom's Taxonomy for evaluating students skills. Three domains:

(i) Cognitive Domain
(Lower levels: K1: Remembering ; K2: Understanding ; K3: Applying; Higher levels: K4: Analysing ; K5: Evaluating; K6: Creating)
(ii) Affective Domain
(iii) Psychomotor Domain

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc. Artificial Intelligence**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of

	learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:	**PROGRAM SPECIFIC OUTCOMES (PSOs) Graduates should be able to:** **PSO1**. Arrive at actionable Foresight, Insight from data for solving simple and business problems. **PSO2**. To create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve societal problems **PSO3**. Develop data analytics and data visualization skills, skills pertaining to knowledge acquisition, knowledge representation and knowledge engineering, and hence be capable of coordinating in projects.

	PSO4. Evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains. **PSO5**. To carry out fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Statistics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.

- The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

Value additions in the Revamped Curriculum:

Semester	**Newly introduced Components**	**Outcome / Benefits**
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects

		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors
IV	DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Statistics for Advanced Explain' component will comprise of advanced topics in

		Statistics and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honors degree**		• To cater to the needs of peer learners / research aspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

6. CREDIT DISTRIBUTION FOR UG PROGRAMME

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language – Tamil	3	2.1. Language – Tamil	3	3.1. Language – Tamil	3	4.1. Language – Tamil	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	4	2.3 Core Course – CC III	4	3.3 Core Course – CC V	4	4.3 Core Course – CC VII Core Industry Module	4	5. 3.Core Course CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	4	2.4 Core Course – CC IV	4	3.4 Core Course – CC VI	4	4.4 Core Course – CC VIII	4	5. 3.Core Course –/ Project with viva- voce CC -XII	4	6.4 Elective - VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.4 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.5 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
		2.7 Skill Enhancement Course –SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.6 Value Education	2	6.7 Professional Competency Skill	2
1.7Ability Enhancement Compulsory Course (AECC) Soft Skill-1	2	2.8 Ability Enhancement Compulsory Course (AECC) Soft Skill-2	2	3.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-3	2	4.7 7Ability Enhancement Compulsory Course (AECC) Soft Skill-4	2	5.5 Summer Internship /Industrial Training	2		
1.8 Skill Enhancement - (Foundation Course)	2			3.8 E.V.S	2						
	23		**23**		**24**		**23**		**26**		**21**
	Total Credit Points										**140**

METHODS OF EVALUATION & METHODS OF ASSESSMENT

METHODS OF EVALUATION FOR THEORY SUBJECTS		
Internal Evaluation	Continuous Internal Assessment Test – 10 Marks	**25 Marks**
	Assignments / Snap Test / Quiz – 5 Marks	
	Seminars – 5 Marks	
	Attendance and Class Participation – 5 Marks	
External Evaluation	End Semester Examination	**75 Marks**
Total		**100 Marks**
METHODS OF EVALUATION FOR PRACTICAL SUBJECTS		
Internal Evaluation	Preparation for the Practical Session	**25 Marks**
	Executing an Exercise within the Stipulated Time	
	Continuous Internal Practical Tests	
	Completing All the Exercises of the Course	
External Evaluation	Coding / Solutions for the Two Problems	**60 Marks** (Coding:20+20 marks + Solution:10+10 marks)
	Preparation of the Record	**10 marks**
	Viva	**5 marks**
Total		**100 Marks**

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions require students to recall information from the course content • Knowledge questions usually require students to identify information in the text book.
Understanding (K2)	• Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together
Application (K3)	• Students have to solve problems by using / applying a concept learned in the class room. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question is one that asks the students to break down something into its component parts. • Analyzing requires students to identify reasons cause or motives and reach conclusions or generalizations.

Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem – solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills

B.Sc. ARTIFICIAL INTELLIGENCE

SEMESTER –I

Part	List of courses	Credits	No. of Hrs
Part I	Language – Tamil	3	6
Part II	English	3	6
Part-III	**Core Course** **CC1:** Programming for Problem Solving	5	6
	Core Course **CC2:** Practical - Problem Solving using C Lab	5	5
	Elective Course I (Generic / Discipline Specific) 1. Statistical Methods and its applications 2. Resource Management Techniques	3	5
Part-IV	**Skill Enhancement Course SEC-I** Introduction to HTML	2	2
	Foundation Course - Office Automation	2	2
TOTAL		**23**	**32**

SEMESTER –II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	**Core Courses** & Elective Courses including laboratory [in Total]		
	CC3 – Python Programming	5	5
	CC4 - Practical II – Python Programming Lab	5	5
	Elective Courses(EC2):(Choose one from the following list)		
	i) Numerical Methods	3	

	ii) Discrete Mathematics		
Part-4	**Skill Enhancement Course -SEC-2** Understanding Internet	2	2
	Skill Enhancement Course -SEC-3 PHP Programming	2	2
		23	**32**

SEMESTER-III

Part	**List of Courses**	**Credit**	**No. of Hours**
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	CC5 – Artificial Intelligence	5	5
	CC6 - Artificial Intelligence Lab	5	5
	Elective Courses(EC3):(Choose one from the following list)		
	i) IOT and its Applications	3	
	ii) Introduction to Data Science		5
Part-4	**Skill Enhancement Course -SEC-4** Software Engineering	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) Operating System Design	2	2
	Environmental Studies	**2**	2
		24	**32**

SEMESTER-IV

Part	**List of Courses**	**Credit**	**No. of Hours**
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	**Core Courses** & Elective Courses including laboratory [in Total]		
	CC7 – R Programming	5	5
	CC8 - R Programming Lab	5	5
	Elective Courses(EC4):(Choose one from the following list)		
	i) Data Mining	3	
	ii) Cloud Computing		6
Part-4	**Skill Enhancement Course -SEC-6** Software Project Management	2	2
	Skill Enhancement Course -SEC-7 Data Communication and Networking	2	2
		23	**32**

SEMESTER-V

Part	List of Courses	Credit	No. of Hours
Part -3	CC9 – Machine Learning	3	4
	CC10 –Machine Learning Lab	3	4
	CC11 - Relational Data Base Management System	3	4
	CC12- Practical: RDBMS Lab using Oracle	3	3
	Elective Courses(EC5):(Choose one from the following list)		
	i) Natural Language Processing	3	4
	ii) Cryptography		
	iii) Quantitative Aptitude		
	Elective Courses(EC6):(Choose one from the following list)		
	i) Software Testing	3	4
	ii) Simulation and Modeling		
	iii) Artificial Neural Networks		
	CC13 - Project with Viva voce	4	5
Part-4	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
	Total	**26**	**30**

SEMESTER-VI

Part	List of Courses	Credit	No. of Hours
Part -3	CC14 –Tensor Flow	3	4
	CC15 – Tensor Flow Lab	3	4
	CC16 - Deep Learning	3	5
	CC17- Deep Learning Lab	3	5
	Elective Courses(EC7):(Choose one from the following list)		
	i) Robotics and its Applications	3	5
	ii) Agile Project Management		
	iii) Mobile Adhoc Networks		
	Elective Courses(EC8):(Choose one from the following list)		
	i) Big Data Analytics	3	5
	ii) Financial Analytics		
	iii) Virtual Reality Technology		
Part-4	**Skill Enhancement Course - SEC8** Ethical Hacking	2	2
Part-5	Extension Activity	1	-
	Total	**21**	**30**

Total:140 Credits

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem- I	Sem- II	Sem- III	Sem- IV	Sem- V	Sem- VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	11	11	11	22	18	84
Part IV	6	6	5	8	4	2	31
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	140

*Part I. II , and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

CREDIT DISTRIBUTION FOR U.G.

3 – Year UG Programme Credits Distribution			
		No. of Papers	**Credits**
Part I	Tamil(3 Credits)	4	12
Part II	English(3 Credits)	4	12
Part III	Core Courses (4 Credits)	15	60
	Elective Courses :Generic / Discipline Specific (3 Credits)	8	24
Total			**108**
Part IV	NME (2 Credits)	2	4
	Ability Enhancement Compulsory Courses Soft Skill(2 Credits)	4	8
	Skill Enhancement Courses (7 courses) Entrepreneurial Skill -1 Professional Competency Skill Enhancement Course	1	13 2
	EVS (2 Credits)	1	2
	Value Education (2 Credits)	1	2
Part IV Credits			**31**
Part V	Extension Activity (NSS / NCC / Physical Education)		1
Total Credits for the UG Programme			**140**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	11	11	11	22	18	84
Part IV	6	6	6	7	3	3	31
Part V	-	-	-	-	-	1	1
Total	23	23	23	24	25	22	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

FIRST YEAR – SEMESTER – I

CORE – I: PROGRAMMING FOR PROBLEM SOLVING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC1	**5**	**0**	**0**	**I**	**5**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Recognize the need for programming languages and problem solving techniques
LO2	Apply memory management concepts and function based modularization
LO3	Recognize the bugs in the C program
LO4	Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.
LO5	develop programming skills to solve real time computational problems

Unit	Contents	No. of Hours
I	Introduction to Programming:Introduction to computers, Computer characteristics, Hardware vs software, Steps to develop a program, Software development life cycle, Structured programming, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Error diagnostics, Debugging techniques.	**15**

II	Operators and Expressions: Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator Branching, if-else statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.	**15**
III	Arrays and Strings: Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string, Initialization of strings, Reading and writing a string, Processing the strings.	**15**
IV	Functions: Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion.	**15**
V	Pointers and Structures: Fundamentals, Pointer declarations, Passing pointers to functions, Pointers and one dimensional arrays, Dynamic memory allocation, Operations on pointers, Defining a structure, Processing a structure, Array of structures, Structures and pointers, Self-referential structures.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	The Student can understand the fundamentals of computer and program development process.
CO2	The Student can prepare innovative solution for the problem using branching and looping statements.
CO3	The Student can decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO4	The Student will be able toformulate algorithms and programs using arrays, pointers and structures
CO5	The Student will be able tocreate a new application software to solve real world problems.

Textbooks

1.	Byron Gottfried, “Schaum's Outline of Programming with C”, 3rd edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900
2.	Balagurusamy, E “Programming in ANSI C”, 7th edition, McGraw Higher Ed, 2016, ISBN: 9789339219666

Reference Books

1.	Yashavant Kanetkar, “Let Us C”, 15th edition, 2016, Bpb Publications, ISBN:9788183331630
2.	Herbert Schildit, “The Complete Reference C”, 4th edition, 2017, McGraw Hill Education(India), 2017, ISBN:978007041183

3.	Beulah Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018
4.	Sumitabha Das, "Computer Fundamentals and C Programming", 18th edition, 2018, McGraw Hill Education (India), ISBN:9789387886070
5.	Stephen G. Kochan, "Programming in C", 4th edition, 2015, ISBN: 9789332554665,

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**3**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**3**	**2**	**2**	**2**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**2**	**2**	**3**
Weightageof coursecontributedtoeachPSO	**15**	**15**	**10**	**10**	**10**	**15**

CORE – II: PROBLEM SOLVING USING C – PRACTICAL

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
CC2	**0**	**0**	**5**	**I**	**5**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the need for programming to solve computational problems.
LO2	discover the basic programming constructs to prepare the program.
LO3	Analyze and interpret data using array, functions and pointers
LO4	Recognize the bugs in the C program.
LO5	Apply problem-solving skills to real-world scenarios

List of Exercises

1. Implementation of Basic C programs
2. Simple computational problems using arithmetic expressions and operators
3. Problem solving using branching and logical expressions
4. Iterative problems using Loops, while and for loops
5. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays
6. Implementation of Text Processing using Strings
7. Find Square Root, numerical differentiation, numerical integration using functions and recursion.
8. Implementation of basic file operations

TOTAL	**75**

CO	Course Outcomes
CO1	translate given algorithms to a working and correct program
CO2	identify and correct logical errors encountered at run time
CO3	create iterative as well as recursive programs.
CO4	represent data in arrays, strings and structures and manipulate them through a program.
CO5	declare pointers of different types and use them in defining self-referential structures.

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**3**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**2**	**2**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**3**	**2**	**2**
Weightageof course contributedtoeachPSO	**15**	**11**	**10**	**11**	**11**	**12**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks	Subject Code
	INTRODUCTION TO HTML	Skill Enha. Course (SEC)	2	-	-		2	25	75	100

Learning Objectives		
LO1	Insert a graphic within a web page.	
LO2	Create a link within a web page.	
LO3	Create a table within a web page.	
LO4	Insert heading levels within a web page.	
LO5	Insert ordered and unordered lists within a web page. Create a web page.	
UNIT	**Contents**	**No. Of. Hours**
I	Introduction: Web Basics: What is Internet–Web browsers–What is Webpage –HTML Basics: Understanding tags.	6

II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headings-paragraph(<p> tag)–Font-style elements:(bold, italic, font, small, strong, strike, big tags)	6
III	Lists: Types of lists: Ordered, Unordered– Nesting Lists–Other tags: Marquee, HR, BR- Using Images –Creating Hyper-links.	6
IV	Tables: Creating basic Table, Table elements, Caption–Table and cell alignment–Row span, Col span–Cellpadding.	6
V	Frames: Frameset–Targeted Links–No frame–Forms: Input, Text area, Select, Option.	6
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO 1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO 2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO 3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO 4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
	Concept of adding images	PO1, PO2, PO3, PO4, PO5,

CO 5	Understand the table creation.	PO6

	Textbooks
1	"Mastering HTML5 and CSS3 Made Easy", TeachUComp Inc., 2014.
2	Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"
	Web Resources
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
FC	**OFFICE AUTOMATION**	**FC**		2	-	-	2	2	25	75	100

	Course Objective	
C1	Understand the basics of computer systems and its components.	
C2	Understand and apply the basic concepts of a word processing package.	
C3	Understand and apply the basic concepts of electronic spreadsheet software.	
C4	Understand and apply the basic concepts of database management system.	
C5	Understand and create a presentation using PowerPoint tool.	
UNIT	**Details**	**No. of Hours**
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse andScanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems&itsfeatures: DOS– UNIX–Windows. Introduction to Programming Languages.	6

II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing Preview, options, merge.	6
III	**Spreadsheets:** Excel– opening, entering text and data, formatting, navigating; Formulas– entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition– Animation effects, audio inclusion, timers.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Possess the knowledge on the basics of computers and its	PO1,PO2,PO3,PO6,PO8
	components	
2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
Text Book		
1	PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.	
Reference Books		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.	
Web Resources		
1.	https://www.udemy.com/course/office-automation-certificate-course/	
2.	https://www.javatpoint.com/automation-tools	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
				2				

CO 1	M	S	M			M		L
CO 2	S	M	S			M		
CO 3		S	S		M		L	
CO 4			S	L	M		M	
CO 5				M		S	M	S

S-Strong M-Medium L-Low

SEMESTER –II

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	PYTHON PROGRAMMING	**CC3**	5	-	-	I	5	25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	To make the students learn best practices in PYTHON programming
LO5	To know the costs and profit maximization

UNIT	**Contents**	**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	**15**

IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. **Tuples**: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.

Reference Books

1.	VamsiKurama, "Python Programming: A Modern Approach", Pearson Education.
2.	Mark Lutz, "Learning Python", Orielly.
3.	Adam Stewarts, "Python Programming", Online.
4.	Fabio Nelli, "Python Data Analytics", APress.
5.	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.

Web Resources

1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html
3.	https://www.w3schools.com/python/python_intro.asp
4.	https://www.geeksforgeeks.org/python-programming-language/

5.	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	14	15	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PYTHON PROGRAMMING LAB	**CC2**	-	-	5	I	5	25	75	100

Course Objectives:

1. Be able to design and program Python applications.
2. Be able to create loops and decision statements in Python.
3. Be able to work with functions and pass arguments in Python.
4. Be able to build and package Python modules for reusability.
5. Be able to read and write files in Python.

LAB EXERCISES	**Required Hours**
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling. 2	**75**

Course Outcomes

On completion of this course, students will	
CO1	Demonstrate the understanding of syntax and semantics of
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
SEC5	**Understanding Internet**	Skill Enha. Course (SEC)	2	-	-		2	25	75	100

Learning Objectives	
LO1	Knowledge of Internet
LO2	Learning TCP/IP – Internet Technologies and Protocol
LO3	Learning Internet connectivity.
LO4	Learning internet networks
LO5	Learning Electronic Mail

UNIT	Contents	No. Of. Hours
I	Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET and Internet history of the World Wide Web, basic Internet Terminology, Net etiquette. Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society Crime on/through the Internet.	**6**
II	Packet switching technology, Internet Protocols: TCP/IP, Router, Internet	**6**

	Addressing Scheme: Machine Addressing (IP address), E-mail Addresses, Resources Addresses	
III	Internet accounts by ISP: Telephone line options, Protocol options, Service options, Telephone line options – Dialup connections through the telephone system, dedicated connections through the telephone system, ISDN, Protocol options – Shell, SLIP, PPP, Service options – E-mail, WWW, News Firewall	**6**
IV	Network definition, Common terminologies: LAN, WAN, Node, Host, Workstation,bandwidth, Interoperability, Network administrator, network security, Network Components: Severs, Clients, Communication Media, Types of network: Peer to Peer,Clients Server, Addressing in Internet: DNS, Domain Name and their organization	**6**
V	Email Networks and Servers, Email protocols –SMTP, POP3, IMAp4, MIME6, Structure of an Email – Email Address, Email Header, Body and Attachments	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Knows the basic concept in internet Concept of internet.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Know the concept of TCP/IP – Internet Technologies and Protocol	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the concept of Internet connectivity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Can be able to know about internet networks	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand the concept of Electronic mail.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Greenlaw R and Hepp E "Fundamentals of Internet and www" 2nd EL, Tata McGrawHill,2007.
2	D. Comer, "The Internet Book", Pearson Education, 2009

Reference Book

1	M. L. Young,"The Complete reference to Internet", Tata McGraw Hill, 2007.
2	B. Patel & Lal B. Barik, " Internet & Web Technology ", Acme Learning Publishers.
3	Leon and Leon, "Internet for Everyone", Vikas Publishing House.

Web Resources

1.	https://www.geeksforgeeks.org/what-is-internet-definition-uses-working-advantages-and-disadvantages/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3

CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	PHP Programming	SEC 3	2	-	-	-	2	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

The objective of this course is to teach the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

Course Outcomes:(for students: To know what they are going to learn)

CO1: Analyze the behaviour of basic quantum algorithms

CO2: Implement simple quantum algorithms and information channels in the quantum circuit model

CO3: Simulate a simple quantum error-correcting code

CO4: Prove basic facts about quantum information channels

CO5:

Units	**Contents**	**Required Hours**
I	Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation- PHP Programming Basics -Syntax of PHP	**6**
II	Introduction to PHP Variable -Understanding Data Types -Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement -Switch() Statements -Using the while() Loop -Using the for() Loop	**6**
III	PHP Functions -PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops -Grouping Form Selections with Arrays -Using Array	**6**
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File -Managing Sessions and Using Session Variables	**6**
V	OOPS Using PHP -OOPS Concept-Class, Object, Abstractions, Encapsulation, Inheritance, Polymorphism -Creating Classes and Object in PHP-Cookies and Session Management	**6**

Recommended Texts

1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.
2	P.Rizwan Ahmed, Open Source Programming , Margham Publications, Chennai, 2017

Reference Books

1	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications

	with PHP and MySQL- Alan Forbes
2	PHP: The Complete Reference-Steven Holzner.
3	DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2nd Edition.

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**13**	**14**	**14**	**13**

SEMESTER-III

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	ARTIFICIAL INTELLIGENCE	**CC 5**	5	-	-	VI	5	25	75	100

Learning Objectives	
LO1	Describe the concepts of Artificial Intelligence
LO2	Understand the method of solving problems using Artificial Intelligence
LO3	Understand Knowledge Representation
LO4	Introduce the concept of Software Agents
LO5	Understand about AI applications

UNIT	**Contents**	**No. Of. Hours**
I	**INTRODUCTION** : Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	**15**
II	**PROBLEM SOLVING METHODS** Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	**15**
III	**KNOWLEDGE REPRESENTATION** First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining –	**15**

	Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information	
IV	**SOFTWARE AGENTS** Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	**15**
V	**APPLICATIONS** AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understand search techniques and gaming theory	PO1, PO2, PO3, PO4, PO5, PO6
CO3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Student should be aware of techniques used for classification and clustering.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Student should aware of basics of pattern recognition and steps required for it.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Elaine Rich, Kevin Knight (2008), Shivsankar B Nair, Artificial Intelligence, Third Edition, Tata McGraw Hill Publication
2	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications, Chennai, 2012

Reference Books

1.	Russel S, Norvig P (2010), Artificial Intelligence : A Modern approach,Third Edition, Pearson Education
2.	Dan W Patterson (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.
3.	Jones M(2006), Artificial Intelligence application Programming, Second Edition, Dreamtech Press
4.	Nilsson (2000), Artificial Intelligence : A new synthesis, Nils J Harcourt Asia Pvt Ltd.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	2	3	3	3	3
CO 3	3	3	2	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	14	15	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ARTIFICIAL INTELLIGELAB	**CC2**	-	-	5	I	5	25	75	100

Course Objectives:

- Understand the concept of AI
- Understanding Different AI Techniques
- Understanding of Natural Language Tool Kit.

LAB EXERCISES	**Required Hours**
1. Write a python program to implement Breadth First Search Traversal? 2. Write a python program to implement Water Jug Problem? 3. Write a python program to remove punctuations from the given string? 4. Write a python program to sort the sentence in alphabetical order? 5. Write a program to implement Hangman game using python. 6. Write a program to implement Tic-Tac-Toe game using python. 7. Write a python program to remove stop words for a given passage from a text file using NLTK? 8. Write a python program to implement stemming for a given sentence using NLTK? 9. Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK? 10. Write a python program to implement Lemmatization using NLTK? 11. Write a python program to for Text Classification for the give sentence using NLTK	**75**

Course Outcomes

On completion of this course, students will	
CO1	Use of python to understand the concept of AI
CO2	Implementation of Different AI Techniques
CO3	Application of AI techniques in practical Life
CO4	Understanding of Natural Language Tool Kit.
CO5	Practical Application of Natural Language Tool Kit

Mapping with Programme Outcomes:

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

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	IOT and its applications	Core	Y	-	-	-	3	4	25	75	100

Course Objective	
C1	Use of Devices, Gateways and Data Management in IoT.
C2	Design IoT applications in different domain and be able to analyze their performance
C3	Implement basic IoT applications on embedded platform
C4	To gain knowledge on Industry Internet of Things
C5	To Learn about the privacy and Security issues in IoT

UNIT	**Details**	**No. of Hours**	**Course Objective**
I	IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and	15	C1

	Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization,		
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities	15	C2
III	**:** IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	15	C3
IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	15	C4
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	15	C5
	Total	**75**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6

5	Learn NoSQL databases and management.	PO3, PO8
Text Book		
1	Vijay Madisetti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.	
Reference Books		
1.	Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.	
2.	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.	
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011	
Web Resources		
1.	https://www.simplilearn.com	
2.	https://www.javatpoint.com	
3.	https://www.w3schools.com	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Introduction to Data Science	Elective	4	-	-	-	3	4	25	75	100
Learning Objectives											

LO1	To learn about basics of Data Science and Big data.	
LO2	To learn about overview and building process of Data Science.	
LO3	To learn about various Algorithms in Data Science.	
LO4	To learn about Hadoop Framework.	
LO5	To learn about case study about Data Science.	
UNIT	**Contents**	**No. of Hours**
I	**Introduction:** Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science	12
II	**The Data science process**:Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .	12
III	**Algorithms** :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised	12
IV	**Introduction to Hadoop** :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types	12
V	**Case Study**: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand the basics in Data Science and Big data.	PO1
CO2	Understand overview and building process in Data Science.	PO1, PO2
CO3	Understand various Algorithms in Data Science.	PO3, PO6
CO4	Understand Hadoop Framework in Data Science.	PO4, PO5
CO5	Case study in Data Science.	PO3, PO5

Text Book	
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016
Reference Books	
1.	Roger Peng, "The Art of Data Science", lulu.com 2016.
2.	MurtazaHaider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book.
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali,"Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press 2016.

4.	Annalyn Ng, Kenneth Soo, "Numsense! Data Science for the Layman: No Math Added", 2017,1st Edition.
5.	Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media 2013.
6.	Lillian Pierson, "Data Science for Dummies", 2017 II Edition
Web Resources	
1.	https://www.w3schools.com/datascience/
2.	https://en.wikipedia.org/wiki/Data_science
3.	http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**11**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	SOFTWARE ENGINEERING	**SEC**	1	-	-	-	1	25	75	100

Learning Objectives:

- To understand the software engineering concepts and to create a system model in real life applications

Course Outcomes:(for students: To know what they are going to learn)

CO1: Gain basic knowledge of analysis and design of systems

CO2: Ability to apply software engineering principles and techniques

CO3: Model a reliable and cost-effective software system

CO4: Ability to design an effective model of the system

CO5: Perform Testing at various levels and produce an efficient system.

Units	Contents	Required Hours
I	**Introduction:** The software engineering discipline, programs vs. software	**12**

	products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.	
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS) **Software Design**: Good software design, cohesion and coupling, neat arrangement	**12**
III	**Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's)	**12**
IV	**Coding and Testing: Coding;** code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing	**12**
V	**Software Maintenance:** Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost;	**12**
		60

Learning Resources:

Recommended Texts

1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018
2. A.Zakiuddin Ahmed, Software Engineering, Margham Publications, Chennai, 2012

Reference Books

1. Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997.
2. Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.
3. James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	2	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	13	13	15	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	OPERATING SYSTEM DESIGN 2	**SEC**	4	-_	-	-	2	25	75	100

Learning Objectives		
LO1	To understand the fundamental concepts and role of Operating System.	
LO2	To learn the Process Management and Scheduling Algorithms.	
LO3	To understand the Memory Management policies.	
LO4	To gain insight on I/O and File management techniques.	
LO5	Analyze resource management techniques	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction**- views and goals – Operating System Services - User and Operating System interface - System Call- Types of System Calls – Operating System Design and Implementation - Operating System Structure. **Process Management**: Process concept- Process Scheduling - Operations on Processes- Interprocess Communication. **Threads**: Types of threads	**12**
II	**Process Scheduling**: Basic Concepts-Scheduling Criteria Scheduling Algorithm Multiple Processor Scheduling CPU Scheduling. **Synchronization**: The Critical-Section Problem Synchronization Hardware – Semaphores- Classic Problem of Synchronization.	**12**
III	**Deadlocks:** Deadlock Characterization - Methods for Handling Deadlocks- Deadlock Prevention- Deadlock Avoidance - Deadlock Detection- Recovery from Deadlock.	**12**
IV	**Memory**-Management Strategies: Swapping - Contiguous Memory Allocation Segmentation- Paging - Structure of the Page Table. **Virtual-Memory Management**: Demand Paging - Page Replacement - Allocation of Frames - Thrashing.	**12**
V	**Storage Management:** File System- File Concept - Access Methods- Directory and Disk Structure -File Sharing- Protection. Allocation Methods - Free- Space Management - Efficiency and Performance – Recovery.	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Define OS with its view and goals and services rented by it Deign of Operating System with its structure. Message through Inter process communication.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Describe the allocation of process through scheduling algorithms. Define critical section problems and its usage. Prevention of multiple process executing through the concept of semaphores.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Describe the concept of Mutual exclusion, Deadlock detection and agreement protocols for deadlock prevention and its avoidance.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze the strategies of Memory management schemes and the usage of Virtual memory. Apply Replacement algorithms to avoid thrashing.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Brief study of storage management. Categorize the methods to allocate files for proper protection.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	A. Silberschatz P.B.Galvin, Gange. "Operating System Concepts", Ninth Edition, 2013, Addison Wesley Publishing Co.
2	P.Rizwan Ahmed, Operating System, Margham Publications, Chennai.2018
Reference Books	
1.	Anderw S Tanenbaum, Albert S. Woodhull, " Operating System Design and Impletation", prentice-Hall India Publication.
2.	William Stallings, "Operating Systems Internals and Design Principles", Pearson, 2018, 9th Edition.
3.	Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition
4.	Operating System Concepts (2nd Ed) by James L. Peterson, Abraham Silberschatz, Addison – Wesley.
5.	Operating Systems Design & implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson.
Web Resources	
1.	https://www.guru99.com/operating-system-tutorial.html
2.	https://www.mygreatlearning.com/blog/what
3.	https://en.wikipedia.org/wiki/Operating_system
4.	https://www.geeksforgeeks.org/what-is-an-operating-system/
5.	http://www.cs.kent.edu/~farrell/osf03/oldnotes/2. th-edition.pdf

Mapping with Programme Outcomes

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	15	12	14

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER-IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	R PROGRAMMING	**CC 7**	6	-	-	V	5	25	75	100
Learning Objectives										
LO1	Understanding and being able to use basic programming concepts									
LO2	Automate data analysis									
LO3	Working collaboratively and openly on code 2									

LO4	Knowing how to generate dynamic documents	
LO5	Understanding the concept of Object oriented programming.	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction**: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations	18
II	**Control structures**, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	18
III	**Lists**: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	18
IV	**FACTORS AND TABLES**, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions	18
V	**OBJECT-ORIENTED PROGRAMMING**: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation.	18
	TOTAL HOURS	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Demonstration and implement of basic R programming framework and data structures	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Explain critical R programming language concepts such as control structures and recursion	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Applying mathematical and statistical operations data in R	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Examine data-sets to create testable hypotheses and identify appropriate statistical tests	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Make use of appropriate statistical tests using R and Create and edit visualizations with regression models	PO1, PO2, PO3, PO4, PO5, PO6

2

Textbooks

1	R Programming for Data Science by Roger D. Peng
2	The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.
	Reference Books
1	Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019.
2	Andy Field, Discovering Statistics Using R, 1st edition, SAGE Publications Ltd
	Web Resources
1	https://www.w3schools.com/r/
2	https://www.javatpoint.com/r-tutorial
3	https://www.tutorialspoint.com/r/index.htm

MAPPING TABLE

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	2	2	2
CO2	2	3	2	3	3	1
CO3	2	2	2	3	3	2
CO4	3	2	1	3	3	2
CO5	3	3	2	3	3	3
Weightageofcourse contributedtoeach PSO	13	11	9	14	14	10

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	R PROGRAMMING LAB	**CC8**	-	-	5	I	5	25	75	100

Leaning Objectives:

LO1 - Gain knowledge in developing basic R programs
LO2-Knowing how to generate dynamic documents
LO3-Being able to use a continuous test-driven development approach

LAB EXERCISES	Required Hours

1. Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators). 2. Write an R Program to Check if a Number is Odd or Even 3. Write an R Program to check if the given Number is a Prime Number 4. Write an R Program to Find the Factorial of a Number 5. Write an R Program to Find the Factors of a Number 6. Write an R Program to Find the Fibonacci sequence Using Recursive Function 7. Write an R Program to Make a Simple Calculator 8. Write an R Program to Find L.C.M of two numbers 9. Write an R Program to create a Vector and to access elements in a Vector 10. Write an R Program to create an S3 Class and S3 Objects. 11. Write an R Program to write a own generic function in S3 Class. 12. Write an R Program to create an S4 Class and S4 Objects. 13. Write an R Program to write a own generic function in S4 Class. 14. Write an R Program to create Reference Class and modify its Methods	**75**

Course Outcomes	
On completion of this course, students will	
CO1	Understand the fundamental concepts in R
CO2	Acquire programming skills in R
CO3	be able to use R to solve statistical problems
CO4	be able to implement and describe Monte Carlo the technology
CO5	be able to minimize and maximize functions using R

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**1**	**2**	**1**	**1**	**2**
CO2	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**13**	**10**	**10**	**11**	**10**	**10**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA MINING	**Elec.**	2	-	-	-	3	25	75	100

Learning Objectives:

- To provide the knowledge on Data Mining and Warehousing concepts and techniques.
- To study the basic concepts of cluster analysis
- To study a set of typical clustering methodologies, algorithms and applications.

Course Outcomes:

CO1: To understand the basic concepts and the functionality of the various data mining and data warehousing component

CO2: To know the concepts of Data mining system architectures

CO3: To analyze the principles of association rules

CO4: To get analytical idea on Classification and prediction methods.

CO5: To Gain knowledge on Cluster analysis and its methods.

Units	Contents	Required Hours
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction.	**6**
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization.	**6**
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases.	**6**
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation.	**6**
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods	**6**

Learning Resources:

Recommended Texts

1. Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi.

2. P.Rizwan Ahmed, Data Mining, Margham Publications, Chennai, 2012

Reference Books

1. K.P. Soman, Shyam Diwakar, V. Ajay "Insight into Data Mining Theory and Practice ", Prentice Hall of India Pvt. Ltd, New Delhi
2. Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	3	3	3	2	2	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	3
CO4	3	2	2	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	14	14	14	13

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Cloud Computing	Elective	4	-	-	-	3	3	25	75	100

Course Objective	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

UNIT	**Contents**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring	12
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service	12

III	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services	12
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – WorkloadCharacteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	12
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6

Text Book	
1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018
Reference Books	
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical*

	Approach, Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.
4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.
Web Resources	
1.	https://en.wikipedia.org/wiki/Cloud_computing
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage ofcoursecontributedtoeachPSO	15	14	11	15	15	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Software Project Management	SEC	2	-	-	-	2	2	25	75	100

Learning Objectives		
LO1	To define and highlight importance of software project management.	
LO2	To formulate and define the software management metrics & strategy in managing projects	
LO3	To famialarize in Software Project planning	
LO4	Understand to apply software testing techniques in commercial environment	
Unit	**Contents**	**No. of Hours**
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	**6**

II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project - Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	**6**
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	**6**
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**6**
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**6**
TOTAL		**30**

CO	**Course Outcomes**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process

Textbooks

1	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002.

Reference Books

1	PankajJalote, “Software Project Management in Practice”, Addison Wesley 2002.
2.	Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition.
3.	P.Rizwan Ahmed, Software Project Management, Margham Publications, 2017

Web Resources

1.	Software Project Management e-resources from Digital libraries
2.	www.smartworld.com/notes/software-project-management

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	1	3	2	2	1	1
CO 2	3	1	3	2	3	3
CO 3	3	2	2	-	2	1
CO 4	2	-	3	3	3	1
CO 5	3	3	3	3	3	2
weightage of course contributed to each PSO	12	9	13	10	12	8

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA COMMUNICATION AND NETWORKING	SEC	2	-	-	-	2	25	75	100

Learning Objectives

LO1	To introduce the fundamental network architecture concepts and their core principle issues in the emerging communication / data networks.
LO2	To have a complete picture of the data and computer networks systematically
LO3	To provide a strong foundation in networking concepts and technology
LO4	To know the significance of various Flow control and Congestion control Mechanisms
LO5	To know the Functioning of various Application layer Protocols.

UNIT	Contents	No. Of. Hours
I	**Data Communications:** Introduction– Networks – The Internet – Protocols and Standards- Network Models: OSI model – TCP/IP protocol suite – Transmission Media: Guided media – Unguided Media.	**2**
II	**Data Link Layer:** Error Detection and Correction: Introduction- Block coding – Linear block codes – Cyclic Codes – Checksum. Framing – Flow and Error Control: Protocols –Noiseless Channels: Stop- and –Wait – Noisy Channel: Stop-and Wait Automatic Repeat Request-Go-Back –N.	**2**
III	**Medium Access and Network Layer:**Multiple Access: Random Access – Controlled access- Channelization. Network LayerLogical addressing: IPv4 addresses – IPv6 addresses. Transport Layer: Process to Process delivery: UDP – TCP. Congestion Control – Quality of Service	**2**
IV	**Application Layer:** Domain Naming System: Name Space - Domain Name Space - Distribution of Name Space - DNS in the INTERNET - Resolution–Remote logging – E-mail – FTP.	**2**
V	**Wireless Networks:**Wireless Communications – Principles and Fundamentals. WLANs – WPAN- Satellite Networks - Ad-hoc Networks	**2**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand the basics of data communication, networking, internet and their importance.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Analyze the services and features of various protocol layers in data networks.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Differentiate wired and wireless computer networks	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze TCP/IP and their protocols.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Recognize the different internet devices and their functions.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Forouzan, A. Behrouz. (2006), Data Communications & Networking, Fourth Edition, Tata McGraw Hill Education	
2	Nicopolitidis, Petros, Mohammad SalamehObaidat, G. L. Papadimitriou(2018), Wireless Networks, John Wiley & Sons.	
Reference Books		
1.	Fred Halsall(1996), Data Communications Computer Networks and Open Systems, Fourth Edition, Addison Wesley.	
Web Resources		
1.	https://www.tutorialspoint.com/data_communication_computer_network/index.htm	
2.	https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	3	3	3	3	3
Weightageof coursecontributedtoeachPSO	14	15	15	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER-V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	MACHINE LEARNING	**CC9**	3	-	-	V	3	25	75	100

Learning Objectives	
LO1	understand the human learning aspects and primitives in learning process by computer
LO2	analyze the nature of problems solved with machine learning techniques
LO3	design and implement suitable machine learning technique for a given application
LO4	Understanding Distance Based Learning
LO5	Understanding Rule Based and Tree Based Models

UNIT	Contents	No. Of. Hours
I	**Introduction** Definition - Types of Machine Learning - Examples of Machine Learning Problems - Training versus Testing - Characteristics of Machine learning tasks - Predictive and descriptive tasks - Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types - Feature Construction and Transformation - Feature Selection.	**15**
II	**Classification and Concept Learning** Classification: Binary Classification- Assessing Classification performance - Class probability Estimation - Multiclass Classification - Regression: Assessing performance of Regression - Error measures - Overfitting- Theory of Generalization: Effective number of hypothesis - Bounding the Growth function.	**15**
III	**Linear and Probabilistic Models** Least Squares method - Multivariate Linear Regression - Perceptron, Multiple Layer Perceptron - Support Vector Machines - Obtaining probabilities from Linear classifiers - Kernel methods for non-Linearity - Probabilistic models for categorical data – Naïve Bayes Classifier	**15**
IV	**Distance Based Models** Distance Based Models: Neighbors and Examples - Nearest Neighbors Classification - Distance based clustering – K-Means Algorithm - K-Medoids Algorithm - Hierarchical clustering - Vector Quantization, Self-Organizing Feature Map - Principal Component Analysis.	**15**
V	**Rule Based and Tree Based Models** Rule Based Models: Rule learning for subgroup discovery - Association rule mining - Tree Based Models: Decision Trees - Ranking and Probability estimation Trees - Regression trees - Classification and Regression Trees (CART), Ensemble Learning, - Bagging and Boosting.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	

CO1	describe the concepts, mathematical background, applicability, limitations of existing machine learning techniques.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	identify the performance evaluation criteria of the model developed	PO1, PO2, PO3, PO4, PO5, PO6
CO3	analyze and design various machine learning based applications with a modern outlook focusing on recent advances.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	build the learning model for a given task	PO1, PO2, PO3, PO4, PO5, PO6
CO5	apply some state-of-the-art development frameworks and software libraries for implementation	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012, ISBN-10: 1107422221, ISBN-13: 978-1107422223.	
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570	
Reference Books		
1.	Christopher Bishop, "Pattern Recognition and Machine Learning (Information Science and Statistics)", Springer, 2007.	
2	Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012	
	Web Resources	
1	https://www.javatpoint.com/machine-learning	
2	https://www.geeksforgeeks.org/machine-learning/	
3	https://www.tutorialspoint.com/machine_learning/index.htm	
4	https://www.w3schools.com/python/python_ml_getting_started.asp	

MAPPING TABLE

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**1**	**1**	**2**
CO3	**2**	**3**	**2**	**2**	**2**	**2**
CO4	**2**	**1**	**2**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**3**	**2**	**2**
Weightageof coursecontributedtoeachPSO	**12**	**10**	**9**	**10**	**9**	**10**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	MACHINE LEARNING LAB	**CC10**	-	-	4	-	3	25	75	100

Learning Objectives:

LO1 - Understand the basic statistical and algorithmic concepts in the field of Machine Learning

LO2- learn to handle the data

LO3- develop data analytics applications especially in the context of current research.

LAB EXERCISES	Required Hour
1. Data Preprocessing 2. Feature Extraction 3. Model Training using Linear/ logistic regression for a recent application 4. Model Training using Decision Tree for a recent application 5. Model Training using Support Vector Machine for a recent application 6. Model Training using Ensemble models for a recent application 7. Bayesian learning 8. Instance based learning 9. Model Evaluation and Improvisation 10. Exporting the model as endpoint	**60**

CO	Course Outcomes
CO1	identify the most relevant features in a dataset
CO2	understand the implementation procedures for the machine learning algorithms
CO3	write Python programs for various Learning algorithms.
CO4	apply appropriate Machine Learning algorithms for the given data sets.
CO5	develop applications using Machine Learning algorithms to solve real world problems

MAPPING TABLE

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**2**	**2**	**3**	**3**	**3**	**2**
CO2	**1**	**3**	**2**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**2**	**1**	**2**
CO5	**2**	**3**	**1**	**3**	**3**	**3**

Weightageof coursecontributedtoeach PSO	**11**	**12**	**11**	**14**	**12**	**10**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	RELATIONAL DATABASE MANAGEMENT SYSTEM	**CC 11**	3	-	-	V	3	25	75	100

Learning Objectives	
LO1	To understand the different issues involved in the design and implementation of a database system.
LO2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
LO3	To understand and use data manipulation language to query, update, and manage a database
LO4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency,
LO5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction:** Database System-Characteristics of Database Management Systems-Architecture of Database Management Systems-Database Models-System Development Life Cycle-Entity Relationship Model.	**18**
II	**Relational Database Model:** Structure of Relational Model-Types of keys. Relational Algebra: Unary operations-Set operations-Join operations. Normalization: Functional Dependency- First Normal form-Second Normal Form-Third Normal form- Boyce-Codd Normal Form-Fourth Normal Form.	**18**
III	**SQL:** Introduction. Data Definition Language: Create, alter, drop, rename and truncate statements. Data Manipulation Language: Insert, Update and Delete Statements. Data Retrieval Language: Select statement. Transaction Control Language: Commit, Rollback and Savepoint statements. Single row functions using dual: Date, Numeric and Character functions. Group/Aggregate functions: count, max, min, avg and sum functions. Set Functions: Union, union all, intersect and minus. Subquery: Scalar, Multiple and Correlated subquery. Joins: Inner and Outer joins.Defining Constraints: Primary Key, Foreign Key, Unique, Check, Not Null.	**18**
IV	**PL/SQL:** Introduction-PL/SQL Basic-Character Set- PL/SQL Structure-SQL Cursor-Subprograms-Functions-Procedures.	**18**

V	**Exception Handling:** Introduction-Predefined Exception-User Defined Exception-Triggers-Implicit and Explicit Cursors-Loops in Explicit Cursor.	**18**
	TOTAL HOURS	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	To demonstrate the characteristics of Database Management Systems. To study about the concepts and models of database. To impart the concepts of System Development Life Cycle and E-R Model.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To classify the keys and the concepts of Relational Algebra. To impart the applications of various Normal Forms Classification of Dependency.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Representation of PL-SQL Structure. To impart the knowledge of Sub Programs, Functions and Procedures.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Triggers, Implicit and Explicit Cursors.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Pranab Kumar Das Gupta and P. Radha Krishnan, "Database Management System Oracle SQL and PL/SQL", Second Edition, 2013, PHI Learning Private Limited.
2	P.Rizwan Ahmed, RDBMS and Oracle, Margham Publications, Chennai. 2018

Reference Books

1	RamezElmasri and Shamkant B. Navathe, "*Fundamentals of Database Systems*", Seventh Edition, Pearson Publications.
2	Abraham Silberschatz, Henry Korth, S. Sudarshan, "*Database System Concepts*", Seventh Edition, TMH.

Web Resources

1	http://www.amazon.in/DATABASE-MANAGEMENT-SYSTEM-ORACLE-SQLebook/dp/B00LPGBWZ0#reader_B00LPGBWZ0

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3

Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	RDBMS LAB USING ORACLE	**CC12**	-	-	3	V	3	25	75	100

Learning Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases
5. To facilitate students in Database design

LAB EXERCISES:

SQL:

1. DDL commands.
2. Specifying constraints-Primary Key, Foreign Key, Unique, Check, Not Null.
3. DML commands.
4. Set Operations.
5. Joins.
6. Sub-queries.

PL/SQL:

7. Control Constructs.
8. Exception Handlers.
9. Implicit Cursor.
10. Explicit Cursor.
11. Procedures.
12. Functions.
13. Triggers.
14. TCL Commands usage (Commit, Rollback, Savepoint)

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	2
CO 2	3	3 2	3	2	3	3

CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	NATURAL LANGUAGE PROCESSING	**Elect**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net Stemmers- POS Tagger-Research Corpora SSAS.	**12**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	

CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding of text data.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog",Springer	
Web Resources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	15	13	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	CRYPTOGRAPHY	**Elect**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To understand the fundamentals of Cryptography
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
LO3	To understand the various key distribution and management schemes.
LO4	To understand how to deploy encryption techniques to secure data in transit across data networks
LO5	To design security applications in the field of Information technology

UNIT	Contents	No. Of. Hours
I	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	**12**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**12**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**12**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocket Layer and Transport Layer Security – Secure Electronic Transaction.	**12**
V	Intruders – Malicious software – Firewalls.	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	**William Stallings,** "Cryptography and Network Security Principles andPractices".
2	P.Rizwan Ahmed, Cryptography, Margham Publications, Chennai, 2017
	Reference Books
1.	**Behrouz A. Foruzan,** "Cryptography and Network Security", Tata McGraw-Hill, 2007.
2	**AtulKahate**, "*Cryptography and Network Security*", Second Edition, 2003,TMH.
3	**M.V. Arun Kumar**, "*Network Security*", 2011, First Edition,USP.
	Web Resources
1	https://www.tutorialspoint.com/cryptography/
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	15	12	14	14

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	QUANTITATIVE APTITUDE	**Elec.**	2	-	-	-	3	25	75	100

Learning Objectives

- To improve the quantitative skills of the students
- To prepare the students for various competitive exams

Course Outcomes

CO1: To gain knowledge on LCM and HCF and its related problems
CO2: To get an idea of age, profit and loss related problem solving.
CO3: Able to understand time series simple and compound interests
CO4: Understanding the problem related to probability, and series
CO5: Able to understand graphs, charts

Units	Contents	Required Hours

I	Numbers- HCF and LCM of numbers-Decimal fractions- Simplification- Square roots and cube roots- Average- problems on Number	**6**
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership- Chain rule.	**6**
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area –Volume and surface area-races and Games of skill.	**6**
IV	Permutation and combination-probability-True Discount-Bankers Discount Height and Distances-Odd man out & Series.	**6**
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs	**6**

Learning Resources:

Recommended Texts

1."Quantitative Aptitude", R.S.AGGARWAL.,S.Chand& Company Ltd.,

Web resources: Authentic Web resources related to Competitive examinations

MAPPING TABLE

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	3
CO2	3	3	3	3	3	3
CO3	3	2	2	2	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	13	13	13	14	15

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Software Testing	Elective	Y	-	-	-	3	4	25	75	100

Course Objective

C1	To study fundamental concepts in software testing
C2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
C3	To study the basic concept of Data flow testing and Domain testing.
C4	To Acquire knowledge on path products and path expressions.
C5	To learn about Logic based testing and decision tables

UNIT	Details	No. of Hours	Course Objective
I	Introduction: Purpose–Productivity and Quality in Software–Testing Vs Debugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6	C1

II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques.	6	C2
III	Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing.	6	C3
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing–Formats–Test Cases	6	C4
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, State Testing.	6	C5
	Total	**30**	

Course Outcomes		**Program Outcomes**
CO	On completion of this course, students will	
1	Students learn to apply software testing knowledge and engineering methods	PO1
2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1, PO2
3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8

Text Book

1	B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia,NewDelhi,2003.
2	K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,NewDelhi,2005
3	P.Rizwan Ahmed, Software Testing, Margham Publications, Chennai, 2016

Reference Books

1.	I.Burnstein,2003,"PracticalSoftwareTesting",SpringerInternationalEdn.
2.	E. Kit, 1995, "Software Testing in the Real World: Improving the Process", Pearson Education,Delhi.
3.	R. Rajani,andP.P.Oak,2004,"SoftwareTesting",TataMcgrawHill,New Delhi.

Web Resources

1.	https://www.javatpoint.com/software-testing-tutorial
2.	https://www.guru99.com/software-testing.html

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				2S	S	M		

CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Simulation and Modeling	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
CO1	Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages
CO2	Discuss the concepts of modelling layers of critical infrastructure networks in society.
CO3	Create tools for viewing and controlling simulations and their results.
CO4	Understand the concept of Entity modelling, Path planning
CO5	To learn about the Algorithms and Modelling.

UNIT	**Details**	**No. of Hours**
I	Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability Distribution.	12
II	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method – Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors .	12
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships	`12
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees -	12
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	12
	Total	**60**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	**Programme Outcomes**

CO1	Introduction To Modeling & Simulation, Input Data Analysis and Modeling.	PO1
CO2	Random Variate and Number Generation. Analysis of Simulations and methods.	PO1, PO2
CO3	Comparing Systems via Simulation	PO4, PO6
CO4	Entity Body Modeling, Visualization, Animation.	PO4, PO5, PO6
CO5	Algorithms and Sensor Modeling.	PO3, PO8
Text Books		
1.	Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice", John Wiley & Sons, Inc., 1998.	
2.	George S. Fishman, "Discrete-Event Simulation: Modeling, Programming and Analysis", Springer-Verlag New York, Inc., 2001.	
References Books		
1.	Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, "Applied Simulation Modeling", Thomson Learning Inc., 2003.	
Web Resources		
1.	https://www.tutorialspoint.com/modelling_and_simulation/index.htm	
2.	https://www.javatpoint.com/verilog-simulation-basics	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong(3) M-Medium (2) L-Low (1)

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Artificial Neural Networks	Core	-	Y	-	-	3	4	25	75	100
Course Objective											
C1	Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.										
C2	Understand the Error Correction and various learning algorithms and tasks.										
C3	Identify the various Single Layer Perception Learning Algorithm.										
C4	Identify the various Multi-Layer Perception Network.										
C5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	**Details**										**No. of Hours**
I	Artificial Neural Model- Activation functions- Feed forward and										15

	Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks.Learning Algorithms-Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	15
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	15
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	15
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks**.**	PO1
2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
3	Learn the various Perception Learning Algorithm.	PO4, PO6
4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO8

Text Book	
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.
2.	"Neural Network- A Comprehensive Foundation"- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.
Reference Books	
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.
Web Resources	
1.	https://www.w3schools.com/ai/ai_neural_networks.asp
2.	https://en.wikipedia.org/wiki/Artificial_neural_network

3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Project with Viva voce	**CC13**	4	-	-		4	25	75	100

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.
LO5	Exercise computational thinking over the entire software life cycle

Project Work

SL	Area of Work	Maximum Marks
1.	**PROJECT WORK:** (i) Project Proposal and Plan	10
	(ii) Execution of the Project Proposal and Plan / Collection of data, Documentation and Presentation of the report.	40
2.	Viva Voce Examination	25
	TOTAL	**75**

*** CIA Marks =25 marks (Project Review 1, Project Review2 and Project Review 3)**

Course Outcomes		**Programme Outcomes**
CO	On successful completion of this course, students will be able to	
1	show leadership skills and learn time management	PO1, PO2, PO3,

		PO4, PO5, PO6
2	identify various tools to be applied to a specific problem	PO1, PO2, PO3, PO4, PO5, PO6
3	evaluate the reports	PO1, PO2, PO3, PO4, PO5, PO6
4	take part in a team as well as manage it to deliver stunning outcomes	PO1, PO2, PO3, PO4, PO5, PO6
5	assess and develop the individual skills to present and organize projects	PO1, PO2, PO3, PO4, PO5, PO6

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**11**

Annexure - I

(A typical Specimen of Cover Page & Title Page)

TITLE OF PROJECT

<Font Size 22><BOLD><Centralized>

A Project Report

<Font Size 14>><BOLD><Centralized>

Submitted by:

<Font Size 14><Italic>><BOLD><Centralized>

NAME OF THE STUDENT (<University Roll Number>)

<Font Size 16>><BOLD><Centralized>

in partial fulfillment for the award of the degree

of

<Font Size 14><1.5 line spacing><Italic><BOLD><Centralized>

<Font Size 14><BOLD><Centralized>
BACHELOR OF SCIENCE
<Font Size 16>><BOLD><Centralized>
IN
ARTIFICIAL INTELLIGENCE
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Under the Supervision of
<NAME OF THE SUPERVISOR(s)>

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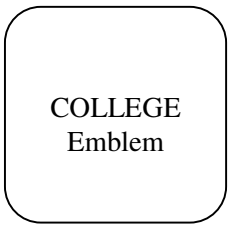

COLLEGE NAME

DEPARTMENT NAME

MONTH & YEAR

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Annexure - 2

CANDIDATE'S DECLARATION

I hereby certify that the project entitled "_____ " submitted by_____ (Student name) & (University Roll no) in partial fulfillment ofthe requirement for the award of degree of the B. Sc. (Artificial Intelligence) submitted at _____ (College Name) is an authentic record of my own work carried out during aperiod from _____ to _____ under the guidance of Mr./Dr. (Guide name, Designation, Department of Artificial Intelligence). The matter presented in this project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

Signature of the Student

Place:

Date:

Annexure – 3

CERTIFICATE

This is to certify that the project titled " _____ "is the bona fide work carried out by (Student name) & (University Roll no) in partial fulfillment of the requirement for the award of degree of the B.Sc. (Artificial Intelligence) submitted at _____ (College Name) is an authentic record his/her work carried out during a period from _____ to _____under the guidance of Mr./Dr._____Guide name, Designation, Department of Artificial Intelligence). The Major Project Viva-Voce Examination has been held on (DD/MM/YYYY)

Signature of the Guide **Signature of the HoD**

Internal Examiner **External Examiner**

	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Internship / Industrial Training	-	-	-	-		2	25	75	100

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and/or statistical methods to facilitate problem solving.
LO5	Exercise computational thinking over the entire software life cycle

Internship / Industrial Training:

The students to undergo 2 weeks of Internship / Industrial Training in the Industry

Sl.No	Area of Work	Maximum Marks
	a) Work Related performance – Work Attitude/ Academic preparation/ problem solving ability/ Adaptability / Overall Attendance / Progress towards learning goals	10
	b) Organizational skills – Time management skills / Planning skills/ communication skills	20
	c) Relationship with others – Willingness to cooperate with co-works/ Ability to work with supervisor / Acceptance of constructive comments / Ability to take direction	20
	Internship Report / Viva Voce Examination	25
	Total	75

*** CIA Marks =25 marks (Internship Review 1, Review2 and Review 3)**

Course Outcomes		Programme Outcomes
CO	On successful completion of this course , students will be able to	
1	Find their specific areas of interest , refine their skills and abilities	PO1, PO2, PO3, PO4, PO5, PO6
2	Show a greater sense of self-awareness and appreciation for others	PO1, PO2, PO3, PO4, PO5, PO6
3	Apply problem solving and critical thinking skills to solve real time problem	PO1, PO2, PO3, PO4, PO5, PO6
4	Design various solution approaches for addressing IT business needs.	PO1, PO2, PO3, PO4, PO5, PO6
5	Apply best practices of IT industries by working in the Product or service domain.	PO1, PO2, PO3, PO4, PO5, PO6

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	1	2	2	2	2
CO2	2	3	2	3	3	1

CO3	3	2	2	3	3	2
CO4	3	3	1	3	3	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	14	12	9	14	14	10

Strong-3 M-Medium-2 L-Low-1

Guidelines for internship

- Internship should be of 2 weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- The home institution cannot be taken as the place of internship.
- Internship can be on any topic covered in the syllabus mentioned in the syllabus,not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to, types oforganizations:
    - Software development firms
    - Hardware/ manufacturing firms
    - Any small scale industries, service providers like banks
    - Clinics/ NGOs/professional institutions like that of CA, Advocate etc
    - Civic Depts like Ward office/post office/police station/ punchayat.

Guidelines for making Internship Report

A student is expected to make a report based on the internship he or she has done inan organization. It should contain the following:

- Certificate: A certificate in the prescribed Performa (given in appendix 1) fromthe organization where the internship done.
- Evaluation form: The form filled by the supervisor or to whom the intern wasreporting, in the prescribed Performa (given in appendix 2).
- Title: A suitable title giving the idea about what work the student has performed during the internship.
- Description of the organization: A small description of 1 to 2 pages on the organization where the student has interned
- Description about the activities done by the section where the intern has worked: A description of 2 to 4

pages about the section or cell of the organization where the intern actually worked. This should give an idea about thetype of activity a new employee is expected to do in that section of the organization.

- Description of work allotted and actually done by the intern: A detailed description of the work allotted and actual work performed by the intern duringthe internship period. Intern may give a weekly report of the work by him or her ifneeded. It shall be of around 7 to 10 pages.
- Self assessment: A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as interpersonal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 20 to 30 pages and this needs to be submitted to the external examiner at the time of University examination.

Appendix 1

(Proforma for the certificate for internship in official letter head)

This is to certify that Mr/Ms_____ of _____College/Institution worked as an intern as part of her B.Sc. course in Artificial Intelligence of Thiruvalluvar University. The particulars of internship are given below:

Internship starting date:

Internship ending date:

Actual number of days worked:

Tentative number of hours worked: Hours

Broad area of work:

A small description of work done by the intern during the period:

_____

_____

_____

_____

_____

Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the organization)

Appendix 2

(Proforma for the Evaluation of the intern by the supervisor/to whom the intern wasreporting in the organization)

Professional Evaluation of intern

Name of intern: College/institution:

[Note: Give a score in the 1-5 scale by putting √ in the respective cells]

S. No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance					
2	Punctuality					
3	Adaptability					
4	Ability to shoulder responsibility					
5	Ability to work in a team					
6	Written and oral communicationskills					
7	Problem solving skills					
8	Ability to grasp new concepts					
9	Ability to complete task					
10	Quality of work done					

Comments:

_____

_____

_____

Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the organization)

SEMESTER-VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	TENSOR FLOW	**CC14**	4	-	-	-	3	25	75	100

Learning Objectives

1. To understand basic operations, constant, variables etc.
2. To understand linear and nonlinear regressions.
3. To understand basics of variable sharing principles. 4. To understand the basic of encoder and its networks
5. To understand the basics of language translations. .

Course Outcomes:

1. After studied unit-1, the student will be able to understand the concept variables, and Data Types, Operators and Expressions
2. After studied unit-2, the student will be able to understand the concepts of linear and nonlinear regressions.
3. After studied unit-3, the student will be able to understand the concepts of variable sharing principle.
4. After studied unit-4, the student will be able to understand the concepts of encoder with networks.
5. After studied unit-5, the student will be able to understand the concepts of language translations.

Units	Contents	Required Hours
I	**Introduction** : Overview of Tensorflow: Why Tensorflow? Graphs and Sessions. Operations: Basic operations, constants, variables, Control dependencies, Data pipeline, TensorBoard	**12**
II	**LINEAR AND LOGISTIC REGRESSION** TensorFlow's Optimizers, tf.data - Example: Birth rate - life expectancy, MNIST dataset. Eager execution: Example: word2vec, linear regression	**12**
III	**VARIABLE SHARING AND MANAGING EXPERIMENTS**. Interfaces Name scope, variable scope Saver object, checkpoints, Autodiff Example: word2vec. Introduction to ConvNet.	**12**

IV	**CONVNET IN TENSORFLOW** Teaching Hours: 7 Hrs. Example: image classification, GANs , Variational Auto- Encoders, Recurrent Neural Networks: Example: Character-level Language Modelling	**12**
V	**SEQ2SEQ WITH ATTENTION** Teaching Hours: 8 Hrs. Example: Neural machine translation, Beyond RNNs: Transformer, Tensor2Tensor: Dialogue agents, Reinforcement Learning in Tensorflow, Keras	**12**

Learning Resources:

Text Book

1. Reza Bosagh Zadeh, Bharath Ramsundar, "Tensor Flow for Deep Learning", 2018. Architecture, Pearson Education.

Reference Books

1. Giancarlo Zaccone,Md.Rezaul Karim, Ahmed Menshawy" Deep Learning with Tensorflow" , 2017
2.Ian Goodfellow, "Deep Learning", 2016.
3. Francois Chollet, "Deep Learning with Python", 2017.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	2	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	14	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	TENSOR FLOW LAB	**CC 15**	-	-	5	VI	3	25	75	100

Objectives

1. To understand basic operations, constant, variables etc.
2. To understand linear and nonlinear regressions.
3. To understand basics of variable sharing principles.
4. To understand the basic of transformer
5. To understand the basics of reinforcement learning in tensor flow.

LIST OF PROGRAMS

1. Implement concepts of Basic operations, constants and variables.
2. Implement concepts of Control dependencies

3. Implement concepts of Data pipeline, TensorBoard
4. Implement concepts of TensorFlow's Optimizers
5. Implement concepts of Linear regression
6. Implement concepts of Interfaces Name scope,Saver object, checkpoints
7. Implement concepts of Autodiff Example: word2vec
8. Implement concepts of Image classification
9. Implement concepts of GANs , Variational Auto-Encoders
10.Implement concepts of Variational Auto-Encoders
11. Implement concepts of Recurrent Neural Networks
12.Implement concepts of Seq2seq with Attention: Neural machine translation
13.Implement concepts of Transformer
14.Implement concepts of Tensor2Tensor: Dialogue agents
15. Implement concepts of Reinforcement Learning in Tensorflow, Keras

Course Outcomes

1. The student will be able to understand the concept variables, and Data Types, Operators and Expressions
2. The student will be able to understand the concepts of linear and nonlinear regressions.
3. The student will be able to understand the concepts of variable sharing principle.
4. The student will be able to understand the concepts of encoder with transformer
5. The student will be able to understand the concepts of reinforcement learning in tensorflow

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	2	2	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	14	14	13	14	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	DEEP LEARNING	CC16	2	-	-	-	3	5	25	75	100
Course Objective											
C1	Understanding the concept of open source										

C2	Understanding the concept of Machine learning	
C3	Understanding the concept of deep neural networks	
C4	Understanding the concept of convolution neural networks	
C5	Understanding the concept of Recurrent Neural Networks and Deep unsupervised Learning	
UNIT	**Details**	**No. of Hours**
I	**Machine Learning** Introduction to machine learning- Linear models (SVMs and Perceptron's, logistic regression) - Intro to Neural Networks - Training a neural network: loss functions, backpropagation and stochastic gradient descent - Neural networks as universal function approximates	6
II	**Deep Neural Networks** Introduction to Deep Learning- A Probabilistic Theory of Deep Learning- Deep Forward Networks - Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks	6
III	**Convolutional Neural Networks** Introduction to Convolutional Neural Network - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	6
IV	**Recurrent Neural Networks and Deep unsupervised Learning** Recurrent networks, LSTM, GRU - Architectures, Autoencoders and VariationalAutoencoders, Adversarial Generative Networks, DBM - Deep Reinforcement Learning	6
V	**Applications** Computer Vision- ImageNet- Detection- Face Recognition- Scene Understanding- Gathering Image Captions - Audio Wave Net - Natural Language Processing Word2Vec - Sentiment Analysis - Recent research	6
	Total	**30**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	understand the basics of deep learning	PO1
2	implement various deep learning models	PO1,PO2
3	realign high dimensional data using reduction techniques	PO4,PO6
4	analyze optimization and generalization in deep learning	PO4,PO5,PO6
5	explore the deep learning applications	PO3,PO8

Text Book	
1	Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
Reference Books	
1.	Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
2.	Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.
Web Resources	
1.	https://www.javatpoint.com/deep-learning

2.	https://www.geeksforgeeks.org/deep-learning-tutorial/

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**1**	**1**	**2**
CO2	**3**	**1**	**3**	**1**	**1**	**2**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**3**	**3**	**2**
Weightageof coursecontributed toeachPSO	**15**	**11**	**10**	**11**	**11**	**10**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	DEEP LEARNING LAB	**CC17**	-	-	5	I	3	25	75	100

Course Objectives:

- study the basic concepts of neural networks and deep learning
- comprehend deep learning techniques
- explore various applications for deep learning techniques

LAB EXERCISES	**Required Hours**

1. Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations 2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network 3. Study the effect of batch normalization and dropout in neural network classifier 4. Familiarization of image labelling tools for object detection, segmentation 5. Image segmentation using Mask RCNN, UNet, SegNet 6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.) 7. Image Captioning with Vanilla RNNs 8. Image Captioning with LSTMs 9. Network Visualization: Saliency maps, Class Visualization 10. Generative Adversarial Networks 11. Chatbot using bi-directional LSTMs 12. Familiarization of cloud based computing like Google colab	**60**

Course Outcomes	
On completion of this course, students will	
CO1	understand the basics of deep learning
CO2	implement various deep learning models
CO3	realign high dimensional data using reduction techniques
CO4	analyze optimization and generalization in deep learning
CO5	explore the deep learning applications

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**1**	**1**	**2**
CO2	**3**	**1**	**3**	**1**	**1**	**2**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**3**	**3**	**2**
Weightageof coursecontributed toeachPSO	**15**	**11**	**10**	**11**	**11**	**10**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Robotics and Its Applications	Elective	Y	-	-	-	3	5	25	75	100

Course Objective	
C1	To understand the robotics fundamentals
C2	Understand the sensors and matrix methods
C3	Understand the Localization: Self-localizations and mapping
C4	To study about the concept of Path Planning, Vision system
C5	To learn about the concept of robot artificial intelligence

UNIT	**Details**	**No. of Hours**
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	15
II	Actuators and sensors :Types of actuators, stepper-DC-servo- and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors	15
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	15
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression	15
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling.	15
	Total	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the different physical forms of robot architectures.	PO1

2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
3	Mathematically describe a kinematic robot system	PO4, PO6
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8
Text Book		
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001	
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011	
Reference Books		
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008	
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009	
Web Resources		
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm	
2.	https://www.geeksforgeeks.org/robotics-introduction/	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Agile Project Management	Elective	-	Y	-	-	3	5	25	75	100
Course Objective											

C1	Learning of software design, software technologies and APIs.	
C2	Detailed demonstration about Agile development and testing techniques.	
C3	Learning about Agile Planning and Execution.	
C4	Learning of Agile Management Design and Quality Check.	
C5	Detailed examination of Agile development and testing techniques.	
UNIT	**Details**	**No. of Hours**
I	**Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test.	15
II	**Being Agile:Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming – Summary **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	15
III	**Agile Planning and Execution:Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning. **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day.	15
IV	**Agile Management: Managing Scope and Procurement:** What's different about Agile scope management – Managing Agile scope – What's different about Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets.	15

V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1, PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO6
4	Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
5	Analysing of Agile development and testing techniques.	PO3, PO8

Text Book	
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.
Reference Books	
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.
3.	Alex Moore, Agile Project Management, 2020.
4.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.
Web Resources	
1.	www.agilealliance.org/resources

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Mobile Ad-hoc Network	Elective	-	Y	-	-	3	5	25	75	100

Course Objective	
C1	To learn about basics concepts of Ad-hoc network models.
C2	To learn about Medium Access Protocols(MAC).
C3	To learn about Network Routing Protocols and Algorithms .
C4	To learn about Delivery and Security in Transport Layer .
C5	To learn about cross layer design and optimizationtechniques, Integration of ad-hoc with Mobile IP networks.

UNIT	**Details**	**No. of Hours**
I	**Introduction**: Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models indoor and out-door models.	15
II	**Medium Access Protocol:** MAC Protocols: Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.	15
III	**Network Protocols :** Routing Protocols: Design issues, goals and classification. Proactive Vsreactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.	15
IV	**End – end delivery and security:** Transport Layer: Issues in designing – Transport layer classification, ad-hoc transport protocols. Security issues in ad-hoc networks: issues and challenges, network security attacks, secure routing protocols.	15
V	Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of ad-hoc with Mobile IP networks.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basics concepts of Ad-hoc network models.	PO1

2	Understand the Medium Access Protocols(MAC).	PO1, PO2
3	Understand Network Routing Protocols, design issues and various types of Routing Algorithms .	PO4, PO6
4	Understand the concepts of Delivery and Security in Transport Layer .	PO4, PO5, PO6
5	Understandcross layer techniques and Integration of ad-hoc with Mobile IP networks.	PO3, PO8
Text Book		
1	C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols II edition, Pearson Edition, 2007.	
	Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000	
Reference Books		
1.	Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.	
2.	Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.	
3.	T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad-hoc Network"	
4.	Research, "Wireless Commn. and Mobile Comp - Special Issue on Mobile Ad-hoc networking Research, Trends and Applications", Vol. 2, no. 5, 2002, pp. 483 – 502.	
5.	A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, FekriM. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no:12007.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Wireless_ad_hoc_network	
2.	https://www.ijert.org/mobile-ad-hoc-network	
3.	https://books.google.com/books/about/Mobile_Ad_Hoc_Networking.html?id=GnkcHEsxAigC	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	**S**							
CO 2	**S**	**S**						
CO 3				**S**		**S**		
CO 4				**S**	**S**	**S**		
CO 5			**S**					**S**

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Big Data Analytics	Core	Y	-	-	-	3	5	25	75	100

Course Objective		
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs	
C2	To identify and understand the basics of cluster and decision tree	
C3	To study about the Association Rules,Recommendation System	
C4	To learn about the concept of stream	
C5	Understand the concepts of NoSQL Databases	
UNIT	**Details**	**No. of Hours**
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value - Understanding Big Data Storage	15
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree.	15
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	15
IV	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 — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	15
V	NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data	15

	Analytic Methods using R.	
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO8
Text Book		
1	AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.	
Reference Books		
1.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013	
2.	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.	
Web Resources		
1.	https://www.simplilearn.com	
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**
	FINANCIAL ANALYTICS	**Elect 2**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To analyze and model financial data.
LO2	To construct and optimize asset portfolios.
LO3	To evaluate and model Risk on various financial assets.
LO4	To use the most powerful and sophisticated routines in R for analytical finance.
LO5	To acquire logical & analytical skills in financial analytics.

UNIT	Contents	No. Of. Hours
I	**Financial Analytics:** Introduction: Meaning-Importance of Financial Analytics uses-Features-Documents used in Financial Analytics: Balance Sheet, Income Statement, Cash flow statement-Elements of Financial Health: Liquidity, Leverage, Profitability. Financial Securities: Bond and Stock investments - Housing and Euro crisis - Securities Datasets and Visualization - Plotting multiple series.	**12**
II	**Descriptive Analytics:** Data Exploration, Dimension Reduction and Data Clustering Geographical Mapping, Market Basket Analysis. Predictive Analytics, Fraud Detection, Churn Analysis, Crime Mapping, Content Analytics, Sentiment Analysis. Analyzing financial data and implement financial models.	**12**
III	**Forecasting Analytics:** Estimating Demand Curves and Optimize Price, Price Bundling, Non Linear Pricing and Price Skimming, Forecasting, Simple Regression and Correlation Multiple Regression to forecast sales. Modeling Trend and Seasonality Ratio to Moving Average Method, Winter's Method.	**12**
IV	**Business Intelligence &Tableau:** Definition of BI – A Brief History of BI – The Architecture of BI. The origin and Drivers of BI. Successful BI Implementation – Analytics Overview – Descriptive, Predictive and Perspective Analytics. Business reporting and Visualization – components - A brief history of data visualization –	**12**
V	**Visualizations:** Using Tableau to Summarize Data, Slicing and Dicing Financial Data, Charts to Summarize Marketing Data. Functions to Summarize Data, Pricing Analytics, Risk based pricing, Fraud Detection and Prediction, Recovery Management, Loss Risk Forecasting, Risk Profiling, Portfolio Stress Testing.	**12**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Interpret and discuss the outputs of given financial models and create their own models.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Design and create visualizations that clearly communicate financial data insights.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Gain essential knowledge and hands-on experience in the data analysis process, including data scraping, manipulation, and exploratory data analysis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Be prepared for more advanced applied financial modeling courses.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Improve leadership, teamwork and critical thinking skills for financial decision making.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Analysis of Economic Data, Gary Koop, (4th Edition), Wiley.
2	Statistics and Data Analysis for Financial Engineering: with R examples; David Ruppert, David S. Matteson, Springers
Reference Books	
1.	Analyzing Financial Data and Implementing Financial Models Using „R", Ang Clifford, Springers.
2.	Microsoft Excel 2013: Data Analysis and Business Modeling, Wayne L. Winston, Microsoft Publishing
Web Resources	
1.	https://www.techtarget.com/searcherp/definition/financial-analytics
2.	https://www.teradata.com/Glossary/What-is-Finance-Analytics

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	15	12	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Virtual Reality Technology	Elective	-	Y	-	-	3	5	25	75	100
Course Objective											
C1	understand the fundamental principles of virtual reality										
C2	infer the essential information about the hardware and software in virtual environment.										
C3	design and construct a simple virtual environment										
UNIT	**Details**										**No. of Hours**

I	**History of Virtual Reality** Commercial VR Technology- Input Devices- Tracker Performance Parameters- Mechanical- Magnetic- Ultrasonic- Optical- Hybrid- Navigation and Manipulation Interfaces- Gesture Interfaces	15
II	**Output Devices** Graphic Displays - Sound Displays-The Human Auditory System- The Convolvotron - Haptic Feedback: The Human Haptic System- Tactile- Force- The Graphics Rendering Pipeline- PC Graphics Architecture- Graphics Benchmarks	15
III	**Workstation based Architecture** Workstation Based Architectures: The Sun Blade 1000 - The SGI Infinite Reality - Distributed VR -Multi pipeline Synchronization- Collocated Rendering- Distributed Virtual Environments- Geometric - Kinematics Modeling- Physical- Behavior- Model Management	15
IV	**Virtual Reality Programming** VR Programming: Toolkits and Scene Graphs- World Tool Kit- Java 3D- General Haptics Open Software Toolkit- People Shop-Usability Engineering Methodology	15
V	**Virtual Reality Applications** Engineering - Education - Medicine - Entertainment - Science - Training	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	recognize the virtual technology and usage of input devices.	PO1
2	identify the essential output devices, sound displays, graphics and feedback.	PO1, PO2
3	demonstrate workstation-based architecture for modelling.	PO4, PO6
4	analyze the programming tool kits in engineering the virtual reality methods.	PO4, PO5, PO6
5	relate the user performance and multimodality feedbacks.	PO3, PO8

Text Book

1	Grigore C. Burdea and Philippe Coiffet, “Virtual Reality Technology”, Third Edition, John Wiley and Sons, 2012,
2	Gerard Kim, “Designing Virtual Reality Systems: The Structured Approach”, Springer, 2007,

Reference Books	
1.	John Vince, "Introduction to Virtual Reality", Springer, 2004, ISBN: 1852337397, 9781852337391.
2.	William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann publisher, 2003, ISBN: 1558603530, 9781558603530.
3.	Alan B. Craig, William R. Sherman, Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009, ISBN: 0080959083, 9780080959085.
Web Resources	
1.	https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-virtual-reality

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	S	S						
CO 3				S		S		
CO 4				S	S	S		
CO 5			S					S

S-Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ETHICAL HACKING	SEC	2	-	-	I	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools– Locating the Network Range – Meta Search Engines	6

II	Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools	**6**
III	Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing –Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Key loggers and Spyware	**6**
IV	Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures	**6**
V	Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing– Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Explain the importance of security and various types of attacks	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understand the concepts of scanning and system hacking	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Explain about penetration testing and its methodology	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Identify the various programming languages used by security professional	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand the concept of security assessments	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	EC-Council, "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning,2010.
2	Jon Erickson, "Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3	Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013

Reference Books

1.	Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hackingand Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
2.	RafayBoloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014

Web Resources

1.	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview 2
2.	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview