PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM-636011

DEGREE OF BACHELOR OF SCIENCE

Syllabus for

B.Sc., COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(SEMESTER PATTERN- CBCS)

(For Candidates admitted in the colleges affiliated to

Periyar university from 2023-2024 onwards)

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION

CHENNAI-600005

1. Introduction

B.Sc. Computer Science, Artificial Intelligence and Machine Learning

Artificial Intelligence and Machine Learning is a hot core field that is rapidly growing in the fast-changing world and powering for great industrial revolution. The world workforce has changed the way the business grows without affecting humanity. A software giant predicted that around 75 million conventional jobs may disappear while 130 million jobs created during the revolution of AI and ML. It is estimated that by 2025, 30% of the jobs will end-up unfilled due to required skills shortage.

Many organizations already face a shortage of skilled talents across different verticals. Technical jobs increasingly require technology skills, organizations have begun to search for skilled persons with specialized skills such as data scientists, robotics experts and AI engineers and block chain developers etc.

The course is designed to bridge the gap between IT industries and academic institutes by incorporating the latest Artificial Intelligence technologies into the curriculum and to give students a complete understanding within a structured framework. The curriculum supports students to gain adequate knowledge in advanced programming as well as Artificial Intelligence practices along with theoretical foundation and also includes interdisciplinary courses and electives for widening the domain expertise. State-of-the-art infrastructure provides an excellent learning environment to hone the knowledge of each student.

The course provides the strong foundations in fundamentals of computer science with the knowledge of AI and Virtual Reality for employability and/or further studies in Post-graduation. Empower students with competencies in creative thinking, working in virtual domain with AI technique problem solving in virtual domain, inter-personal communication and managerial skills. Facilitate overall understanding of the technological development with legal and ethical issues. Equip the students in providing professional solutions to next generation solutions using AI techniques and adopting Virtual Reality concepts.

This is the primary reason the syllabus of Machine learning courses includes concepts that touch base on cloud computing, big data, natural language processing, and data sentiment analysis. The future of Machine Learning is estimated to bring opportunities in various areas of banking, finance, insurance, entertainment, telecommunication, automobile, etc. A data scientist will help

grow an organization by assisting them in making better decisions. Artificial Intelligence has become important due to recent technology disruptions. Most fundamental is Moore's Law which has driven an exponential growth in computing, storage, and communications per rupee over the past 50 years. This rate of growth shows no signs of abating. Consequently, today we have the Internet of Things: a plethora of sensors costing 10s of rupees or less, a global Internet with almost limitless bandwidth, and enormous storage in global clouds. The present era is full of technological advances in almost all spectrum of life and we are flooded with enormous amount of data. There is an increasing demand of capturing, analyzing, and synthesizing this large amount of data sets in a number of application domains to better understand various phenomena and to convert the information available in the data into actionable strategies such as new scientific discoveries, business applications, policy making, and healthcare etc.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc., Computer Science, Artificial Intelligence and Machine Learning**
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 to embrace 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 demon starting the 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:	**PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making. **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment. **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing. **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens. **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
PSO 1	Y	Y	Y	Y	Y	Y	Y	Y
PSO 2	Y	Y	Y	Y	Y	Y	Y	Y
PSO3	Y	Y	Y	Y	Y	Y	Y	Y
PSO 4	Y	Y	Y	Y	Y	Y	Y	Y
PSO 5	Y	Y	Y	Y	Y	Y	Y	Y

3 – Strong, 2- Medium, 1- Low

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 mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics 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 Industrial Statistics course is newly introduced in the fourth semester, 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 - Artificial Intelligence.

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 overviewof the pedagogy of learningLiterature and analyzing the world through the literary lens Gives rise to a new perspective.	➢ Instill confidence among students ➢ Create interest for thesubject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	➢ Industryreadygraduates ➢ Skilled human resource ➢ Students are equippedwith essential skills tomake them employable
		➢ Training on language and communication skills enable the students gain Knowledge and exposure in the competitive world.
		➢ Discipline centric skill will improve the Technical knowhow of solving real life problems.
III, IV, V & VI	Elective papers	➢ Strengthening the domain knowledge ➢ Introducing the stake holders to the State-of Art techniques from the streams ofmulti-disciplinary, cross disciplinary andinter disciplinary nature ➢ Emerging topics inhigher education/ industry/ communication network / health sectoretc. are introduced with hands-on-training.

IV	Elective Papers	➢ Exposure to industrymoulds students into solution providers ➢ Generates Industryready graduates ➢ Employment opportunities enhanced
V	Elective papers	➢ Self-learning isenhanced ➢ Application of the concept to real situationis conceived resulting in tangible outcome
VI	Elective papers	➢ Enriches the studybeyond the course. ➢ Developing a researchframework and presenting their independent and intellectual ideaseffectively.
Extra Credits: **For Advanced Learners / Honors degree**		➢ To cater to the needs ofpeer learners / research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Credit Distribution for UG Programmes

Sem I	Credit	Hours	Sem II	Credit	Hours	Sem III	Credit	Hours	Sem IV	Credit	Hours	Sem V	Credit	Hours	Sem VI	Credit	Hours
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course –\ CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

Choice Based Credit System (CBCS),
Learning Outcomes Based Curriculum Framework (LOCF)
Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

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 [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
Total		**23**	**30**

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]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
Total		**23**	**30**

Second Year
Semester-III

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]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
Total		**22**	**30**

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]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
Total		**25**	**30**

Third Year -Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	26
Part-4	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	2
Total		**26**	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
Total		**21**	**30**

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	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
NMSDC	-	2	-	-	-	-	2
Total	23	25	22	25	26	21	**142**

***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.

B.Sc. COMPUTER SCIENCE,ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester I				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language - Tamil	3	6
Part II		English	3	6
Part-III	23UAMCC01	CC1-Object Oriented Programming in C++	4	5
	23UAMCCP01	CC2-Practical:Programming in C++ lab	3	3
		Elective Course -EC1 (Generic Specific) Choose from Annexure I	6	6
Part- IV		Skill Enhancement Course- SEC1 (Non Major Elective)	2	2
		Foundation Course FC – Problem Solving Techniques	2	2
TOTAL			**23**	**30**

Semester II				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	4
Part-II	NMSDC	Language Proficiency for Employability- Overview of English Communication	2	2
Part III	23UAMCC02	CC3- Programming in Java	4	5
	23UAMCCP02	CC4-Practical: Programming Lab in Java	3	3
		Elective Course - EC2 (Generic Specific) Choose from Annexure I	6	6
Part IV		Skill Enhancement Course -SEC2 (Non Major Elective)	2	2
		Skill Enhancement Course - SEC3 Choose from Annexure II	2	2
TOTAL			**25**	**30**

Semester – III				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part-III	23UAMCC03	CC5-Programming in Python	4	5
	23UAMCCP03	CC6-Practical:Python Lab	3	3
		Elective Course- EC3 (Generic Specific) Choose from Annexure I	6	6
Part-IV		Skill Enhancement Course -SEC4 Choose from Annexure II	1	1
		Skill Enhancement Course -SEC5 Choose from Annexure II	2	2
		Environmental Studies		1
TOTAL			**22**	**30**

Semester – IV				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part III	23UAMCC04	CC7-R Programming	4	4
	23UAMCCP04	CC8-Practical:R Programming Lab	3	3
		Elective Course - EC4 (Generic Specific) Choose from Annexure I	6	6
Part IV		Skill Enhancement Course - SEC6 Choose from Annexure II	2	2
		Skill Enhancement Course - SEC7 Choose from Annexure II	2	2
		Environmental Studies	2	1
TOTAL			**25**	**30**

Semester – V				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part-III	23UAMCC05	CC9-Machine Learning techniques	4	5
	23UAMCCP05	CC10-Practical:Machine Learning Lab	4	5
	23UAMCC06	CC11-Deep Learning	4	5
		Elective Course - EC5 (Discipline Specific) Choose from Annexure I	3	4
		Elective Course – EC6 (Discipline Specific) Choose from Annexure I	3	4
	23UAMCCPR1	CC12 - Project with Viva voce	4	5
Part-IV		Value Education	2	2
		Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
TOTAL			**26**	**30**

Semester – VI				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part III	23UAMCC07	CC13- Natural Language Processing	4	6
	23UAMCCP06	CC14-Practical:Natural Language Processing Lab	4	6
	23UAMCC08	CC15- Practical-Artificial Intelligence	4	6
		Elective Course – EC7 (Discipline Specific) Choose from Annexure I	3	5
		Elective Course – EC8 (Discipline Specific) Choose from Annexure I	3	5
Part IV		Skill Enhancement Course - SEC8 Choose from Annexure II	2	2
		Extension Activity	1	-
TOTAL			**21**	**30**
Total Credits				**142**

ANNEXURE- I

Elective Course (EC1- EC8) (Generic / Discipline Specific)

Generic Specific

S.No	Paper Title
1	Mathematics-I
2	Mathematics-II
3	Mathematics Practical
4	Discrete Mathematics-I
5	Discrete Mathematics-II
6	Numerical Methods
7	Optimization Techniques
8	Introduction to Linear Algebra
9	Graph Theory and its Application
10	Numerical Methods-I
11	Numerical Methods-II
12	Statistical Methods and its Application-I
13	Statistical Methods and its Application-II
14	Statistical Practical
15	Physics-I
16	Physics Practical-I
17	Physics-II
18	Physics Practical-II
19	Digital Logic Fundamentals
20	Nano Technology
21	Electronics Science

22	Microprocessor & Micro Controller
23	Applied Electronics-I
24	Applied Electronics-II
25	Applied Electronics Lab

Discipline Specific

S.No	Paper Code	Paper Title
1	23UAMDE01	Analytics for Service Industry
2	23UAMDE02	Financial Analytics
3	23UAMDE03	Marketing Analytics
4	23UAMDE04	Data Communication And Computer Networks
5	23UAMDE05	Big Data Analytics
6	23UAMDE06	Computer Networks
7	23UAMDE07	Cryptography
8	23UAMDE08	Operating System
9	23UAMDE09	Artificial Neural Networks
10	23UAMDE10	Software Engineering
11	23UAMDE11	Software Quality Assurance
12	23UAMDE12	Software Project Management
13	23UAMDE13	Software Metrics
14	23UAMDE14	Organizational Behavior
15	23UAMDE15	Agile Project Management
16	23UAMDE 16	Computing Intelligence
17	23UAMDE 17	Information Security
18	23UAMDE 18	Grid Computing

[Pl. Note: In Semester-VI - For EC7 and EC8 subjects
Instructional hours may be used as: 5 per cycle]

Annexure II

Skill Enhancement Course (SEC1-SEC8)

S.No	Paper Code	Paper Title
1	23UAMSE01	Introduction To Html
2	23UAMSE02	Office Automation
3	23UAMSE03	Qualitative Aptitude
4	23UAMSE04	Cyber Forensics
5	23UAMSE05	Multimedia Systems
6	23UAMSE06	Software Testing
7	23UAMSE07	Data Mining And Warehousing
8	23UAMSE08	Bio Metrics
9	23UAMSE09	Enterprise Resource Planning
10	23UAMSE10	Robotics And Applications
11	23UAMSE11	Simulation And Modeling
12	23UAMSE12	Pattern Recognition
13	23UAMSE13	Advanced Excel
14	23UAMSE14	Open Source Software Technologies
15	23UAMSE15	PHP Programming
16	23UAMSE16	Web Technology
17	23UAMSE17	Network Security
18	23UAMSE18	Image Processing

Note: For Semester I & II [if other department select our paper as Non Major Elective choose from the above Skill Enhancement Course]

FIRST YEAR –SEMESTER- I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	OBJECT ORIENTED PROGRAMMING IN C++	**CCI**	5	-	-	I	4	25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Object Oriented Programming concepts using the C++ language.
LO2	To describe and use constructors and destructors.
LO3	To impart knowledge on the principles of Operator overloading and inheritance.
LO4	To understand tokens, expressions, and control structures
LO5	To understand and employ file management.

UNIT	**Contents**	**No. of Hours**
I	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures: - Decision Making and Statements: If ... else, jump, goto, break, continue, Switch case statements - Loops in C++: for, while, do - functions in C++ - inline functions – Function Overloading	**15**
II	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.	**15**
III	Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.	**15**
IV	Pointers – Declaration – Pointer to Class, Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding, Polymorphism and Virtual Functions.	**15**
V	Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions.	**15**

	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Explain the object oriented concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Explain the various file stream classes; file types, usage of templates and exception handling mechanisms.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Ashok N Kamthane, Object-Oriented Programming with Ansi and Turbo C++, Pearson Education, 2003..

Reference Books

1.	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998
2.	Maria Litvin& Gray Litvin, C++ for you, Vikas publication, 2002
3.	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002.

Web Resources

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

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
	PROGRAMMING LAB IN C++	**CCII**	-	-	5	I	4	25	75	100

Course Objectives:

1. Be able to design and program C++ applications.
2. Be able to create loops and decision statements in C++.
3. Be able to work with functions and pass arguments in C++.
4. Be able to work on the concept of Inheritance.
5. Be able to read and write files in C++.

	Required Hours
	75

LAB EXERCISES:

1. Program using Class and Object.
2. Program using C++ operators.
3. Program using Decision-making statements
4. Program using Loop Statements.
5. Program using Library function.
6. Program using Inline Function.
7. Program in Passing object to function
8. Program in Returning object from function
9. Program using Constructor and Destructor.
10. Program using Function Overloading.
11. Program using Virtual Function
12. Program using Static data members and member functions
13. Program using Inheritance.
14. Program using Command line arguments.
15. Program using File Handling

Course Outcomes	
On completion of this course, students will	
CO1	To understand the concepts of Object-Oriented Programming Paradigm and the programming constructs of C++
CO2	Illustrate the concept of Virtual Classes, inline functions and friend functions
CO3	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.
CO4	Compare the pros and cons of procedure oriented language with the concepts of object oriented language
CO5	Apply the various basic programming constructs like decision making statements. Looping statements, functions, concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors

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
	COMPUTER FUNDAMENTALS	**SEC-2**	2	-	-	II	2	25	75	100

Learning Objectives	
LO1	Discuss the Introduction about Computer and its Components.
LO2	To Perform the Microsoft Word, Excel, PowerPoint and its operations.
LO3	To get Knowledge about the Internet and Intranet
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 to Computers** - Generations of Computer – Data and Information – Components of Computer – Software – Hardware – Input Devices - Output Devices — Types of Operating System.	**6**
II	**MS Word**: Introduction – Elements of Window – Files, Folders and Directories – Text Manipulating: Cut, Copy, Paste, Drag and Drop – Text Formatting: Font – Style, Size, Face and Colors (Both foreground and background) – Alignment - Bullets and Numbering - Header and footer-watermark – inserting objects (images, other application document) – Table creation – Mail merge.	**6**
III	**Ms Excel**: Introduction – Inserting rows and columns – Sizing rows and columns – Implementing formulas – Generating series - Functions in excel – Creation of Chart – Inserting objects – Filter – Sorting – Inserting worksheet.	**6**
IV	**MS PowerPoint**: Introduction – Slides Manipulation (Inserting new, Copy, paste, delete and duplicate slides) – Slide show– Types of Views – Types of Animations – Inserting Objects – Implementing multimedia (Video and Audio) – Templates (Built-in and User-Defined).	**6**
V	**Internet**: Introduction to Internet and Intranet – Services of Internet - Domain Name – URL – Browser – Types of Browsers – Search Engine - E-Mail – Basic Components of E-Mail –.How to send group mail. **E-Commerce**: Digital Signature – Digital Currency – Online shopping and transaction.	**6**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand the basics of Computer and its Generations. Be able to understand the components of computer.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To Understand the introduction about MS Word. Be able to perform the Elements of window, Text Formatting, Text Manipulating options in MS Word.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To Understand the introduction about MS Excel. Be able to inserting and sizing the cells Implementing formulas and inserting worksheet.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To Understand the introduction about MS PowerPoint Be able to perform the slides manipulation. Implementing Multimedia and templates.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	To Understand the introduction about Internet and Intranet. Be able to access the browsers. To get knowledge about basic components of E-Mail and E-Commerce	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	G. Manjunath, “Computer Basics”, Vasan Publications, 2010.
2	Pradeep K. Sinha&PritiSinha, “Computer Fundamentals”, 6th Edition, BPB Publications, 2004.
Web Resources	
1.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
2.	https://www.tutorialspoint.com/basics_of_computers/index.htm
3.	https://www.tutorialspoint.com/word/index.htm
4.	https://www.tutorialspoint.com/excel/index.htm
5.	https://www.tutorialspoint.com/powerpoint/index.htm

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	2	3	3	2
CO 3	2	3	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	2	3
Weightage of course contributed to each PSO	14	14	13	15	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
	PROBLEM SOLVING TECHNIQUES	**FC**	2	-	-	I	2	25	75	100

Learning Objectives	
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
LO2	Implement different programming constructs and decomposition of problems into functions.
LO3	Use data flow diagram, Pseudo code to implement solutions.
LO4	Define and use of arrays with simple applications
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	**6**
II	**Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. **Pseudocode:** Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming.	**6**
III	**Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	**6**
IV	**Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	**6**
V	**Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files.	**6**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.	PO1, PO2, PO3, PO4,

		PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers.	
Web Resources		
1.	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm	
2.	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067	
3.	http://utubersity.com/?page_id=876	

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

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

FIRST YEAR –SEMESTER- II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PROGRAMMING IN JAVA	**CC III**	5	-	-	II	4	25	75	100

Learning Objectives	
LO1	To understand the basic concepts and fundamentals of platform independent object oriented language.
LO2	To apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
LO3	To understand streams and efficient user interface design techniques
LO4	To develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
LO5	To understand the concept of applets by how to create and run applets and Graphics programming by various classes in the graphics class.

UNIT	Contents	No. Of. Hours
I	**Fundamentals of OOP** Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm – Basic Concepts of Object-Oriented Programming – Benefits of Object-Oriented Programming – Application of Object Oriented Programming. Java Evolution: History – Features – How Java differs from C and C++ – Java and Internet – Java and www –Web Browsers. Overview of Java: simple Java program – Structure – Java Tokens – Statements – Java Virtual Machine	**15**
II	**Variables & Control Structures** Constants, Variables, Data Types - Operators and Expressions – Decision Making and Branching: if, if...else, nested if, switch? : Operator - Decision Making and Looping: while, do, for – Jumps in Loops - Labeled Loops – Classes, Objects and Methods	**15**
III	**Arrays & Classes** Arrays, Strings and Vectors – Interfaces: Multiple Inheritance – Packages: Putting Classes together – Multithreaded Programming.	**15**
IV	**Error Handling & Graphics** Managing Errors and Exceptions – Applet Programming – Graphics Programming.	**15**
V	**I/O Stream** Managing Input / Output Files in Java: Concepts of Streams-Stream Classes – Byte Stream classes – Character stream classes – Using streams – I/O Classes – File Class – I/O exceptions – Creation of files – Reading / Writing characters, Byte-Handling Primitive Data Types – Random Access Files.	**15**

	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Recite the history of JAVA and its evolution	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Explain the various programming language constructs, object oriented concepts like overloading, inheritance, polymorphism, Interfaces , threads, exception handling and packages.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Illustrate the concepts of Applets, files and the concept of stream classes.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Outline the benefits and applications of objects oriented programming concepts and defend how JAVA differs from other programming languages	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Judge the pros and cons of other object oriented language with the concepts of JAVA	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Programming with Java – A Primer - E. Balaguruswamy, 3rd Edition, TMH.
Reference Books	
1.	The Complete Reference Java 2 - Patrick Naughton& Hebert Schildt, 3rd Edition, TMH
2.	Programming with Java – John R. Hubbard, 2nd Edition, TMH
Web Resources	
1.	https://www.javatpoint.com/jsf-web-resources
2.	https://www.computerscience.org/resources/java/
3.	https://www.w3schools.com/java/java_intro.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	3	3	3	3
CO 3	3	3	3	3	1	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	2

Weightage of course contributed to each PSO	15	15	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
	Programming Lab in Java	**CC IV**	-	-	5	II	4	25	75	100

Objectives

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.
- Be able to create an application using string concept.
- Be able to create a program using files in application.
- Be able to create an Applet to create an application.
- Identify and fix defects and common security issues in code.

	Required Hour
LIST OF PROGRAMS **Applications:** 1. Program using Class and Object. 2. Program using Constructors. 3. Program using Command-Line Arguments. 4. Program using Random Class. 5. Program using Vectors. 6. Program using String Tokenizer Class. 7. Program using Interface. 8. Program using all forms of Inheritance. 9. Program using String class. 10. Program using String Buffer class. 11. Program using Exception Handling. 12. Implementing Thread based applications 13. Program using Packages. 14. Program using Files. **Applets**: 15. Working with Colors and Fonts. 16. Parameter passing technique. 17. Drawing various shapes using Graphical statements. 18. Usage of AWT components and Listener in suitable applications.	**75**

Course Outcomes	
CO	On completion of this course, students will
CO1	To understand the concepts of Linked List, Stack and Queue.
CO2	Concepts of Trees and Graphs. Perform traversal operations on Trees and Graphs. To enable the applications of Trees and Graphs.
CO3	To apply searching and sorting techniques
CO4	To determine the concepts of Greedy Method To apply searching techniques.
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.

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

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	COMPUTER FUNDAMENTALS	**SEC-2**	2	-	-	II	2	25	75	100
Learning Objectives										
LO1	Discuss the Introduction about Computer and its Components.									
LO2	To Perform the Microsoft Word, Excel, PowerPoint and its operations.									

LO3	To get Knowledge about the Internet and Intranet
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 to Computers** - Generations of Computer – Data and Information – Components of Computer – Software – Hardware – Input Devices - Output Devices — Types of Operating System.	**6**
II	**MS Word**: Introduction – Elements of Window – Files, Folders and Directories – Text Manipulating: Cut, Copy, Paste, Drag and Drop – Text Formatting: Font – Style, Size, Face and Colors (Both foreground and background) – Alignment - Bullets and Numbering - Header and footer-watermark – inserting objects (images, other application document) – Table creation – Mail merge.	**6**
III	**Ms Excel**: Introduction – Inserting rows and columns – Sizing rows and columns – Implementing formulas – Generating series - Functions in excel – Creation of Chart – Inserting objects – Filter – Sorting – Inserting worksheet.	**6**
IV	**MS PowerPoint**: Introduction – Slides Manipulation (Inserting new, Copy, paste, delete and duplicate slides) – Slide show– Types of Views – Types of Animations – Inserting Objects – Implementing multimedia (Video and Audio) – Templates (Built-in and User-Defined).	**6**
V	**Internet**: Introduction to Internet and Intranet – Services of Internet - Domain Name – URL – Browser – Types of Browsers – Search Engine - E-Mail – Basic Components of E-Mail –.How to send group mail. **E-Commerce**: Digital Signature – Digital Currency – Online shopping and transaction.	**6**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand the basics of Computer and its Generations. Be able to understand the components of computer.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To Understand the introduction about MS Word. Be able to perform the Elements of window, Text Formatting, Text Manipulating options in MS Word.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To Understand the introduction about MS Excel. Be able to inserting and sizing the cells Implementing formulas and inserting worksheet.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To Understand the introduction about MS PowerPoint Be able to perform the slides manipulation. Implementing Multimedia and templates.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	To Understand the introduction about Internet and Intranet. Be able to access the browsers.	PO1, PO2, PO3, PO4, PO5, PO6

	To get knowledge about basic components of E-Mail and E-Commerce	

Textbooks	
1	G. Manjunath, "Computer Basics", Vasan Publications, 2010.
2	Pradeep K. Sinha&PritiSinha, "Computer Fundamentals", 6th Edition, BPB Publications, 2004.
Web Resources	
1.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
2.	https://www.tutorialspoint.com/basics_of_computers/index.htm
3.	https://www.tutorialspoint.com/word/index.htm
4.	https://www.tutorialspoint.com/excel/index.htm
5.	https://www.tutorialspoint.com/powerpoint/index.htm

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

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

SECOND YEAR –SEMESTER- III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PROGRAMMING IN PYTHON	**CC V**	5	-	-	III	4	25	75	100

Learning Objectives		
LO1	To understand the basic concepts of Python	
LO2	To understand the control statements, lists and tuples	
LO3	To acquire a concept of function in Python.	
LO4	To understand the error handling concept in python	
LO5	To understand the object oriented features in Python.	
UNIT	**Contents**	**No. Of. Hours**
I	**BASICS** Python - Variables - Executing Python from the Command Line - Editing Python Files -Python Reserved Words - Basic Syntax-Comments - Standard Data Types – Relational Operators -Logical Operators - Bit Wise Operators - Simple Input and Output.	**15**
II	**CONTROL STATEMENTS, LISTS, TUPLES** CONTROL STATEMENTS: Control Flow and Syntax - Indenting - if Statement - statements and expressions- string operations- Boolean Expressions -while Loop - break and continue - for Loop. LISTS: List-list slices - list methods - list loop–mutability–aliasing - cloning lists - list parameters. TUPLES: Tuple assignment, tuple as return value -Sets–Dictionaries..	**15**
III	**FUNCTIONS**: Definition - Passing parameters to a Function - Built-in functions- Variable Number of Arguments - Scope – Type conversion- Type coercion-Passing Functions to a Function – Mapping Functions in a Dictionary – Lambda - Modules - Standard Modules – sys – math – time - dir – help Function	**15**
IV	**ERROR HANDLING**: Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.	**15**
V	**OBJECT ORIENTED FEATURES**: Classes Principles of Object Orientation - Creating Classes -Instance Methods - File Organization - Special Methods - Class Variables – Inheritance – Polymorphism - Type Identification - Simple Character Matches - Special Characters – Character Classes – Quantifiers - Dot Character - Greedy Matches – Grouping - Matching at Beginning or End - Match Objects – Substituting - Splitting a String - Compiling Regular Expressions.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Apply the various basic programming constructs like operators, expressions, decision making statements and Looping statements	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Summarize the concept of lists, tuples , functions and error handling	PO1, PO2, PO3, PO4, PO5, PO6

CO3	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze the concepts of Lists, tuples and error handling mechanisms	PO1, PO2, PO3, PO4, PO5, PO6
CO5	To evaluate a program incorporating all the python language constructs.	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001
	Reference Books
1.	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist__, 2nd edition, Updated for Python 3, Shroff/O_Reilly Publishers, 2016
2.	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3	Kenneth A. Lambert(2012), Fundamentals of Python: First Programs, C engage Learning

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	2	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	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**
	PYTHON LAB	**CC VI**	-	-	4	III	4	25	75	100

Learning Objectives:

- Acquire programming skills in core Python.
- Acquire Object-oriented programming skills in Python.
- Develop the skill of designing graphical-user interfaces (GUI) in Python.
- Develop the ability to write database applications in Python.
- Acquire Python programming skills to move into specific branches

Course Outcomes:

CO1: To understand the problem solving approaches

CO2: To learn the basic programming constructs in Python

CO3: To practice various computing strategies for Python-based solutions to real world problems

CO4: To use Python data structures - lists, tuples, dictionaries.

CO5: To do input/output with files in Python**.**

	List of Exercises:	**Required Hours**
	1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice. 2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria: Grade A: Percentage >=80 Grade B: Percentage >=70 and 80 Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60 Grade E: Percentage < 40 3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters	**60**

	from user. 4. Write a Python script that prints prime numbers less than 20. 5. Program to find factorial of the given number using recursive function. 6. Write a Python program to count the number of even and odd numbers from array of N numbers. 7. Write a Python class to reverse a string word by word. 8. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3) 9. Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance). 10. Write a Python program to construct the following pattern, using a nested loop * ** *** **** ***** **** *** ** * 11. Read a file content and copy only the contents at odd lines into a new file. 12. Create a Turtle graphics window with specific size.	

	13. Write a Python program for Towers of Hanoi using recursion 14. Create a menu driven Python program with a dictionary for words and their meanings. 15. Devise a Python program to implement the Hangman Game.	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	2	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	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
	ECOMMERCE	**SEC 4**	1	-	-	III	2	25	75	100

Learning Objectives	
LO1	Understanding of the foundations and importance of E-commerce
LO2	Understanding of retailing in E-commerce by in terms of branding and pricing strategies and determining the effectiveness of market research.
LO3	Assess the Internet trading relationships including Business to Consumer, Business- to-Business, Intra-organizational.
LO4	Knowing key features of Internet, Intranets and Extranets and how they relate to each other.
LO5	Understanding legal issues and privacy in E-Commerce.

UNIT	Contents	No. Of. Hours

I	**E-Commerce:** E-Commerce Framework – E-Commerce and Media Convergence – The anatomy of E-commerce applications - E-Commerce Consumer Applications - E- Commerce Organization Applications.	**6**
II	**The Internet:** The Internet Terminology – NSFNET – Architecture and Components– National Research and Education Network – Internet Governance – An overview of Internet Applications. The Business of Internet Commercialization: Telco/Cable/Online companies - National Independent ISPs – Regional level ISPs – Local level ISPs.	**6**
III	**E-Commerce and the World Wide Web:** Architectural Framework for E-commerce – WWW as the architecture – Technology behind the web – Security and the web.	**6**
IV	**Electronic Payment Systems:** Types of Electronic Payment Systems – Digital token Electronic Payment Systems – Credit Card Based Electronic Payment Systems – Risk and Electronic Payment Systems. Electronic Data Interchange: Legal, Security and Privacy issues.	**6**
V	**Advertising and Marketing on the Internet:** E-Commerce Catalogs – Information Filtering – Consumer Data Interface – Emerging tools. Software Agents: Characteristics and Properties of Software Agents – Technology behind Software Agents - Applets, Browsers, and Software Agents.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Demonstrate E-Commerce Frameworks. Distinguish E-Commerce and media Convergence. Illustrate E-Commerce Applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Describe the E-Commerce Networks and Research Networks, Analyze the Internet Commercialization	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Evaluate the E-Commerce how incorporate the Internet, Construct the Web Security	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Distinguish the different payment system. Illustrate the data interchange	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understanding the Advertising and Marketing on the Internet, Describe Software Agents	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1. **Ravi Kalakota& Andrew Whinston,** "*Frontiers of Electronic-Commerce*", Addison Wesley.

Reference Books

1. **EfraimTurvanJ.Lee, David Kug and Chung**, "Electronic Commerce", Pearson Education, Asia.
2. **Manlyn Greenstein and Miklos**, "Electronic Commerce", TMH.

Web Resources	
1.	https://www.the-reference.com/en/expertise/creation-and.../e-commerce
2.	https://en.wikipedia.org/wiki/E-commerce
3.	https://www.tutorialspoint.com/e_commerce/index.htm

Mapping with Programme Outcomes:

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

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

SECOND YEAR –SEMESTER- IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	R PROGRAMMING	**CC VII**	5	-	-	IV	4	25	75	100

Learning Objectives		
LO1	Master the use of the R and R Studio interactive environment.	
LO2	Expand R by installing R packages	
LO3	Explore and understand how to use the R documentation.	
LO4	Read Structured Data into R from various sources.	
UNIT	**Contents**	**No. Of. Hours**
I	**Introducing to R** Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names. (9)	**15**

II	**Matrices** Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.	**15**
III	**Data Frames** Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R. –Stack –Hash tables – String class.	**15**
IV	**Classes** S3Classes – S4 Classes -Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.	**15**
V	**Interfacing R** Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Expose the student sot the fundamental concepts of R Programming	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understand the basics in R programming in terms of constructs, control statements, string functions	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the use of R for Big Data analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply R programming for Text processing	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Appreciate and apply the R programming from a statistical perspective	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1 P.Naughton and H.Schildt(1999), Java 2 (The Complete Reference), Third Edition, Tata MCGraw Hill Edition

2	K.K. Aggarwal &Yogesh Sing (2008), Software Engineering, Revised Third Edition, New Age International Publishers.

Reference Books

1.	Mark Gardner, ―Beginning R – The Statistical Programming Language‖, Wiley, 2013. 2
2.	Robert Knell, ―Introductory R: A Beginner‘s Guide to Data Visualisation, Statistical Analysis and programming in R‖, Amazon Digital South Asia Services Inc, 2013.

Web Resources

1.	https://www.w3schools.com/r/
2.	https://www.tutorialspoint.com/r/index.htm
3.	https://www.javatpoint.com/r-tutorial

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

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	R PROGRAMMING LAB	**CC VIII**	-	-	4	IV	4	25	75	100

Learning Objectives:

- Understand the basics in R programming in terms of constructs, control statements, string

functions

- Understand the use of R for Big Data analytics K
- Apply R programming for Text processing
- Appreciate and apply the R programming from a statistical perspective

Lab Exercises:	**Required Hours**
1. R Expressions and Data Structures 2. Manipulation of vectors and matrix 3. Operators on Factors in R 4. Data Frames in R 5. Lists and Operators 6. Working with looping statements. 7. Graphs in R 8. 3D plots in R	**60**

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

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

THIRD YEAR –SEMESTER- V

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Marks**		
								CIA	**External**	**Total**

	MACHINE LEARNING TECHNIQUES	CC IX	6	-	-	V	4	25	75	100

Learning Objectives	
LO1	To Learn about Machine Intelligence and Machine Learning applications
LO2	To implement and apply machine learning algorithms to real-world applications
LO3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems
LO4	To create instant based learning
LO5	To apply advanced learning

UNIT	Contents	No. Of. Hours
I	**Introduction Machine Learning -** Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines	**18**
II	**Neural networks and genetic algorithms** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.	**18**
III	**Bayesian and computational learning** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**18**
IV	**Instant based learning** K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.	**18**
V	**Advanced learning** Recommendation systems – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.	**18**
	TOTAL HOURS	**90**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Appreciate the importance of visualization in the data analytics solution	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Apply structured thinking to unstructured problems	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand a very broad collection of machine learning algorithms and problems	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theor	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop an appreciation for what is involved in learning from data.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.	
2	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press	
Reference Books		
1.	EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.	
2	Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.	

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

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

Subject	Subject Name	C a	L	T	P	S	C x	Marks

Code								CIA	External	Total
	MACHINE LEARNING LAB	**CCX**	-	-	5	V	4	40	60	100

Learning Objectives:

To apply the concepts of Machine Learning to solve real-world problems and to implement basic algorithms in clustering & classification applied to text & numeric data

	Required Hour
LAB EXERCISES: 1. Solving Regression & Classification using Decision Trees 2. Root Node Attribute Selection for Decision Trees using Information Gain 3. Bayesian Inference in Gene Expression Analysis 4. Pattern Recognition Application using Bayesian Inference 5. Bagging in Classification 6. Bagging, Boosting applications using Regression Trees 7. Data & Text Classification using Neural Networks 8. Using Weka tool for SVM classification for chosen domain application 9. Data & Text Clustering using K-means algorithm 10. Data & Text Clustering using Gaussian Mixture Models	**75**

Course Outcomes	
CO	On completion of this course, students will
CO1	Effectively use the various machine learning tools
CO2	Understand and implement the procedures for machine learning algorithms CO3
CO3	Design Python programs for various machine learning algorithms

CO4	Apply appropriate datasets to the Machine Learning algorithms
CO5	Analyze the graphical outcomes of learning algorithms with specific datasets

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
	DEEP LEARNING	**CC XI**	5	-	-	V	4	25	75	100

Learning Objectives	
LO1	To understand the basic concepts and techniques of Deep Learning.
LO2	To understand and apply the Machine learning principles
LO3	To study the deep learning architectures
LO4	To explore and create deep learning applications with tensor flow

UNIT	Contents	No. Of. Hours
I	**Introduction to Learning** The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Softmax output layers	**15**
II	**Deep Learning Models** Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization	**15**
III	**CNN** Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications	**15**
IV	**RNN** Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM — Memory augmented Neural Networks –	**15**

	NTM—Application	
V	**Reinforcement Learning** Reinforcement Learning – MDP – Q Learning – Applications	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the main fundamentals that drive Deep Learning	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Be able to build, train and apply fully connected deep neural networks	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Know how to implement efficient CNN or RNN.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Understand the key features in a neural network's architecture	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Nikhil Buduma, Nicholas Locascio, ―Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms, O'ReillyMedia, 2017.

Reference Books

1	Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning (Adaptive computation and Machine Learning series‖, MITPress, 2017.

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

THIRD YEAR –SEMESTER- VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	NATURAL LANGUAGE PROCESSING	**CC XIII**	6	-	-	VI	4	25	75	100

Learning Objectives	
LO1	To gain a foundational understanding in natural language processing methods and strategies.
LO2	To evaluate the strengths and weaknesses of various NLP technologies and frameworks as they gain practical experience in the NLP toolkits available.
LO3	To gain a foundational understanding in natural language processing methods and strategies.
LO4	To learn how to employ literary-historical NLP-based analytic techniques like stylometry, topic modeling, synsetting and named entity recognition in their personal research.
LO5	To understand the theoretical underpinnings of natural language processing in linguistics and formal language theory.

UNIT	Contents	No. Of. Hours
I	**Introduction to NLP** Introduction: application of NLP techniques and key issues- MT grammer checkers- dictation – document generation- NL interfaces- Natural language processing key issues- the different analysis level used for NLP: morpho-lexical-syntactic-semantic-pragmatic-markup(TEI, UNICODE)-finite state automata- Recursive and augmented transition networks- open problems	**18**
II	**Lexical Level** Lexical level: error tolerant lexical processing(spelling error correction)-transducers for the design of morphologic analyzers features-towards syntax: part-of-speech tagging(BRILL,HMM)- efficient representations for linguistic resources(lexica, grammars,….) tries and finite state automata.	**18**
III	**Syntactic Level** Syntactic level: grammars(eg.formal/Chomsky hierarchy,DCSGs,systematic case, unification, stochastic)- parsing (top-down ,bottom up,char(early algorithm),CYK algorithm)- automated estimation of probabilistic model parameters(inside-outside algorithm)-data oriented parsinggrammar formalisms and treebanks- efficient patsing for context-free grammars(CFGs)-statistcial parsing and probabilistic CFGs(PCFGs)-lexicilized PCFGse.	**18**
IV	**Semantic Level** Semantic level: logical forms - ambiguity resolution - semantic network and parsers-procedural semantics - montague semantics- vector space approaches - distributional semantics-lexical semantics and word sense disambiguation-compositional semantics	**18**

	semantic role labeling and sematic parsing	
V	**Pragmatic Level** Pragmatic level: knowledge representation- reasoning-plan/goal recognition –speech acts/intentions – belief models- discourse-reference. Natural language generation: content determination – sentence planning- surface realization, subjectivity and sentiment analysis: information extraction – automatic summarization- information retrieval and question answering– named entity recognition and relation extraction.	**18**
	TOTAL HOURS	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the fundamental concepts and techniques of Natural Language Processing (NLP)	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Understanding of the models and algorithms in the field of NLP.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Understanding semantics and pragmatics of languages for processing	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understanding the capabilities and limitations of current natural language technologies, and some of the algorithms and techniques that underlie these technologies	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Danie lJ and JamesH. Martin, An Introduction to natural language processing, computation a linguistics and speech recognition prenticehall,2009.

Reference Books

1.	1.LanH Written and Elbef, Mark A. Hall, datamining: practical machine learning tools and techiniques, Morgan Kaufmann, 2013.
2.	Mohamed ZakariaKurdi, Natural Language Processing and Computational Linguistics 1, speech, Morphology, and syntax, wiley, ISTE Ltd, 2016.

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	3	3	3
CO 3	3	3	3	3	3	3
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	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**
	NATURAL LANAGUAGE PROCESSING LAB	**CC XIV**	-	-	6	VI	4	25	75	100

Objectives

To introduce the fundamental concepts and techniques of natural language processing (NLP)

	Required Hours
LIST OF PROGRAMS 1. Implementing word similarity 2. Implementing simple problems related to word disambiguation 3. Simple demonstration of part of speech tagging. 4. Lexical analyzer. 5. Semantic Analyzer. 6. Sentiment Analysis.	**90**

Course Outcomes

CO	On completion of this course, students will
CO1	To analyze the syntax, semantics, and pragmatics of a statement written in a natural language.
CO2	To develop a conversational agent that uses natural language understanding and generation.

CO3	To recognize the significance of research in natural language processing for common NLP tasks such as text classification, spam filtering, spell checking, machine learning, etc. to engage in lifelong learning
CO4	Understand the concepts of linguistic foundations that underlie natural language processing, which would provide the knowledge for building components of NLP systems.
CO5	Apply the computational knowledge for Natural Language Processing to understand the properties of natural languages, its algorithms for processing linguistic information in various tasks such as Machine translation, Information extraction and retrieval, and Speech Technology.

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**	**Marks**		
								CIA	**External**	**Total**
	ARTIFICIAL INTELLIGENCE	**CC XV**	6	-	-	VI	4	25	75	100

Learning Objectives	
LO1	Describe the concepts of Artificial Intelligence
LO2	Understand the method of solving problems using Artificial Intelligence
LO3	Understand natural language processing
LO4	Introduce the concept of Expert system, Fuzzy logic

LO5	Understand about operating system and their uses	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction to Artificial Intelligence** What is Artificial Intelligence? AI Technique, Representation of a problem as State space search, production systems, Problem characteristics, Production System characteristics – Issues in the design of search programs, Heuristic Search Techniques - Generate & Test Hill Climbing, Best First search, Problem reduction, Constraint satisfaction, Means-End Analysis	**18**
II	**Knowledge Representation** Approaches and issues in knowledge representation –Using Predicate Logic – Representing simple facts in logic – Representing Instance and ISA relationship – Computable functions and predicates – resolution – Natural deduction - Representing knowledge using rules –Procedural versus declarative knowledge – Logic programming - Forward versus backward reasoning – Matching – Control Knowledge - Symbolic reasoning under uncertainty - Logics for Nonmonotonic reasoning – Implementation Issues – Augmenting a problem solver – Implementation: Depth first search, Breadth first search	**18**
III	**Statistical Reasoning** Probability and Bayes‟ Theorem - Certainty factors and rule-based systems- Bayesian networks – Dempster - Shafer Theory - Weak slot-filler structure - Semantic nets – frames. Strong slot-filler structure- Conceptual dependency – Scripts – CYC – Syntatic – Semantic spectrum of Representation – Logic and slot-and-filler structure – Other representational Techniques	**18**
IV	**Game Playing, Planning & NLP** Minimax search procedure-Adding alpha-beta cutoffs- Additional Refinements – Iterative Deepening – Reference on specific games Planning - Components of a Planning system – Goal stack planning – Nonlinear planning using constraint posting- Hierarchical planning – Reactive systems.Natural Language Processing - Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing – Statistical Natural Language processing	**18**
V	**Learning & Advanced Topics in AI** What is learning? – Rote learning – Learning by taking advice – Learning in problem solving – Learning from examples: Induction – Explanation based learning – Discovery – Analogy – Formal learning theory - Neural Net learning and Genetic learning - Expert System: Representation-Expert System shells-Knowledge Acquisition. Fuzzy logic system – Crisp sets – Fuzzy sets – Fuzzy terminology – Fuzzy logic control – Sugeno style of Fuzzy inference processing – Fuzzy Hedges – Neuro Fuzzy systems.	**18**
	TOTAL HOURS	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Design user interfaces to improve human–AI interaction and real-time decision-making. Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Extract information from text automatically using concepts and methods from natural language processing (NLP), including stemming, n-grams, POS tagging, and parsing	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	**Elaine Rich, Kevin Knight** (2008), Shivsankar B Nair, Artificial Intelligence, Third Edition, Tata McGraw Hill Publication	
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 PTE 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

ANNEXURE- I

Elective Course (EC1- EC8)

Discipline Specific

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ANALYTICS FOR SERVICE INDUSTRY	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives	
LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high attrition risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	**Contents**	**No. Of. Hours**
I	**Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	**15**
II	**Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	**15**
III	**HR Analytics:** Evolution of HR Analytics, HR information systems and data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model.	**15**
IV	**Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions.	**15**
V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty	

	Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods of business analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Create viable solutions to decision making problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2015.
2	Edwards Martin R, Edwards Kirsten (2016),"Predictive HR Analytics: Mastering the HR Metric", Kogan Page Publishers, ISBN-0749473924
3	Fitz-enzJac (2010), "The new HR analytics: predicting the economic value of your company's human capital investments", AMACOM, ISBN-13: 978-0-8144-1643-3
4	RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Within the Service Sector.

Reference Books	
1.	Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016
2.	Fitz-enzJac, Mattox II John (2014), "Predictive Analytics for Human Resources", Wiley, ISBN- 1118940709.

Web Resources	
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-

	26524.html

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	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	14	15	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
	FINANCIAL ANALYTICS	**Elect**	5	-	-	-	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.	**15**

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. Process of Data analytics: obtaining publicly available data, refining such data, implement the models and generate typical output, Prices and individual security returns, Portfolio returns, Risks, Factor Models.	**15**
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.	**15**
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 – Different types of charts and graphs – The emergence of data visualization and visual analytics – Performance dashboards – Dashboard design – Best practices in dashboarddesign – Business performance management – Balanced Scorecards – Six sigma as a performance measurement system.	**15**
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.	**15**

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	Subject Name	Category	L	T	P	S	C	Marks

Code								CIA	External	Total
	MARKETING ANALYTICS	**ELECT**	5	-	-	-	3	25	75	100
Learning Objectives										
LO1	Understand the importance of marketing analytics for forward looking and systematic allocation of marketing resources 2.									
LO2	Know how to use marketing analytics to develop predictive marketing dashboard for organization									
LO3	Recognize challenges in dealing with data sets in marketing.									
LO4	Identify and apply appropriate algorithms for analyzing the social media and web data									
LO5	Make choices for a model for new machine learning tasks.									

UNIT	Contents	No. Of. Hours
I	**Marketing Analytics :** Introduction to marketing research, Research design setup, Qualitative research, Quantitative research, Concept development, scale development, Exploring Data, Descriptive Statistics. Product analytics- features, attributes, benefits, Price analytics, Promotion analytics, Channel analytics, Multiple Discriminate analysis.	**15**
II	**Customer Analytics:** Customer Analytics, Analyzing customer satisfaction, Prospecting and Targeting the Right Customers, Covariance and Correlation analysis, Developing Customers, Retaining Customers, Customer lifetime value case, Factor analysis. Market Segmentation & Cluster Analysis, Scatterplots & Correlation Analysis, Linear Regression, Model Validation & Assessment, Positioning analytics, Cross tabulation**.**	**15**
III	**Social Media Analytics (SMA)** :Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.	**15**
IV	**Facebook Analytics:** Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. 9 (LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)	**15**
V	**Web Analytics and making connections** : Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web	**15**

	analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.	
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Critically evaluate the key analytical frameworks and tools used in marketing. Apply key marketing theories, frameworks and tools to solve marketing problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Utilize information of a firm's external and internal marketing environment to identify and prioritize appropriate marketing strategies.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Exercise critical judgment through engagement and reflection with existing marketing literature and new developments in the marketing environment.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Critically evaluate the marketing function and the role it plays in achieving organizational success both in commercial and non-commercial settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Evaluate and act upon the ethical and environmental concerns linked to marketing activities.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World, Chuck Hemann & Ken Burbary, Pearson, ISBN 9780789750303
2	Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Eric Siegel, Pearson.
3	Marketing Analytics: Optimize Your Business with Data Science in R, Python, and SQL, Dave Jacobs.
4	Matthew Ganis, Avinash Kohirkar. Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media. Pearson 2016.
5	Jim Sterne. Social Media Metrics: How to Measure and Optimize Your Marketing Investment. Wiley, 2020.
6	Marshall Sponder. Social Media Analytics. McGraw Hill Latest edition.

Reference Books

1.	Marketing Analytics: A practical guide to real marketing science, Mike Grigsby, Kogen Page, ISBN 9780749474171
2.	Cutting Edge Marketing Analytics: Real World Cases and Data Sets for Hands on Learning, Raj Kumar Venkatesan, Paul Farris, Ronald T. Wilcox.
3.	Marketing Metrices3e, Bendle, Farris, Pferfery, Reibstein
Web Resources	
1.	https://www.coursera.org/learn/uva-darden-market-analytics
2.	https://www.wrike.com/marketing-guide/marketing-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	2	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	14	15	12	14

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 COMPUTER NETWORKS	**Elective**	5	-	-	-	3	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.	**15**
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.	**15**
III	**Medium Access and Network Layer:** Multiple Access: Random Access – Controlled access- Channelization. Network Layer Logical addressing: IPv4 addresses – IPv6 addresses. Transport Layer: Process to Process delivery: UDP – TCP. Congestion Control – Quality of Service	**15**
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.	**15**
V	**Wireless Networks:** Wireless Communications – Principles and Fundamentals. WLANs – WPAN- Satellite Networks - Ad-hoc Networks	**15**
	TOTAL HOURS	**75**

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
Weightage of course contributed to each PSO	14	15	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
	BIG DATA ANALYTICS	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives		
LO1	To know the fundamental concepts of big data and analytics..	
LO2	To explore tools and practices for working with Big data	
LO3	To learn about stream computing.	
LO4	To know about the research that requires the integration of large amounts of data	
LO5	To analyze data by utilizing clustering and classification algorithms.	
UNIT	**Contents**	**No. Of. Hours**

I	**Big data Introduction :** Big Data introduction - definition and taxonomy - Big data value for the enterprise - The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.	**15**
II	**Map reduce :** Introduction to Map Reduce frame work - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem- Streaming in Hadoop- Improving the performance using combiners- Chaining Map Reduce jobs- Joining data from different sources.	**15**
III	**Pig and Hive :** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - Fundamentals of HBase and ZooKeeper.	**15**
IV	**Mongo DB :** No SQL databases: Mongo DB: Introduction – Features - Data types - Mongo DB Query language - CRUD operations – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate - Map Reduce. Cursors – Indexes - Mongo Import – Mongo Export.	**15**
V	**Cassandra:** Introduction – Features - Data types – CQLSH - Key spaces - CRUD operations – Collections – Counter – TTL - Alter commands - Import and Export - Querying System tables.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand Big Data and its analytics in the real world	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Analyze the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Implement Big Data Activities using Hive.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	JSeema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2	Ramesh Sharda, Dursun Delen, Efraim Turban (2018), Business Intelligence, Pearson Education Services Pvt Ltd.
Reference Books	
1.	Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013.
2.	Tom White, "Hadoop: The Definitive Guide", O"Reilly Publications, 2011.
3.	Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.
4.	Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.
Web Resources	
1.	https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics
2.	https://www.coursera.org/articles/big-data-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	Marks		
								CIA	External	Total
	COMPUTER NETWORKS	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives		
LO1	To make students understand the concepts of Network hardware and Network Software.	
LO2	To analyze different network models	
LO3	To impart knowledge on Design Issues of Data Link Layer	
LO4	To impart knowledge on IP Addresses and Routing algorithm	
LO5	To make the students understand the establishment of Network connection	
UNIT	**Contents**	**No. Of. Hours**
I	Introduction – Uses of Computer Networks – Network Hardware- Network Software- OSI Reference Model – TCP/IP Reference Model**.**	**15**
II	Physical Layer – Guided Transmission media – Wireless Transmission – Public Switched Telephone Network –Local Loop – Trunks – Multiplexing- Switching.	**15**
III	Data Link Layer – Design Issues- Error Detection and Correction- Simplex Stop and Wait Protocol- Sliding Window Protocol.	**15**
IV	Network Layer – Design Issues – Routing Algorithm- IP Protocol – IP Addresses-Internet Control Protocols.	**15**
V	Transport Layer: Addressing- Connection Establishment-Connection Release. Internet Transport Protocol: UDP-TCP. Application Layer: DNS- Electronic Mail-World Wide Web.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Usage of computer networks. Describe the functions of each layer in OSI and TCP/IP model.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Basics of Physical layer and apply them in real time applications. Techniques in multiplexing and switching.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Design of Data link layer. Deduction of errors and correction. Flow control using protocols	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Design of Network layers.Generate IP address to find out the route through Routing algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Design of transport layer.Protocols needed for End–End delivery of packets. Role of Application layer in real time applications	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	A. S. Tanenbaum, “Computer Networks”, Prentice-Hall of India 2008, 4th Edition.
Reference Books	
1.	Stallings, “Data and Computer Communications”, Pearson Education 2012, 7th Edition
2.	B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill 2007, 4th Edition.
3.	F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education 2008.
4.	D. Bertsekas and R. Gallagher, “Data Networks”, PHI 2008, 2nd Edition.
5.	Lamarca, “Communication Networks”, Tata McGraw Hill 2002.
Web Resources	
1.	https://www.geeksforgeeks.org/basics-computer-networking/
2.	https://en.wikipedia.org/wiki/Computer_network
3.	https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
4.	https://www.javatpoint.com/computer-network-tutorial
5.	http://ceit.aut.ac.ir/~91131079/SE2/SE2%20Website/Lecture%20Slides.html

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	Subject Name	Ca	L	T	P	S	C	Marks

Code								CIA	External	Total
	CRYPTOGRAPHY	**Elect**	5	-	-	-	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.	**15**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**15**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**15**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocket Layer and Transport Layer Security – Secure Electronic Transaction.	**15**
V	Intruders – Malicious software – Firewalls.	**15**
	TOTAL HOURS	**75**

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".	
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

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	**Elect**	5	- _	-	-	3	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	**15**
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.	**15**
III	**Deadlocks:** Deadlock Characterization - Methods for Handling Deadlocks-Deadlock Prevention- Deadlock Avoidance - Deadlock Detection- Recovery from Deadlock.	**15**
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.	**15**
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.	**15**
	TOTAL HOURS	**75**

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 deadlockprevention 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. SilberschatzP.B.Galvin, Gange. "Operating System Concepts", Ninth Edition, 2013, Addison WesleyPublishing Co..

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ARTIFICIAL NEURAL NETWORK	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives:

The objective of this course is to teach the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.

Course Outcomes:

CO1: Understand the basics of artificial neural networks and its architecture.

CO2: Understand the various learning algorithms and their applications.

CO3: Identify the appropriate neural network model to a particular application.

CO4: Apply the selected neural network model to a particular application.

CO5: Analyze the performance of the selected neural network.

Units	Contents	Required Hours
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	**15**
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 Perceptron 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	**15**

	propagation algorithm	
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neo cognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications	**15**

Learning Resources:

- **Recommended Texts**

  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.

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**
	SOFTWARE ENGINEERING	**Elect**	5	-	-	-	3	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 products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.	**15**
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS)**Software Design**: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design	**15**
III	**Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.	**15**
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; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.	**15**
V	**Software Maintenance:** Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost;	**15**
		75

Learning Resources:

- **Recommended Texts**
  1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018

- **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

SOFTWARE QUALITY ASSURANCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	5	0	0	0	3	5	25	75	100

Learning Objectives	
LO1	Learn the basic concepts of Software Quality Assurance.
LO2	Understand quality management processes
LO3	Understand the importance of standards in the quality management process and their impact on the final product.
LO4	Understand to apply software testing techniques in commercial environment
LO5	Gain knowledge of the various software development methodologies and their impact on quality assurance processes.

Unit	Contents	No. of Hours
I	Introduction- quality and the quality system – standards and procedures technical activities. Software tasks –management responsibility – quality system – contract review – design control – document control – purchasing product identification and traceability.	**15**
II	Process control–checking– identification of testing tools– control of non conforming product –corrective action.	**15**
III	Handling, storage, packing and delivery –quality records- internal quality audits –training –servicing –statistical techniques.	**15**

IV	QA and new technologies –QA and Human–computer interface-process modeling–standards and procedures.	**15**
V	ISO-9001-ElementsofISO9001-improvingqualitysystem– Case study.	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	To have broad understanding of the role of Quality Assurance in Software Engineering.
CO2	Illustrate the role of automation in software quality assurance and gain practical experience in using automated testing tools
CO3	Apply the concepts in preparing the quality plan & documents.
CO4	Analyze and executing software test plans, test cases, and test scripts.
CO5	Evaluate information quality, software quality and business value of information system.

Textbooks

➢	Darrel Ince "An introduction to software quality assurance and its implementation", MGH 1994. Darrel Ince "ISO 9001 software quality assurance", MGH 1994.

Reference Books

1.	Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2.	Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 1997

NOTE: Latest Edition of Textbooks May be Used

Web Resources

1.	NPTEL & MOOC courses titled Software Quality Assurance
2.	https://www.linkedin.com/learning/topics/software-quality-assurance

MAPPING TABLE

CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**

CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**13**	**11**	**10**	**13**	**13**	**12**

SOFTWARE PROJECT MANAGEMENT

Subject Code	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
							CIA	**External**	**Total**
	5	**0**	**0**	**0**	**3**	**5**	**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 understand the software working and future enhancement of developments
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.	**15**
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.	**15**
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.	**15**
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.	**15**
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	**15**
TOTAL		**75**

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	
➢	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.
Reference Books	
1.	Pankaj Jalote, "Software Project Management in Practice", Addison Wesley 2002.
2.	Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	NPTEL & MOOC courses titled Software Project Management
2.	www.smartworld.com/notes/software-project-management

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**13**	**11**	**10**	**13**	**13**	**12**

SOFTWARE METRICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
	5	0	0	0	3	5	25	75	100

Learning Objectives	
LO1	Gain a solid understanding of what software metrics are and their significance
LO2	Learn how to identify and select appropriate software metrics based on project goals
LO3	Acquire knowledge and skills in collecting and measuring software metrics
LO4	Learn how to analyze and interpret software metrics data to extract valuable insights
LO5	Gain the ability to evaluate software quality using appropriate metrics

Unit	Contents	No. of Hours
I	**Fundamentals of Measurement: Need for** Measurement: Measurement in Software Engineering, Scope of Software Metrics, **The Basics of measurement**: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement	**15**
II	**A Goal-Based Framework For Software Measurement:** Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing Software MeasurementValidation **Empirical investigation**: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies	**15**
III	**Software Metrics Data Collection:** Defining good data, Data collection for incident reports, How to collect data, Reliability of data collectionProcedures **Analyzing software measurement data:** Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques	**15**
IV	**Measuring internal product attributes: Size** Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures **Measuring internal product attributes: Structure:** Aspects of Structural Measures, Control flow structure of program units, Design-level Attributes, Object-oriented Structural attributes and measures	**15**
V	**Measuring External Product Attributes:** Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures, Security Measures **Software Reliability: Measurement and Prediction:** Basics of	**15**

	reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy	
TOTAL		**75**
CO	**Course Outcomes**	
CO1	Understand various fundamentals of measurement and software metrics	
CO2	Identify frame work and analysis techniques for software measurement	
CO3	Apply internal and external attributes of software product for effort estimation	
CO4	Use appropriate analytical techniques to interpret software metrics data and derive meaningful insights	
CO5	Recommend reliability models for predicting software quality	
Textbooks		
➢	**Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , ThirdEdition, 2014**	
Reference Books		
1	**Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997**	
2	**Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, AddisonWesley Professional**	
3	**Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.**	
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.	https://lansa.com/blog/general/what-are-software-metrics-how-can-i-measure-these-metrics/	
2.	https://stackify.com/track-software-metrics/	

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	3	3	3	3	2	3
CO 5	3	2	3	3	3	3

Weightage of course contributed to each PSO	15	13	15	12	14	14

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

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**O**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
	Organizational Behaviour	**Elect**	5	-	-	-	3	5	25	75	100

Learning Objectives	
CO1	To have extensive knowledge on OB and the scope of OB.
CO2	To create awareness of Individual Behaviour.
CO3	To enhance the understanding of Group Behaviour
CO4	To know the basics of Organisational Culture and Organisational Structure
CO5	To understand Organisational Change, Conflict and Power

UNIT	**Details**	**No. of Hours**
I	INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics)	15
II	INDIVIDUAL BEHAVIOUR: 1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace. 2. Motivation : Concept; Theories (Hierarchy of needs, X and	15

	Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs, 3. Personality and Values: Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of values; Linking personality and values to the workplace (person-job fit, person-organization fit) 4. Perception, Decision Making : Perception and Judgement Factors; Linking perception to individual decision making:	
III	GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal);	15
IV	ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options	15
V	ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics.	15
	TOTAL	**75**
Course Outcomes	On Completion of the course the students will	**Program Outcomes**
CO1	To define Organisational Behaviour, Understand the opportunity through OB.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To apply self-awareness, motivation, leadership and learning theories at workplace.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To analyze the complexities and solutions of group behaviour.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To impact and bring positive change in the culture of the organisation.	PO1, PO2, PO3, PO4, PO5, PO6

CO5	To create a congenial climate in the organization.	PO1, PO2, PO3, PO4, PO5, PO6
Reading List		
1.	NeharikaVohra Stephen P. Robbins, Timothy A. Judge , *Organizational Behaviour*, Pearson Education, 18th Edition, 2022.	
2.	Fred Luthans, *Organizational Behaviour*, Tata McGraw Hill, 2017.	
3.	Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, *Organizational Behaviour*, John Wiley & Sons, 2011	
4.	Louis Bevoc, Allison Shearsett, Rachael Collinson, *Organizational Behaviour Reference*, Nutri Niche System LLC (28 April 2017)	
5.	Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, *Organizational Behaviour: A Skill-Building Approach*, SAGE Publications, Inc; 2nd edition (29 November 2018).	
References Books		
1.	Uma Sekaran, Organizational Behaviour Text & cases, 2nd edition, Tata McGraw Hill Publishing CO. Ltd	
2.	GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1st edition	
3.	S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi.	
4.	J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017.	
5.	John Newstrom, *Organizational Behaviour: HumaBehaviour at Work*, McGraw Hill Education; 12th edition (1 July 2017)	
Web Resources		
1	https://www.iedunote.com/organizational-behavior	
2	https://www.london.edu/faculty-and-research/organisational-behaviour	
3	Journal of Organizational Behavior on JSTOR	
4	International Journal of Organization Theory & Behavior | Emerald Publishing	
5	https://2012books.lardbucket.org/pdfs/an-introduction-to-organizational-behavior-v1.1.pdf	

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	3	3	3	3	2	3
CO 5	3	2	3	2	3	3
Weightage of course contributed to each PSO	15	13	15	11	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
	AGILE PROJECT MANAGEMENT	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives:

- To provide students with a theoretical as well as practical understanding of Agile software development practices and how small teams can apply them to creating high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To provide a detailed examination and demonstration of Agile development and testing techniques.
- To provide an understanding of the benefits and pitfalls of working in an Agile team.

Course Outcomes:

CO1: Understanding of the Agile manifesto and its advantages over other SDLC paradigms.

CO2: Understanding essential Agile concepts.

CO3: Understanding how to plan and execute a project using Agile concepts

CO4: Understanding Agile management concepts.

CO5: Practical application of Agile principles.

Units	Contents	Required 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 12 Agile	**15**

	Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.	
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. Showcasing Work, Inspecting and Adapting: The sprint review – The sprint retrospective. Preparing for Release: Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment	**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. Managing Team Dynamics and Communication: What's different about Agile team dynamics – Managing Agile team dynamics – What's different about Agile communication – Managing Agile communication. Managing Quality and Risk: What's different about Agile quality – Managing Agile quality – What's	**15**

	different about Agile risk management – Managing Agile risk.	
V	Implementing Agile Building a Foundation: Organizational and individual commitment – Choosing the right pilot team members – Creating an 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. Benefits, Factors for Success and Metrics: Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	**15**

Learning Resources:

- **Recommended Texts**
  1. Mark C. Layton, Steven J. Ostermiller, *Agile Project Management for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.
  2. 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. Alex Moore, *Scrum*, 2020.
  5. 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

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	2	3	3

Weightage of course contributed to each PSO	14	13	15	11	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
	COMPUTING INTELLIGENCE	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives:

- To provide strong foundation on fundamental concepts in Computing Intelligence
- To apply basic principles of Artificial Intelligence and solutions that require problem solving, influence, perception, knowledge representation and learning

Course Outcomes:

CO1: Describe the fundamentals of artificial intelligence concepts and searching techniques.

CO2: Develop the fuzzy logic sets and membership function and defuzzification techniques.

CO3: Understand the concepts of Neural Network and analyze and apply the learning techniques

CO4: Understand the artificial neural networks and its applications

CO5: Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.

Units	Contents	Required Hours
I	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	**15**
II	Fuzzy Logic Systems: Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	**15**
III	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.	**15**

IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	**15**
V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.	**15**

Learning Resources:

Recommended Texts

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Pearson Education in Asia.
3. S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI.

Reference Books

1. F. Martin, Mc neill, and Ellen Thro, "Fuzzy Logic: A Practical approach", AP Professional, 2000. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.
2. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.

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	3	3	3	3	2	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	15	14	15	11	14	14

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

Subject Code	**Subject Name**	**C a**	**L**	**T**	**P**	**S**	**C**	**Marks**

								CIA	External	Total
	INFORMATION SECURITY	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives:

- To know the objectives of information security
- Understand the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms
- Understand the basic categories of threats to computers and networks

Course Outcomes:

CO1: Understand network security threats, security services, and countermeasures

CO2: Understand vulnerability analysis of network security

CO3: Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

CO4: Gain hands-on experience with programming and simulation techniques for security protocols.

CO5: Apply methods for authentication, access control, intrusion detection and prevention.

Units	Contents	Required Hours
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms.	**15**
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	**15**
III	Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.	**15**
IV	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the-middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples.	**15**
V	Security in Networks: Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security,	**15**

	Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction.	

Learning Resources:

- **Recommended Texts**

  1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education

  2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson

- **Reference Books**

  1.Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, lst Edition.

  2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2"d Edition

  3. Information Security, Principles and Practice: Mark Stamp, Wiley India.

  4. Principles of Computer Sceurity: WM.Arthur Conklin, Greg White, TMH

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	3	3	3	3	2	3
CO 5	3	3	3	2	3	2
Weightage of course contributed to each PSO	15	14	15	11	14	13

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	GRID COMPUTING	**Elect**	5	-	-	-	3	25	75	100

Learning Objectives:

- To provide the knowledge on the basic construction and use of Grid computing.
- To know and understand the grid computing applications.
- To assess the efficiency of the grid computing in solving large scale scientific problems

Course Outcomes:

CO1: To understand the basic elements and concepts related to Grid computing

CO2: To identify the Grid computing toolkits and Framework.

CO3: To know about the concepts of Virtualization

CO4: To analyze the concept of service oriented architecture.

CO5: To Gain knowledge on grid and web service architecture.

Units	Contents	Required Hours
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.	**15**
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.	**15**
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology	**15**
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	**15**
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.	**15**

Learning Resources:

Recommended Texts

1. Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.

Reference Books

2. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.

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

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

ANNEXURE-II

Skill Enhancement Course (SEC1-SEC8)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	INTRODUCTION TO HTML	**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:** Introduction to Java-Features of Java-Object Oriented Concepts-Software Evolution - Software Development,	**6**

	SDLC Models – SDLC steps – Software Testing – Software Quality - Lexical Issues-Data Types – Variables – Arrays – Operators - Control Statements – Classes – Objects –Constructors - Overloading method - Access control - static and fixed methods - Inner classes -Inheritance-Overriding Methods-Using super-Abstract class.	
II	**Packages & Threads:** Packages-Access Protection-Importing Packages-Interfaces-Exception Handling-Throw and Throws-Thread-Synchronization-Messaging- Runnable Interface-Inter thread communication-Deadlock-suspending, resuming and stopping threads-Multithreading	**6**
III	**Input/Output & Collection API:** I/O Streams-File Streams-String Objects-String Buffer-Char Array - Java Utilities-Collectionsinterface - Collection classes-Enumeration – Vector - Stack –Hash tables - String class.	**6**
IV	**Networking:** Networking –Networking basics – java and the Net – InetAddress- TCP/IP Client Sockets –URL- URLConnection – TCP/IP Server Sockets – Datagrams.	**6**
V	**Graphical User Interface in Java:** Working with windows using AWT Classes - Class Hierarchy of Window and Panel -AWT controls - Layout Managers – Menus- Menu bars - Dialog Boxes-File Dialog- Applets-Lifecycle of Applet-Types of Applets-Event handling-Applet tags - JDBC and connecting to Databases – CRUD operations.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, 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

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

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- The major objective in introducing the Computer Skills course is to impart training for students in Microsoft Office which has different components like MS Word, MS Excel and Power point.
- Thecourseishighlypracticeorientedratherthanregularclassroomteaching.
- To acquire knowledge on editor, spreadsheet and presentation software.

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

CO1: Understand the basics of computer systems and its components.

CO2: Understand and apply the basic concepts of a word processing package.

CO3: Understand and apply the basic concepts of electronic spreadsheet software.

CO4: Understand and apply the basic concepts of database management system.

CO5: Understand and create a presentation using PowerPoint tool.

Units	Contents	Required Hours
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems &its features: 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 extend 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,	**6**

	Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive application sin query language (MS–Access).	
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**
		30

Learning Resources:

- **Recommended Texts**

1. Peter Norton, "Introduction to Computers"–Tata McGraw-Hill.

- **Reference Books**

1. JenniferAckermanKettel,GuyHat-Davis,CurtSimmons,"Microsoft2003",TataMcGraw-Hill.

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

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Toimprovethequantitativeskillsofthestudents
- Topreparethestudentsforvariouscompetitiveexams

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

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 Numbers	**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 -Volumeandsurfacearea-racesandGamesofskill.	**6**
IV	Permutationandcombination-probability-TrueDiscount-BankersDiscount - Height and Distances-Odd man out & Series.	
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Piecharts-Linegraphs	**6**

LearningResources:

- **RecommendedTexts**

1. .“QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&CompanyLtd.,

- **Webresources: Authentic** Web resources related to Competitive examinations

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	CYBER FORENSICS	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives:

- To correctly define and cite appropriate instances for the application of computer forensics.
- To Correctly collect and analyze computer forensic evidence and data seizure. Identify the essential and up–to–date concepts, algorithms, protocols, tools, and methodology of Computer Forensics.

Course Outcomes:

CO1: Understand the definition of computer forensics fundamentals.

CO2: Evaluate the different types of computer forensics technology.

CO3: Analyze various computer forensics systems.

CO4: Apply the methods for data recovery, evidence collection and data seizure.

CO5: Gain your knowledge of duplication and preservation of digital evidence.

Units	Contents	Required Hours
I	**Overview of Computer Forensics Technology:** • Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer • Forensics in Law Enforcement, Computer Forensics Assistance to Human • Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional • Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer. • Forensics Technology: Types of Business Computer Forensic, Technology–Types of	**6**
II	**Computer Forensics Evidence and capture:**	**6**

	• Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up • in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: • Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody.	
III	**Duplication and Preservation of Digital Evidence:** • Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation.	**6**
IV	**Computer Forensics Analysis:** • Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices.	**6**
V	**Reconstructing Past Events:** • How to Become a Digital Detective, Useable File Formats, • Unusable File Formats, Converting Files. • Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, Documenting • The Intrusion on Destruction of Data, System Testing.	**6**

Learning Resources:

- **Recommended Texts**

1. John R. Vacca, "Computer Forensics: Computer Crime Investigation", 3/E, Firewall Media, New Delhi, 2002.

- **Reference Books**

1. Nelson, Phillips Enfinger, Steuart, "Computer Forensics and Investigations" Enfinger, Steuart, CENGAGE Learning, 2004.
2. Anthony Sammes and Brian Jenkinson, "Forensic Computing: A

Practitioner's Guide",Second Edition, Springer–Verlag London Limited, 2007.

3. Robert M.Slade," Software Forensics Collecting Evidence from the Scene of a DigitalCrime", TMH 2005.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	MULTIMEDIA SYSTEMS	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives:

- Tounderstandthestandardsavailablefordifferentaudio,videoandtextapplications
- Tolearnvariousmultimediaauthoringsystemsinmultimediaproductionteam

Course Outcomes:

CO1: Write action script for a particular problem.

CO2: Design and Draw customized GUI components.

CO3: Apply Transformations on Components.

CO4: To make use of fundamental concepts and formulate best practices

CO5: Apply technical concepts and practices in specialized areas

Units	Contents	Required Hours
I	Multimedia Definition- Use Of Multimedia- Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text – Font Editing and Design Tools- Hypermedia and Hypertext.	**6**
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivs.	**6**
III	Animation: The Power of Motion- Principles of Animation – Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays- Digital Video Containers- Obtaining Video Clips -Shooting and Editing Video.	**6**

IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs – An Authoring System Needs- Multimedia Production Team.	**6**
V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent.	**6**

Learning Resources:

- **Recommended Texts**

  1. Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw- Hill, 2001.

- **Reference Books**

  1. RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication& Applications",PearsonEducation,2012

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	SOFTWARE TESTING	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives:

- To study various Software techniques
- To study fundamental concepts in software testing

Course Outcomes:

CO1: Understand and describe the basic concepts of functional (black box) software testing.
CO2: Understand the basic application of techniques used to identify useful ideas for tests.
CO3: Help determine the mission and communicate the status of your testing with the rest of your project team.
CO4: Characterize a good bug report, peer-review the reports of your colleagues, and improve your own report writing.
CO5: Understand where key testing concepts apply within the context of unified processes.

Units	Contents	Required Hours
I	Introduction: Purpose–Productivity and Quality in Software– Testing Vs Debugging– Model for Testing– Bugs– Types of Bugs – Testing and Design Style.	**6**
II	Flow / Graphs and Path Testing – Achievable paths	**6**

	– Path instrumentation – Application– Transaction Flow Testing Techniques	
III	Data Flow Testing Strategies - Domain Testing: Domains and Paths – Domains and Interface Testing.	**6**
IV	Linguistic–Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing– Formats–Test Cases.	**6**
V	Logic Based Testing – Decision Tables–Transition Testing– States, State Graph, State Testing.	**6**

Learning Resources:

- **Recommended Texts**
  1. B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia,NewDelhi,2003.
  2. K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,NewDelhi,2005.

- **Reference Books**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA MINING AND WAREHOUSING	**SEC**	2	-	-	-	2	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.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

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.

- **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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	BIOMETRICS	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn and understand biometric technologies and their functionalities.
- To learn the role of biometrics, computational methods, context of Biometric Applications.
- To learn to develop applications with biometric security

Course Outcomes: (forstudents:Toknowwhattheyaregoingtolearn)

CO1: Identify the various biometric technologies.

CO2: Design of biometric recognition.

CO3: Develop simple applications for privacy

CO4: Understand the need of biometric in the society

CO5: Understand the scope of biometric techniques

Units	Contents	Required Hours
I	**Introduction**: What is Biometrics, History, Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System.	**6**
II	**Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris	**6**

	Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region.	
III	**Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics.	**6**
IV	**Watermarking Techniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General Watermarking Process.	**6**
V	**Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics.	**6**

Learning Resources:

- **Recommended Texts**
  1. Biometrics: Concepts and Applications by G.R Sinha and Sandeep B.Patil , Wiley, 2013
- **Reference Books**

1. Guide to Biometrics by Ruud M. Bolle , Sharath Pankanti, Nalini k.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009
2. Introduction to Biometrics by Anil k. Jain, Arun A. Ross, Karthik Nandakumar
3. Hand book of Biometrics by Anil K. Jain, Patrick Flynn, Arun A.Ross

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ENTERPRISE RESOURCE PLANNING	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Understand the concept of ERP and the ERP model; define key terms; identify the levels of ERP maturity.
- To integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation.
- To know the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)
CO1: Understand the basic concepts of ERP.
CO2: Identify different technologies used in ERP
CO3: Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules
CO4: Discuss the benefits of ERP
CO5: Apply different tools used in ERP

Units	Contents	Required Hours
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	**6**
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration.	**6**
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Func-tional Modules: Introduction, Functional	**6**

	Modules of ERP Software, Integration of ERP, Supply chain.	
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	**6**
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	**6**

Learning Resources:

- **Recommended Texts**
  1. Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.
- **Reference Books**
  1. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
  2. Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	ROBOTICS AND ITS APPLICATIONS	**SEC**	2	-	-	-	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To make the students familiar with the various drive systems of robots, sensors and their applications in robots
- To introduce the parts of robots, basic working concepts and types of robots

Course Outcomes: (forstudents:Toknowwhattheyaregoingtolearn)

CO1: Describe the different physical forms of robot architectures

CO2: Kinematically model simple manipulator and mobile robots

CO3: Mathematically describe a kinematic robot system.

CO4: Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.

CO5: Program robotics algorithms related to kinematics, control, optimization, and uncertainty.

Units	Contents	Required 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.	**6**
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	**6**
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	**6**
IV	Path Planning :Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies	**6**
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications- nuclear applications-space applications	**6**

Learning Resources:

- **Recommended Texts**

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	SIMULATION AND MODELING	**SEC**	2	-	-	-	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

In this course, modeling and simulation (M&S) methodologies considering the theoretical aspects. A wide range of Modeling and Simulation concepts that will lead you to develop your own M&S applications. Students learn the methodologies and tools for simulation and modeling of a real time problem/ mathematical model.

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Introduction To Modeling & Simulation, Input Data Analysis and Modeling.

CO2: Random Variate and Number Generation. Analysis of Simulations and methods.

CO3: Comparing Systems via Simulation

CO4: Entity Body Modeling, Visualization, Animation.

CO5: Algorithms and Sensor Modeling.

Units	Contents	Required 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	**6**
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	**6**
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 -	**6**
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)	**6**
V	Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	**6**

Learning Resources:

- **Recommended Texts**

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.

- **Reference Books**

1. Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, "Applied Simulation Modeling", Thomson Learning Inc., 2003.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PATTERN RECOGNITION	**SEC**	2	-	-	-	2	25	75	100

Learning Objectives: (forteachers:whattheyhavetodointheclass/lab/field)
To study the Pattern Recognition techniques and its applications

Course Outcomes: (forstudents:Toknowwhattheyaregoingtolearn)

CO1: To learn the fundamentals of Pattern Recognition techniques

CO2: To learn the various Statistical Pattern recognition techniques

CO3: To learn the linear discriminant functions and unsupervised learning and clustering

CO4: To learn the various Syntactical Pattern recognition techniques

CO5: To learn the Neural Pattern recognition techniques

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	Required Hours
I	PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	**6**
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	**6**

III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	**6**
IV	SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.	**6**
V	NEURAL PATTERN RECOGNITION: Introduction to Neural Networks-Feed forward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR	**6**

Learning Resources:

- **Recommended Texts**

1. Robert Schalkoff, "Pattern Recognition: Statistical Structural and Neural Approaches", John wiley & sons.

- **Reference Books**

1. Earl Gose, Richard Johnson baugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India, Pvt Ltd, New Delhi.
2. Duda R.O., P.E.Hart & D.G Stork, " Pattern Classification", 2nd Edition, J.Wiley.
3. Duda R.O.& Hart P.E., "Pattern Classification and Scene Analysis", J.wiley.
4. Bishop C.M., "Neural Networks for Pattern Recognition", Oxford University Press.

Title of the Course/ Paper	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
Skill Enhancement course	**ADVANCED EXCEL**	SEC	2	-	-	-	2	2	25	75	100
Course Objective											

C1	Handle large amounts of data	
C2	Aggregate numeric data and summarize into categories and subcategories	
C3	Filtering, sorting, and grouping data or subsets of data	
C4	Create pivot tables to consolidate data from multiple files	
C5	Presenting data in the form of charts and graphs	
UNIT	**Details**	**No. of Hours**
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables	6
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	6
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6
	Total	**30**

Course Outcomes		**Programme Outcome**
CO	Upon completion of the course the students would be able to:	
1	Handle large amounts of data	PO1, PO6
2	Aggregate numeric data and summarize into	PO2

	categories and subcategories	
3	Filtering, sorting, and grouping data or subsets of data	PO4 ,PO7
4	Create pivot tables to consolidate data from multiple files	PO6
5	Presenting data in the form of charts and graphs	PO7,PO8
Text Book		
1	E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition.	
Reference Books		
1.	Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education 2003.	
2.	Maria Litvin& Gray Litvin, "C++ for you", Vikas publication 2002.	
Web Resources		
1.	https://alison.com/course/introduction-to-c-plus-plus-programming	

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SKILL ENHANCEMENT COURSE	**Open Source Software Technologies**	SEC	2	-	-	-	2	2	25	75	100
Course Objective											
C1	Able to Acquire and understand the basic concepts in Java,application of OOPS concepts.										
C2	Acquire knowledge about operators and decision-making statements.										
C3	To Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays										
C4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.										
C5	Can Create window-based programming using applet and graphics programming.										
UNIT	**Details**								**No. of Hours**		**CO**
I	Open Source – open source vs. commercial software – What is Linux? – Free Software – Where I can use Linux? - Linux kernel – Linux								6		C1

	distributions.		
II	Introduction Linux Essential Commands – File System concept – Standard Files –The Linux Security Model – Introduction to Unix – Unix Components Unix Files –	6	C2
III	Introduction - Apache Explained – Starting, Stopping and Restarting Apache –Modifying the Default configuration – Securing Apache – Set user and Group	6	C3
IV	**MySQL:** Introduction to MySQL – The show databases and table – The USE command –Create Database and Tables – Describe Table –	6	C4
V	I**ntroduction** –PHP Form processing – Database Access with PHP – MySQL, MySQLFunctions – Inserting Records – Selecting Records – Deleting Records – Update Records.	6	C6
	Total	**30**	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Acquire and understand the basic concepts in Java, application of OOPS concepts.	Po1
2	Acquire knowledge about operators and decision-making statements.	Po1,Po2
3	Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays	Po4,Po6
4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.	Po4,Po5,Po6
5	Create window-based programming using applet and graphics programming.	Po3,Po8

Text Book

1	1. James Lee and Brent Ware "Open Source Web Development with LAMP using
2	2. LINUX, Apache, MySQL, Perl and PHP", Dorling Kindersley (India) Pvt. Ltd, 2008.

Reference Books

1.	Eric Rosebrock, Eric Filson, "Setting up LAMP: Getting Linux, Apache, MySQL and PHP and

	working together", John Wiley and Sons, 2004.
2.	2. Anthony Butcher , "Teach Yourself MySQL in 21 days", 2nd Edition, Sams Publication.
3.	3. Rich Bower, Daniel Lopez Ridreejo, Alian Liska , "Apache Administrator's Handbook", Sams Publication.
4.	4. Tammy Fox, "RedHat Enterprise Linux 5 Administration Unleashed", Sams Publication.
5.	5. Naramore Eligabette, Gerner Jason, Wrox Press, Wiley Dreamtech Press, "Beginning PHP5, Apache, MySQL Web Development", 2005.
Web Resources	
1.	Introduction to Open-Source and its benefits - GeeksforGeeks
2.	https://www.bing.com/

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SKILL ENHANCEMENT COURSE	**PHP Programming**	SEC	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:(forstudents:Toknowwhattheyaregoingtolearn)

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**

LearningResources:

- **RecommendedTexts**

  Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.

- **ReferenceBooks**

  The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SKILL ENHANCEMENT COURSE	**Web Technology**	SEC	2	-	-	-	2	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn the basic web concepts and to create rich internet applications that use most recent client-side programming technologies.
- To learn the basics of HTML, DHTML, XML, CSS, Java Script and AJAX.

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Ability to Develop and publish Web pages using Hypertext Markup Language(HTML).

CO2: Ability to optimize page styles and layout with Cascading Style Sheets(CSS).

CO3: Ability to Understand, analyze and apply the role of languages to create acapstone

CO4: Website using client-side web programming languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX

CO5: Able to understand the concept of jQuery and AngularJS

Units	Contents	Required Hours
I	HTML: HTML-Introduction-tag basics- page structure-adding comments	**6**

	working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment- links-tables-frames	
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	**6**
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	**6**
IV	JavaScript: Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.	**6**
V	Ajax: Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statements-date & time-mathematics- strings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS	**6**

Learning Resources:

- **Recommended Texts**

1. Pankaj Sharma, "*Web Technology*", Sk Kataria &SonsBangalore, 2011.(UNIT I, II, III &IV).
2. Achyut S Godbole & Atul Kahate, "*Web Technologies*", 2002, 2nd Edition. (UNIT V:AJAX)

- **Reference Books**

1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, *"Mastering HTML, CSS & Javascript Web Publishing*",2016.
2. DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2ndEdition.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SKILL ENHANCEMENT COURSE	**NETWORK SECURITY**	SEC	2	-	-	-	2	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To study the number theory used for network security
- To understand the design concept of cryptography and authentication

- To develop experiments on algorithm used for security

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Develop an understanding of the fundamentals of networking and security

CO2: Gain an appreciation for the complexities of protecting networks and systems from attack

CO3: Learn about the tools used to detect and protect against malicious attacks

CO4: Develop the skills to configure various security-related technologies

CO5: Utilize protocols such as TLS/SSL, IPSec, and SNMP in order to build secure systems.

Units	Contents	Required Hours
I	Model of network security–Security attacks, services and attacks– OSI security architecture – Classical encryption techniques – SDES – Block cipher Principles DES– Strength of DES–Block cipher design principles – Block cipher mode of operation	6
II	Number Theory– Prime number–Modular arithmetic– Euclid's algorithm	6
III	Authentication requirement – Authentication function – MAC – Hash function –Security of hash function and MAC – SHA - HMAC – CMAC	6
IV	Authentication applications – Kerberos – X.509 Authentication services - E-mail security–IP security- Web security.	6
V	Intruder–Intrusion detection system–Virus and related threats– Counter measures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	6

Learning Resources:

- **Recommended Texts**

1. WilliamStallings,"Cryptography&NetworkSecurity",PearsonEducation,FourthEditi on2010.

- **Reference Books**

1. CharlieKaufman,RadiaPerlman,MikeSpeciner,"NetworkSecurity,Privatecom municationinpublicworld",PHISecondEdition,2002.
2. BruceSchneier,NeilsFerguson,"PracticalCryptography",WileyDreamtechIndi aPvtLtd,FirstEdition,2003.
3. DouglasRSimson"Cryptography– Theoryandpractice",CRCPress,FirstEdition,1995.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
SKILL ENHANCEMENT COURSE	**IMAGE PROCESSING**	SEC	2	-	-	-	2	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

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

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Gain a fundamental understanding of digital image processing

CO2: Learn the basics of how digital images are represented and processed

CO3: Understand image enhancement techniques

CO4: Develop your programming skills to apply digital image processing algorithms

CO5: Design solutions for real-world problems that involve digital image processing.

Units	Contents	Required Hours
I	**DIGITAL IMAGE FUNDAMENTALS:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization	**6**
II	**IMAGE ENHANCEMENT**: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering,	**6**
III	**IMAGE RESTORATION:** Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters	**6**
IV	**IMAGE SEGMENTATION:** Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging	**6**
V	**IMAGE COMPRESSION AND RECOGNITION:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG.	**6**

LearningResources:

- **Recommended Texts**
    1. Anil K. Jain , Digital Image Processing: Principles and Applications
    2. Wayne Niblack, "Introduction to Digital Image Processing"
    3. B.S. Manjunath and Srimat T.V. Rao, "Digital Image Processing: An Algorithmic Approach Using Java"
- **Reference Books**
    1. Rafael C. Gonzalez and Richard Eugene Woods, "Digital Image Processing"

- **Web resources**
- https://www.learnopencv.com/
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-435j-digital-image-processing-fall-2004/
- http://web.stanford.edu/class/cs155/