MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

(Affiliated to Periyar University)
[Accredited by NAAC with"A++"Grade Recognized u/s 2(f) and12(B) of the UGC act 1956]

KALIPPATTI-637501

BACHELOROF SCIENCE

SYLLABUS FOR B.Sc. COMPUTER SCIENCE with

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

OUTCOMEBASEDEDUCATIONWITHCHOICEBASEDCREDITSYSTEM

FOR THE STUDENTS ADMITTED FROMTHE
ACADEMICYEAR2023–2024ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE
(Autonomous)
(Affiliated to Periyar University)

Department of Computer Science & Applications

REGULATIONS FOR B.Sc. Computer Science with Artificial Intelligence and Data Science PROGRAMME OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(Effective from the academic year 2023-2024)

I. PREAMBLE

B.Sc. Computer Science with Artificial Intelligence and Data Science is a systematically designed three- year course that prepares the student for a career in software industry. The syllabus of Computer Science subject along with that of two allied subjects (Mathematics and Statistics) forms the required basics for pursuing higher studies in computer science. The syllabus also develops requisite professional skills and problem-solving abilities for pursuing a career in software industry.

II. GRADUATES ATTRIBUTES

- **In-depth knowledge and understanding of major concepts:** Understanding of theoretical principles and experimental findings in different sub-areas available in respective disciplines

- **Creative and Critical thinking:** The capability of using creative and critical thinking in respective areas

- **Analytical ability:** The ability to analyze issues and problems in all the disciplines

- **Problem- solving skills:** The capability towards solving problems

- **Entrepreneur skills:** The inclusion of leadership, business management, time management skills

- **Communication skills:** The ability to transfer complicated/technical information in a precise manner

- **Mutual and multidisciplinary competence:** The ability of teamwork in interdisciplinary fields

- **Digital literacy:** The capability of utilizing modern digital tools to carry out the simulation process

- **Moral and ethical awareness:** Ability to adopt moral ethics

- **Social responsibility:** Creating socially responsible citizens

III. PROGRAMME EDUCATIONAL OBJECTIVES

- Graduates will have successful careers in computer fields or will be able to successfully pursue higher studies.
- Graduates will apply their technical knowledge and skills to develop and implement solutions for the problems that accomplish goals to the Industry, Academic, Government or Research area.
- Contribute effectively to the computing profession by fostering effective interaction, ethical practices and communication skills, while pursuing education through lifelong learning.

IV. PROGRAMME OUTCOMES

1. Acquire scientific knowledge leading to creative thinking and research motivations.
2. Internalize the learned concepts and that will enable them to become skilled professionals.
3. Develop a sense of an interdisciplinary approach to identify and resolve issues through the project, seminars, fieldwork, internships, and industrial visits.
4. Become empowered individuals who will emerge as entrepreneurs or be employed in industry, academia, and Government sectors.
5. Establish a self-sustained environment for a healthy society.

V. PROGRAMME SPECIFIC OUTCOMES

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline. After completing the B.Sc. Computer Science with Artificial Intelligence and Data Science Programme, the graduates would have

1. Acquired the required knowledge in the Hardware and Software aspects of Computer Science domain and the art of programming.

2. Understood the development methodologies of software systems and the ability to analyze design and develop computer applications for real life problems.

3. Knowledge and skills to collaborate and communicate with peers for performance enhancement in IT / ITES industries.

4. Ability to understand, adjust and adapt with the dynamic technical environment for the growth of IT industry.

5. Capacity to transfer the skills gained, to provide innovative and novel solutions by maintaining ethical norms for the betterment of humane society.

VI. REGULATIONS

These regulations shall take effect from the academic year 2023-2024, i.e., for students who are to be admitted to the first year of the course during the academic year 2023-24 and thereafter.

1. **Eligibility for Admission:**

   A candidate who has passed in Higher Secondary Examination with Mathematics or Business Mathematics or Computer Science or Statistics or Computer Applications (Academic stream or Vocational stream) as one of the subject under Board of Higher Secondary Examination, Tamil Nadu as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the syndicate, subject to such other conditions as may be prescribed , are permitted to appear and qualify for the B.Sc. Computer Science with Artificial Intelligence and Data Science degree examination of this university, after a programme of study of three academic years.

2. **Duration of the Programme:**

   The course of study of Bachelor of Science in Computer Science with Artificial Intelligence and Data Science shall consist of three academic years divided into six semesters with **140**credits. The Programme of study will comprise the course according to the syllabus.

3. **Programme of Study:**

   The programme of study for the UG degree has been divided into the following five categories:

Part-I	: Tamil / Other Languages.	
Part-II	: English Language.	
Part-III	: Core Courses, Elective Courses, and Project with viva-voce.	
Part-IV	: Foundation Course, Skill Enhancement Courses (Non-Major Elective Course), Skill Enhancement Courses (Discipline Specific), Enhancement Compulsory Courses and Internship.	
Part-V	: Value added Courses, Extension Activity, etc.	

Extension Activity:

Every student shall participate compulsorily for period of not less than two years (4 semesters) in any one of the following programmes. NSS/ Sports/YRC/Other Extra- curricular and Co-curricular activities (Club/IIC/EDC). The student's performance shall be examined by the staff in-charge of extension activities along with the Head of the respective department and a senior member of the Department on the following parameters.

The marks shall be sent to the Controller of Examinations before the commencement of the final semester examinations.20% of marks for Regularity of attendance.

60% of marks for Active Participation in classes/ camps/ games/ special Camps/ programmes in the college/ District/ State/ University activities.

10% of marks for Exemplary awards/ Certificates/ Prizes.

10% of marks for Other Social components such as Blood Donations, Fine Arts, etc.

The above activities shall be conducted outside the regular working hours of the college. The mark sheet shall carry the gradation relevant to the marks awarded to the candidates.

A - Exemplary - 80 and above

B - Very good - 70-79

C - Good - 60-69

D - Fair - 50-59

E - Satisfactory - 40 – 49

This grading shall be incorporated in the mark sheet to be issued at the end of the semester. (Handicapped students who are unable to participate in any of the above activities shall be required to take a test in the theoretical aspects of any one of the above fields and be graded and certified accordingly).

4. **Examinations:**

The programme of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) theory examinations. The theory examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subjects(s) will be permitted to reappear for the same in the subsequent semester examinations.

VII. STRUCTURE OF THE PROGRAMME

SEMESTER - I

Part	Course Category	Title of the Course	Course Code	Hrs/Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
I	LANGUAGE COURSE-I	Tamil-I/ Hindi-I/French-I	M23UFTA01/ M23UFHI01	6	–	3	25	75	100
II	LANGUAGECOURSE-II	English–I	M23UFEN01	6	–	3	25	75	100
III	CORECOURSE-I	Data Structures	M23UAD01	5	–	5	25	75	100
	COREPRACTICAL–I	Computer Programming Lab	M23UADP01	–	3	3	40	60	100
	GENERIC ELECTIVE COURSE	Elective – I – Generic Elective – Discrete Mathematics - I	M23UMAGE2	6	–	5	25	75	100
IV	SKILL ENHANCEMENT COURSE	SEC – I - NME - I Aptitude for Competitive Examinations-I	M23UMAN01	2	–	2	25	75	100
	FOUNDATION COURSE	Fundamentals of Computer Programming	M23UADFC1	2	–	2	25	75	100
Total				**27**	**3**	**23**	**190**	**510**	**700**

Semester–II

Part	Course Category	Title of the Course	Course Code	Hrs/Week		No. of Credits	Max. Mark		
				L	P		Int.	Ext.	Total
I	LANGUAGECOURSE-I	Tamil-II /Hindi-II/ French-II	M23UFTA02/ M23UFHI02	6	-	3	25	75	100
II	LANGUAGE COURSE-II	English – II	M23UFEN02	6	-	3	25	75	100
III	CORE COURSE-II	Introduction to Python Programming	M23UAD02	5	-	5	25	75	100
	COREPRACTICAL–II	Python Programming Lab	M23UADP02	-	3	3	40	60	100
	GENERIC ELECTIVE COURSE	Elective – II – Generic Elective – Discrete Mathematics -II	M23UMAGE4	6	-	5	25	75	100
IV	SKILL ENHANCEMENT COURSE	SEC – II - NME - II	M23UMAN03	2	-	2	25	75	100
	SKILL ENHANCEMENT COURSE (DisciplineSpecific)	Introduction to HTML	M23UADS01	2	-	2	25	75	100
Total				**27**	**3**	**23**	**190**	**510**	**700**

Semester–III

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No.of Credits	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
	LANGUAGE COURSE-I	Tamil-III/ Hindi-III /French-III	M23UFTA03	6	–	3	25	75	100
II	LANGUAGECOURSE-II	English	M23UFEN03	6	–	3	25	75	100
III	CORECOURSE-III	Foundation of Artificial intelligence	M23UAD03	6	–	5	25	75	100
III	COREPRACTICAL–III	PracticalIII :- Internet Programming Lab	M23UADP03	–	3	3	40	60	100
III	GENERIC ELECTIVE COURSE	Generic Elective – Numerical Methods	M23USTGE5	5	–	5	25	75	100
IV	SKILL ENHANCEMENT COURSE	SEC – IV PHP Programming	M23UADS02	2	–	2	25	75	100
	SKILL ENHANCEMENT COURSE	SEC – V MultimediaSystems	M23UADS03	2	–	2	25	75	100
Total				**27**	**3**	**23**	**190**	**510**	**700**

SEMESTER: IV

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credits	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
I	LANGUAGE COURSE-I	Tamil-IV/ Hindi-IV/ French-IV	M23UFTA04	6	–	3	25	75	100
II	LANGUAGE COURSE-II	English	M23UFEN04	6	–	3	25	75	100
III	CORE COURSE-IV	Fundamental of Data Science	M23UAD04	4	–	4	25	75	100
III	CORE PRACTICAL–IV	Practical–IV- Database Programming Lab	M23UADP04	–	3	3	40	60	100
III	GENERIC ELECTIVE COURSE	Generic Elective – Mathematical Statistics - II	M23USTGE6	5	–	5	25	75	100
IV	SKILL ENHANCEMENT COURSE	SEC – VI – Web Designing	M23UADS04	2	–	2	25	75	100
	SKILL ENHANCEMENT COURSE	SEC – VII – Biometrics	M23UADS05	2	–	2	25	75	100
	ENHANCEMENT COMPULSORY COURSE	Environment Studies	M23UES01	2	–	2	25	75	100
Total				**27**	**3**	**24**	**215**	**585**	**800**

SEMESTER:V

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credits	Int.	Ext.	Total
III	CORE COURSE-V	Ethics of Artificial intelligence	M23UAD05	6	-	4	25	75	100
III	CORE COURSE-VI	Database Design and management	M23UAD06	6	-	4	25	75	100
III	CORE PRACTICAL-V	Practical–V-Data Science Lab	M23UADP05	-	5	4	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVECOURSE - I	Elective - I	M23UADDSE3	6	-	3	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVECOURSE - II	Elective - II	M23UADDSE7	5	-	3	25	75	100
IV	VALUE EDUCATION	Value Education - Yoga	M23UVE01	2		2	25	75	100
IV	CORE INTERNSHIP	Internship /Industrial Training (Summer vacation at the end of IV semester activity)	M23UADIS01	-	-	2	40	60	100
Total				**25**	**5**	**22**	**190**	**510**	**700**

SEMESTER:VI

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credits	Int.	Ext.	Total
III	CORE COURSE-VII	Robotic Process Automation	M23UAD07	6	-	4	25	75	100
III	CORE COURSE-VIII	Natural Language Processing	M23UAD08	5	-	4	25	75	100
III	CORE PRACTICAL–VI	Practical-VII-Practical: Programming in UI Path Automation Lab	M23UADP06	-	5	4	40	60	100
III	DISCIPLINE SPECIFIC ELECTIVE COURSE - III	Elective - III	M23UADDSE10	4	-	3	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVE COURSE - IV	Elective - IV	M23UADDSE14	4	-	3	25	75	100
III	PROJECT	PROJECT With Viva Voce	M23UADPR1	4	-	4	40	60	100
IV	SKILL ENHANCEMENT COURSE	Professional Competency SkillEnhancement	M23UADPCS1	2	-	2	25	75	100
IV	Extension Activity	Extension Activity	M23UEX01	-	-	1	-	-	-
Total				**25**	**5**	**25**	**205**	**495**	**700**

	TOTAL	150	30	140	1180	3120	4300

*The students will gain extra credits for successful completion of online courses from SWAYAM/MOOC. Also applicable for Value Added Course

Summary of Credits, Hours and Mark Distribution

Part	Course Name	No. of Credits						Total Credits	Total Hours	No. of Courses	Max. Marks
		I	II	III	IV	V	VI				
I	Language Courses –I	3	3	3	3	–	–	12	24	04	400
II	Language Courses–II	3	3	3	3	–	–	12	24	04	400
III	Core courses	5	5	5	4	8	8	35	43	08	800
	Core Practical	3	3	3	3	4	4	20	22	06	600
	Discipline Specific Elective Courses	–	–	–	–	6	6	12	19	04	400
	Project/Internship					2	4	6	04	02	200
	Generic Elective Courses	5	5	5	5	–	–	20	22	04	400
IV	SEC	–	2	4	4	–	2	12	12	06	600
	Foundation Course	2	–	–	–	–	–	02	02	01	100
	SEC (NME)	2	2	–	–	–	–	04	04	02	200
	ECC	–	–	–	2	2	–	04	04	02	200
V	Extension Activities	–	–	–	–	–	01	01	–	–	–
		–	–	–	–	–	–	–	–	–	–
	TOTAL	23	23	23	24	22	25	140	180	43	4300

GENERIC ELECTIVE COURSE SUBJECTSFOR B.Sc., Computer Science with Artificial Intelligence and Data Science **STUDENTS**

Semester	Subject	Course Code
I	GEC– I – DISCRETEMATHEMATICS -I	M23UMAGE2
II	GEC–II –DISCRETEMATHEMATICS -II	M23UMAGE4
III	GEC- III - MATHEMATICAL STATISTICS - I	M23USTGE4
IV	GEC- IV - MATHEMATICAL STATISTICS - II	M23USTGE6

**DISCIPLINE SPECIFIC ELECTIVE SUBJECTS FOR B.Sc.
Computer Science Artificial Intelligence and Data Science
STUDENTS**

Semester	ELECTIVE –I	
	Course Title	**Course Code**
V	Grid Computing	M23UADDSE1
	Artificial Intelligence	M23UADDSE2
	Computational Intelligence	M23UADDSE3
	Cryptography	**M23UADDSE4**
	ELECTIVE –II	
	IntroductiontoDataScience	M23UADDSE5
	Analytics for Service Industry	**M23UADDSE6**
	SoftwareProject Management	M23UADDSE7
	ImageProcessing	M23UADDSE8
	ELECTIVE - III	
VI	**CourseTitle**	**CourseCode**
	Agile Project Management	M23UADDSE9
	Big Data Analytics	**M23UADDSE10**
	Cloud Computing	M23UADDSE11
	Human Computer Interaction	M23UADDSE12
	ELECTIVE–IV	
	RoboticsanditsApplications	M23UADDSE13
	IOTanditsApplications	**M23UADDSE14**
	Artificial Neural Network	M23UADDSE15
	VirtualReality	M23UADDSE16

SKILL ENCHANCEMENT COURSES (SEC – 1 - SEC – 7)

CourseTitle	CourseCode
Introduction to HTML	M23UADS01
PHP Programming	M23UADS02
Multimedia Systems	M23UADS03
Biometrics	M23UADS04
WebDesigning	M23UADS05

ENHANCEMENT COMPULSORY COURSES

Semester	Course Title	Course Code
III & IV	ECC- I- Environmental studies	M23UES01
V	ECC- II -Value Education – Yoga	M23UVE01

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VI. SCHEMEOFEXAMINATION

1. QuestionPaperPatternforTheoryExamination

Time:ThreeHours   MaximumMarks:75

Knowledge Level	Sections		Marks	TotalMarks	MeaningofK's
K1	**Part-A** 10Questions-Objectivestype *1Marks(NoChoice)	TwoQuestionsfromeachunit	10	75	K1- Memory LevelK2- Understanding Level K3- ApplicationLevelK4- AnalyticalLevel
K1,K2	**Part-B** 5Questions*2Marks (NoChoice)	OneQuestionfromeachunit	10		
K2,K3	**Part-C** 5Questions(eitherortype) *5Marks	OneQuestionfromeachunit	25		
K2, K3,K4	**Part-D** 3outof5Questions *10Marks	OneQuestionfromeachunit	30		

2. QuestionPaperPatternforPracticalExamination

Time:ThreeHours   MaximumMarks:60

TwoMajorQuestionsfromtheListofPractical'seachcarry30Marks

a)Fromthelistofpractical's1,2and3(or)
b)Fromthelistofpractical's4and5.

(AND)

a)Fromthelistofpractical's6,7and8(or)
b)Fromthelistofpractical's9and10.

3. DistributionofMarks:

The following are the distribution o f marks for external and internalfor End Semester Examinations and continuous internal assessmentand passing minimum marks for Theory / Practical / Internship / ProjectpapersofUGprogrammes.

ESE	CIA Total	EA Total	Total MarksAllotted	Passing Minimum forEA	Passing Minimum(ESE)
Theory	25	75	100	30	40
Practical	40	60	100	24	40
Project	40	60	100	24	40
Internship	100	60	100	24	40

ThefollowingaretheDistributionofmarksfortheContinuousInternalAssessmentinTheory/PracticalpapersofUGprogrammes.

THEORY

EVALUATIONOFINTERNALASSESSMENT

Test	: 15 Marks
Assignment	: 05 Marks
MarksAttendance	:05Marks

Total	:25Marks

PRACTICAL

EVALUATIONOFINTERNALASSESSMENT

Test	: 20 Marks
Attendance	:10 Marks
Record	: 10Marks

Total	: 40Marks

PROJECT

EVALUATIONOFINTERNALASSESSMENT

Review1	: 10Marks
Review2	: 10Marks
Review3	:10Marks
Pre-Viva	: 10Marks

Total	: 40Marks
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3. PassingMinimum:

TheCandidatesshallbedeclaredtohavepassedtheexaminationifhe/she secures not less than 40 marks in total (CIA mark + Theory Exammark) with minimum of 30 marks (out of 75 marks) in the End SemesterTheoryExaminations.

TheCandidatesshallbedeclaredtohavepassedtheexaminationifhe/she secures not less than 40 marks in total (CIA mark + Practical Exammark) with minimum of 24 marks (out of 60 marks) in the End SemesterPracticalExaminations.

4. SubmissionofRecordNoteBooksforPracticalExaminations

Candidatesappearingforpracticalexaminationsshouldsubmitabonafi derecordnotebooksprescribedforpracticalexaminations.Thecandidate s failed to submit the record book shall not be permitted to appearforthepracticalexaminations.

5. Internship/Project:

Internship

Internshiptraining(Minimumtwoweeksperiod)fortheUGprogrammesduri ngsecondyearvacationperiod.

The Internship training Report shouldbevaluedfor60marksbyanExternal examiner;howeverthe Viva-Voceexaminationshouldconducted byboththeexternalexaminerappointedby theCollegeandtheinternalexaminer/guide/teacherconcerned..

a. TheInternshiptrainingReportmayconsistofminimumof30pages.
b. ThecandidatemustsubmittheInternshiptrainingReport20daysbefo rethecommencementoftheVSemesterExaminations.

Project:

The following guidelines to be followed for the Project with Viva-voce:
The project should be valuedfor60marksbyanexternalexaminer,howeverthe Viva-Voceexaminationshouldbeconducted byboththeexternalexaminerappointedby theCollegeandtheinternalexaminer/guide/teacherconcerned.

1. TheProjectReportmayconsistofminimumof60pages.

2. The candidate must submit the Project Report 10 days before thecommencementoftheIVSemesterExaminations.

3. A candidate who fails in the Project/Dissertation or is absent mayresubmitthereport,onthesametopic,withnecessarymodification / correction / improvements in the subsequent EvenSemester Examinations for evaluation and shall undergo viva-voceExamination.

VII.NOTE

a) SWAYAM/MOOC–FreeOnlineCourse

SWAYAM/MOOCisaninstrumentforself-

actualizationprovidingopportunitiesforalife-

longlearning.Herethestudentcanchoosefromhundreds of courses,

virtually every course taught at the college level,

offeredbythebestteachersinIndiaandelsewhere.

ThestudentscanchooseanonlineSWAYAM/MOOCcourse

duringtheirperiod of study which will earn an extra credit and it will be

transferred to theacademicrecordsofthestudents.

b) ValueAddedCourses

Studentsareprovidedwithadditionalcoursesduringtheircourseofstudy right from the First year. Students are free to choose the courses. Onsuccessfulcompletionofeachcourse,thestudentswillgainoneextracr edits.

CoreCourse-I	B.Sc.ComputerScience with (AI & DS)	Credits : 5
Coursecode: M23UAD01	DATA STRUCTURES	Contact Hours per week : 5

Objectives
- Tounderstand theconcept of abstract data types
- Toanalyzelinear data structures, such as lists, queues, andstacks, accordingto the needs of differentapplications.
- Todemonstrate theconceptoftrees andits applications
- Todesign, implement andanalyzeefficient treestructures to meet requirements such as searching, indexing,andsorting
- To enhancethe knowledgeto solveproblems asgraph problems and implement efficient graph algorithms to solvethem

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Classify linear data structures, such as lists, queues, andstacks, accordingto theneeds ofdifferentapplications.	K4
CO2	Demonstrate theconceptoftrees andits applications.	K1
CO3	Determine the concept of function, function arguments,Implementingthe concept strings in various application, Significanceof Modules, Work with functions, Strings andmodules.	K2
CO4	Design, implement andanalyzeefficient treestructures to meet requirements suchas searching, indexing, and sorting	K4
CO5	Enhancethe knowledgeto solveproblems asgraph problems and implement efficientgraph algorithms to solvethem	K3

UNIT I **15Hours**
AbstractDataTypes(ADTs)–ADTsandclasses–introductiontoOOP– classes in Python– inheritance – namespaces– shallow and deep copying. Introductiontoanalysisof algorithms–asymptotic notations–recursion–analyzingrecursivealgorithms.

UNIT II   **15Hours**
Linear Structures- List ADT – array-based implementations – linked list implementations–singlylinkedlists–circularlylinkedlists–doublylinkedlists – applications of lists– Stack ADT – QueueADT– double ended queues.

UNIT III   **15 Hours**
SortingandSearching-Bubblesort–selectionsort–insertionsort–mergesort – quicksort–linearsearch–binary search–hashing–hashfunctions–collision handling–load factors,rehashing,and efficiency.

UNITIV   **15Hours**
TreeStructures-TreeADT–Binary TreeADT–treetraversals–binary search trees – AVLtrees– heaps– multi-waysearch trees.

UNITV   **15Hours**

GraphStructures-GraphADT–representationsofgraph–graphtraversals–DAG – topological ordering – shortest paths– minimum spanningtrees.

TextBooks				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	Ellis Horowitz Sartaj Shani	Data Structures	GalgotiaPublication	2015
2.	Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran	Computer Algorithms	GalgotiaPublication	2010
3.	Michael T. Goodrich, Roberto Tamassia,and Michael H. Goldwasser	Data Structures &Algorithms in Python	JohnWiley&SonsInc	2013
4.	Lee, Kent D.,Hubbard, Steve,	Data Structuresand Algorithms with Python	Springer Edition	2015
5.	Aho, Hopcroft,and Ullman	DataStructures andAlgorithms	Pearson Education	1983
ReferenceBooks				
1.	Jean-Paul,Tremblay &PaulG. .	AnIntroductiontoDatastructureswith Applications	PSorenson, Tata McGraw Hill Company2008, 2ndEdition	2008

2.	Samanta.D	ClassicDataStructure	PrenticeHallofIndia PvtLtd	2007
3.	SeymourLipschutz,	DataStructures	McGraw HillPublications	2014
4.	RanceD.Necaise	DataStructuresandAlgorithmsUsingPython	JohnWiley&Sons	2011
5.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein	Introduction to Algorithms	McGraw Hill	2002

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	S	S
CO2	S	S	M	S	M
CO3	M	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

SEMESTER –I

CorePractical–I	B.Sc.ComputerScience with (AI & DS)	Credits :3
Coursecode: M23UADP01	PRACTICAL -I- COMPUTER PROGRAMMING LAB	Contact Hours per week :3

Objectives
- To applythe various basic programming constructs like decision makingstatements,looping statements ,functions, concepts like overloading, inheritance,polymorphism ,virtual functions, constructors and destructors
- To illustrate the concept of Virtual Classes, in line functions and friend functions
- To compare the various file stream classes; file types, usageof templates andexception Handling mechanisms
- To compare the pros and cons of procedure oriented language withthe concepts of objects oriented language.
- To ableto read and writefiles in Programming.

CourseOutcomes
Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge level
CO1	Applythe various basic programming constructs like decision makingstatements. looping statements ,functions, concepts like overloading, inheritance,polymorphism, virtual functions , constructors and destructors	
CO2	IllustratetheconceptofVirtualClasses,inlinefunctionsandfriendfunctions	
CO3	Identifysuitableprogrammingconstructs for problem solving.	K3 & K4
CO4	Compare the various file streams classes file types, usage of templates and exception Handling mechanisms..	
CO5	Compare the pros and cons of procedure oriented language with the concepts of object Oriented language	

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ListofExercises:

1.Write a C program to find the sum, average, standard deviation for a given set of numbers.

2. Write a C program to generate n prime numbers.

3. Write a C program to generate Fibonacci series.

4. Write a C program to sort the given set of numbers in ascending order.

5. Write a C program to count the number of Vowels in the given sentence.

6. Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_ Number, E_ Name, Department, Basic, Salary, Grade. Write a member function to get and display them.

7. Write C++ Program to create class SHAPE which consists of two virtual functions

8. Write a C++Program using function overloading to read two matrices of different Data Types Such as integers and floating point numbers.

9. Write a C++ Program to create a File and to display the contents of that file with line numbers.

10. Write a C++ Program to merge two files into a single file.

SEMESTER –I

Foundation Course	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Coursecode: M23UADFC1	FUNDAMENTALS OF COMPUTER PROGRAMMING	Contact Hours per week : 2

Objectives

- To impart knowledge about Computer fundamentals
- To understand the concepts and techniques in C Programming.
- To equip and indulgethemselves in problem solvingusingC
- To introduce the concepts of Object Oriented Programming Paradigm in C++
- To understandabout operatingsystem andtheiruses.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	Outlineabout theComputer fundamentals and theProblem solving and understand the basicconcepts of C and C++programming	K1
CO2	Demonstrate thevariousbasic programmingconstructs like decision makingstatements.Loopingstatements and functions.	K3
CO3	Analyzethe object oriented concepts like overloading, inheritance, polymorphism, Virtual functions, constructors and destructors.	K4
CO4	Develop programs in corporation the programming constructs of objectoriented Programmingconcepts	K1
CO5	Discussabout Numeric data and character-based data. Analyzeabout Arrays.	K2

UNITI   **6Hours**

IntroductiontoC-IntroductiontoC12HoursOverviewofC-
Introduction-Characterset-Ctokens -keyword&Identifiers - Constants-
Variables-Data types-Declarationof variables- Assigning valuestovariables-
Defining   SymbolicConstants-   Arithmetic,
Relational,Logical,Assignment,Conditional,   Bitwise,
Special,IncrementandDecrementoperators-ArithmeticExpressions   -
Evaluationof expression- precedence of arithmetic operators- Type
conversion in expression – operator precedence&as sociativity-

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Mathematicalfunctions-Reading& Writing a character-Formatted inputand output.

UNITII   **6Hours**
Decision Making , Looping and Arrays-Decision Making and Branching:Introduction–if,if….else,nesting ofif…else Statements elseifladder–The switchstatement,The ?:Operator–The gotoStatement.DecisionMaking andLooping:Introduction-The while statement- thedostatement–the for statement-jumpsinloops. Arrays – Character Arrays andStrings.

UNITIII   **6Hours**
Pointers&Files-Pointers–Declaration–PointertoClass, Object–this pointer – Pointers toderivedclassesandBase classes–Arrays– Characteristics–array ofclasses.Files–Filestreamclasses–filemodes–
SequentialRead/Writeoperations–Binary andASCIIFiles–Random Access Operation–Templates–Exception Handling– Miscellaneous functions.

UNIT I V   **6Hours**
Programming– Advantages– Object OrientedLanguages–I/O in C++-C++Declarations. Functions in C++-inline functions– Function Overloading.
Classes andObjects:DeclaringObjects–Defining Member Functions– Static Membervariables and functions–arrayof objects–friend functions–Overloadingmember functions– Bit fields and classes–Constructorand destructorwith static members.

UNITV   **6Hours**
Inheritance - Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid ,Multipath inheritance –Virtual base Classes–Abstract Classes.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	EBalagurusamy	ComputingFundamentals&CProgramming	TataMcGraw-Hill,Second	2008
2.	AshokNKamthane,	Object-OrientedProgrammingwithAnsiand TurboC++	Pearson Education	2003

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MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	S	M
CO2	M	M	S	S	M
CO3	S	S	M	M	S
CO4	M	M	S	M	M
CO5	M	M	M	M	S

S - Strong M - Medium

SEMESTER –II

CoreCourse-II	B.Sc.ComputerScience with (AI & DS)	Credits :5
Coursecode: M23UAD02	INTRODUCTION TO PYTHON PROGRAMMING	Contact Hours per week :5

Objectives
- To know the basics of algorithmicproblem solvingwith read andwritesimple Python Programs
- To develop Python programs with conditionals and loops.
- To definePythonfunctionsand callthem
- To understand various sortingand searching.
- To usePython datastructures-lists, tuples, dictionaries and fixinput/output with files

CourseOutcomes
Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	Develop algorithmicsolutions to simple computational problems	K3
CO2	Build a simplePython programs using Structures.	K2
CO3	DeriveaPython program using functions	K4
CO4	Recallthehash function and concepts of collision and its resolution methods	K1
CO5	Illustrate compound datausingPython lists, tuples, and dictionaries.	K3

UNIT 1   15Hours
Algorithms,buildingblocksofalgorithms(statements,state,controlflow, functions),notation(pseudocode,flowchart,programming language), algorithmic problemsolving,simple strategiesfor developingalgorithms (iteration, recursion).

UNITII   15Hours
Python interpreter and interactive mode, values and types: int, float, Boolean, string and list; variables, expressions, statements, tuple assignment,precedenceofoperators,comments,modulesandfunctions function definition and use, flow of execution, parameters andarguments.

UNIT III   15Hours

Conditionals: Booleanvaluesandoperators,conditional(if),alternative (if-else), chainedconditional(if-elif-else). **Iteration:**state, while, for, break, continue, pass.Fruitful functions:return values, parameters, local andglobal scope, function composition, recursion. **Strings:** string slices, immutability, string functions andmethods, string module.

UNITIV   15Hours

Lists:list operations, list slices, list methods, list loop, mutability, aliasing,cloning lists,listparameters.**Tuples:**tupleassignment,tupleas returnvalue, **Dictionaries**:operationsandmethods,advancedlist processing-list comprehension.

UNITV   15Hours

Filesandexception:textfiles,readingandwritingfiles,formatoperator, command linearguments, errorsandexceptions, handling exceptions, **Modules, packages**- Numpy- Scikit.

TextBooks				
S.No	**Author**	**Titleofthe Book**	**Publisher**	**Yearof Publications**
1.	AllenB.Downey	ThinkPython:HowtoThinkLikeaComputerScientis	Shroff/O"ReillyPublishers n	2016
2.	Guido van Rossum and FredL.DrakeJr	Introduction to Python–Revised and updated forPytho	Network Theory Ltd	2011
ReferenceBooks				
1.	John V Guttag	Introduction toAlgorith Introduction to Computation and Programming Using Python ms	,MIT Press	2013
2.	RobertSedgewick,Kevin Wayne,RobertDondero	Introduction toProgrammingin Python:AnInter-disciplinaryApproach	Pearson Education	2016
3.	TimothyA.Budd	ExploringPython	Mc-GrawHillEducation(India)PrivateLtd	2015
4.	KennethA.Lambert	FundamentalsofPython	CENGAGELearning	2012

Mappingwith Programme SpecificOutcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	S	S	M	S
CO4	S	M	S	M	S
CO5	S	S	S	S	S

S-Strong M-Medium

SEMESTER –II

CorePractical-II	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADP02	PRACTICAL–II:PYTHON PROGRAMMING LAB	Contact Hours per week : 3

Objectives
- To write, test, and debug simple Python programs
- To implement Python programs with conditionals and loops.
- To use functions forstructuringPython programs.
- To use functions forstructuringPython programs.
- To read and writedata from/to files in Python.

CourseOutcomes
Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	Restate debugsimplePython programs. Read and writedata from/to files in Python	
CO2	CreatePython programs with conditionals and Loops	
CO3	Develop Python programs step-wisebydefining functions and callingthem.	K3 & K4
CO4	Describethehash function and concepts of collision and its resolution methods	
CO5	ApplyAlgorithm forsolvingproblems like sorting, searching, insertion anddeletion of data	

List of Exercises:
1. Computethe GCD oftwo numbers.
2. Find thesquare root of anumber (Newton's method)
3. Exponentiation using Numpy
4. Find themaximum of alist of numbers
5. Linear searchand Binarysearch.
6. Selection sort,Insertion sort
7. Mergesort
8. First n primenumbers
9. List Comprehension
10. Programs that take command line arguments (word count)

SEC - III	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Course code: M23UADS01	SEC-III- INTRODUCTION TO HTML	Contact Hours per week : 2

Objectives
- ➢ To insert a graphic within a web page.
- ➢ To create a link within a web page.
- ➢ To create a table within a web page.
- ➢ To insert heading levels within a web page.
- ➢ To insert ordered and unordered lists within a web page.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Knows the basic concept in HTML Concept of resources in HTML	K1
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	K2
CO3	Understand the page formatting. Concept of list	K4
CO4	Creating Links. Know the concept of creating link to email address	K3
CO5	Concept of adding images Understand the table creation.	K4

UNIT I   **6 Hours**
    Introduction: Web Basics: What is Internet – Web browsers – What is Web page – **HTML Basics:** Understanding tags.

UNIT II   **6 Hours**
    Tags for Document structure (HTML, Head, Body Tag). Block level text elements: Headings paragraph (tag) – Font style elements: (bold, italic, font, small, strong, strike, big tags)

UNIT III   **6 Hours**
    Lists:Types of lists: Ordered, Unordered – Nesting Lists – **Other tags**: Marquee, HR, BR- Using Images – Creating Hyperlinks.

UNIT IV   **6 Hours**
    Tables: Creating basic Table, Table elements, Caption – Table and cell alignment – Rowspan, Colspan –Cell padding

UNIT V   **6 Hours**
    Frames: Frameset – Targeted Links – No frame – Forms: Input, Text area, Select, Option.

Text Book				
S.No	Author	Title of the book	Publisher	Year of publication
1.	Teach U	Mastering HTML5 and CSS3 Made Easy	Comp Inc	2014

MappingwithProgrammeOutcomes:

CO's/PSO's	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	M	S
CO2	M	S	S	M	S
CO3	S	M	M	S	S
CO4	S	S	S	S	M
CO5	M	S	S	M	S

S-Strong   M-Medium

CoreCourse-III	B.Sc.ComputerScience with (AI & DS)	Credits : 5
Coursecode: M23UAD03	Foundation of Artificial Intelligence	Contact Hours per week : 6

Objectives

- To understand the basic concepts of intelligent agents
- To develop general-purpose problem solving agents, logical reasoning agents and agents that reason under uncertainty.
- To employ AI techniques to solve some of today's real world problems.
- To analyze the implications of applying AI systems to organizations and future of work
- To explain how to develop AI systems to meet business, organizational, and technology requirements.

CourseOutcomes

Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	Understand autonomous agents that make effective decisions in fully informed, partially observable and adversarial setting.	K2
CO2	Choose appropriate algorithms for solving given AI problems.	K4
CO3	Design and implement logical reasoning agents.	K3
CO4	Demonstrate agents that can reason under uncertainty.	K1
CO5	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K3

UNIT I   18Hours

Introduction to AI –Agents and Environments –Concept of rationality – Nature of environments –Structure of agents Problem solving agents – search algorithms –uninformed search strategies.

UNITII   18Hours

Heuristic search strategies –heuristic functions. Local search and optimization problems –local search in continuous space –search with non-deterministic actions –search in partially observable environments –online

search agents and unknown environment.

UNIT III   **18Hours**

Game theory –optimal decisions in games –alpha-beta search –montecarlo tree search – stochastic games –partially observable games. Constraint satisfaction problems –constraint propagation –backtracking search for CSP –local search for CSP –structure of CSP.

UNITIV   **18Hours**

Knowledge-based agents –propositional logic –propositional theorem proving – propositional model checking –agents based on propositional logic. First-order logic –syntax and semantics –knowledge representation and engineering –inferences in first-order logic –forward chaining –backward chaining –resolution.

UNITV   **18Hours**

Ontological engineering –categories and objects –events –mental objects and modal logic – reasoning systems for categories –reasoning with default information. Classical planning – algorithms for classical planning – heuristics for planning –hierarchical plan – nondeterministic domains –time, schedule, and resources –analysis.

TextBooks				
S.No	**Author**	**Titleofthe Book**	**Publisher**	**Yearof Publications**
1.	Stuart Russel and Peter Norvig	Artificial Intelligence: A Modern Approach	Pearson Education	Fourth Edition 2020
2.	Dan W. Patterson	Introduction to AI and ES	Pearson Education	2007
3.	Kevin Night, Elaine Rich, and Nair B	Artificial Intelligence	McGraw Hill	2008
ReferenceBooks				
1.	Patrick H. Winston	Artificial Intelligence	Pearson Edition	2006
2.	Deepak Khemani	Artificial Intelligence	McGraw Hill Education	2013
3.	Dennis Rothman	Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases		2018

Mappingwith Programme SpecificOutcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	S	S	M	S
CO4	S	M	S	M	S
CO5	S	S	S	S	S

S-Strong M-Medium

CorePractical-III	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADP03	PRACTICAL– III:Internet Programming Lab	Contact Hours per week : 3

Objectives

- To introduce the concepts of Object Oriented Programming Paradigm and the Programming constructs of JAVA
- To use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- To read and make elementary modifications to Java programs that solve real-world problems..
- To validate input in a Java program.
- To document a Java program

CourseOutcomes

Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	To introduce the concepts of Object Oriented Programming Paradigm and the Programming constructs of JAVA	K3 & K4
CO2	Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.	
CO3	Read and make elementary modifications to Java programs that solve real-world problems.	
CO4	Validate input in a Java program.	
CO5	Document a Java program using Javadoc	

List of Exercises

1. Write a Java Applications to extract a portion of a character string and print the extracted string.
2. Write a Java Program to implement the concept of multiple inheritance using Interfaces
3. Write a Java Program to create an Exception called payout-of-bounds and throw the exception
4. Write a Java Program to implement the concept of multi the reading with the use of any three multiplication tables and assign three different priorities to them.
5. Write a Java Program to draw several shapes in the created windows.
6. Write a Java Program to demonstrate the Multiple Selection List-box.
7. Write a Java Program to create a frame with three text fields for name, age and qualification and a text Field for multiple line for address.

8. Write a Java Program to create Menu Bars and pull down menus.

9. Write a Java Program to create frames which respond to the mouse clicks.
10. Write a Java Program to draw circle ,square ,ellipse and rectangle at the mouse click position.

SEC -IV	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Course code: M23UADS02	SEC – IV- PHP Programming	Contact Hours per week : 2

Objectives

- ➢ To provide the necessary knowledge on basics of PHP.
- ➢ To design and develop dynamic, database-driven web applications using PHP Version
- ➢ To get an experience on various web application development techniques.
- ➢ To learn the necessary concepts for working with the files using PHP.
- ➢ To get a knowledge on OOPS with PHP

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Write PHP scripts to handle HTML forms.	K1
CO2	Write regular expressions including modifiers, operators, and meta characters.	K2
CO3	Create PHP Program using the concept of Array.	K3
CO4	Create PHP programs that use various PHP library functions.	K4
CO5	Manipulate files and directories.	K3

UNIT I   **6 Hours**

Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation.

UNIT II   **6 Hours**

PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types -Using Operators - Using Conditional Statements -If(), else if() and else if condition Statement.

UNIT III   **6 Hours**

Switch () Statements -Using the while () Loop -Using the for() Loop PHP 6 Functions. PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections

with Arrays -Using Array Functions.

UNIT IV   **6 Hours**

PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.

UNIT V   **6 Hours**

　　　Managing Sessions and Using Session Variables -Destroying a Session - Storing Data in Cookies -Setting Cookies.

Text Book

S.No	Author	Title of the book	Publisher	Year of publication
1.	Lynn mighley and Michael Morrison.	Head First PHP & MySQL: A Brain-Friendly Guide	-	2009
2.	Alan Forbes	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL	-	-

Reference Book

	Author	Title of the book	Publisher	Year of publication
1.	Steven Holzner	PHP: The Complete Reference	-	-
2.	DT Editorial Services	HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)	Paperback	2016, 2nd Edition.

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

SEC - V	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Course code: M23UADS03	SEC -V - Multimedia Systems	Contact Hours per week : 2

Objectives

➢ To understand the basics of Multimedia.
➢ To study about the Image File Formats, Sounds Audio File Formats.
➢ To understand the concepts of Animation and Digital Video Containers.
➢ To study about the Stage of Multimedia Project
➢ To understand the concept of Ownership of Content Created for Project Acquiring Talent.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts, importance, application and the process of developing multimedia	K1
CO2	To have basic knowledge and understanding about image related processing.	K2
CO3	To understand the framework of frames and bit images to animations	K4
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.	K3
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing.	K3

UNIT I **6 Hours**

  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.

UNIT II **6 Hours**

  Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. **Sound:** The Power of Sound –Digital Audio-Midi Audio Midi vs. Digital Audio-Multimedia System Sounds Audio File Formats -Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project

UNIT III **6 Hours**

  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.

UNIT IV   **6 Hours**
        Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs Multimedia Production Team.

UNIT V   **6 Hours**
        Planning and Costing: The Process of Making Multi media-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - **Content and Talent:** Acquiring Content Ownership of Content Created for Project Acquiring Talent.

Text Book				
S.No	Author	Title of the book	Publisher	Year of publication
1.	TayVaughan	Multimedia: Making It Work	Osborne/Mc Graw Hill	8thEdition 2001
Reference Book				
1.	Ralf Steinmetz & Klara	Multimedia Computing, Communication & Applications Nahrstedt	Pearson Education,	2012

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

Core Course - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Course code: M23UAD04	Fundamentals of Data Science	Contact Hours per week : 4

Objectives

- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the skills of data inspecting and cleansing.	K1
CO2	Determine the relationship between data dependencies using statistics	K2
CO3	Understand the can handle data using primary tools used for data science.	K4
CO4	Represent the useful information using mathematical skills.	K3
CO5	Apply the knowledge for data describing and visualization using tool.	K4

UNIT I **12 Hours**

Need for data science –benefits and uses –facets of data –data science process –setting the research goal –retrieving data –cleansing, integrating and transforming data –exploratory data analysis –build the models – presenting and building applications.

UNIT II **12 Hours**

Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions –frequency distributions for nominal data –interpreting distributions –graphs – averages –mode –median – mean–averages for qualitative and ranked data.

UNIT III **12 Hours**

Normal distributions –z scores –normal curve problems –finding proportions –finding scores – more about z scores –correlation –scatter plots –correlation coefficient for quantitative data – computational

formula for correlation coefficient.

UNIT IV   **12 Hours**
      Basics of Numpy arrays, aggregations, computations on arrays, comparisons, structured arrays, Data manipulation, data indexing and selection, operating on data, missing data, hierarchical indexing, combining datasets –aggregation and grouping, pivot tables.

UNIT V   **12 Hours**
      Visualization with matplotlib, line plots, scatter plots, visualizing errors, density and contour plots, histograms, binnings, and density, three dimensional plotting, geographic data.

Text Books				
S.No	**Author**	**Title of the book**	**Publisher**	**Year of publication**
1.	Jake VanderPlas	Python Data Science Handbook	O"Reilly	2016
2.	Robert S. Witte and John S. Witte,	Statistics	Eleventh Edition, Wiley Publications	2017
Reference Book				
1.	Allen B. Downey	Think Stats: Exploratory Data Analysis in Python	Green Tea Press	2014

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

Core Practical - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Course code: M23UADP04	Database Programming Lab	Contact Hours per week : 3

Objectives

- To understand the database development life cycle.
- To learn database design using conceptual modeling, Normalization.
- To implement database using Data definition, Querying using SQL manipulation and SQL programming.
- To implement database applications using IDE/RAD tools.
- To learn querying Object-relational databases

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the database development life cycle.	K3 & K4
CO2	Design relational database using conceptual-to relational mapping, Normalization.	
CO3	Apply SQL for creation, manipulation and retrieval of data.	
CO4	Develop database applications for real – time problems.	

List of Exercises

1. Database Development Life cycle: Problem definition and Requirement analysis Scope and Constraints.
2. Database design using Conceptual modeling (ER-EER) –top-down approach .Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming –Stored Procedures/Functions -Constraints and security using Triggers.
6. Database design using Normalization –bottom-up approach
7. Develop database applications.

8. Create a table for Employee details with Employee Number as primary key and following fields: Name, Designation, Gender, Age, Date of Joining and Salary. Insert at least ten rows and perform various queries using any one Comparison, Logical, Set, Sorting and Grouping operators.

9. Write a PL/SQL to update the rate field by 20% more than the current rate in inventory table which has the following fields: Prono, ProName and Rate. After updating the table a new field (Alter) called for Number of item and place for values for the new field without using PL/SQL block.

10. Querying the Object-relational database using Objet Query language.

SEC - VI	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Course code: M23UADS04	SEC – VI - BIOMETRICS	Contact Hours per week : 2

Objectives

➢ To identify the various biometric technologies.
➢ To design of biometric recognition.
➢ To develop simple applications for privacy.
➢ To understand the need of biometric in the society
➢ To understand the scope of biometric techniques

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications	K1
CO2	To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics.	K2
CO3	To analyse the Privacy Enhancement and Multimodal Biometrics	K3
CO4	To get analytical idea on Water marking Techniques.	K1
CO5	To Gain knowledge on Future scope of Biometrics, and Study of various Biometric Techniques	K4

UNIT I **6 Hours**

   Introduction: What is Biometrics, History, Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages.

UNIT II **6 Hours**

   Retina and Iris Biometrics: Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages.

Vein and Fingerprint Biometrics: Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.

UNIT III   6 Hours

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. **Multimodal Biometrics:** Introduction to Multimodal Biometrics, Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.

UNIT IV   6 Hours

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, Image Watermarking 6 CO4 Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking.

UNIT V   6 Hours

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, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques. **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.

Text Book				
S.No	Author	Title of the book	Publisher	Year of publication
1.	G.R Sinha and Sandeep B.Patil	Biometrics: Concepts and Applications	Wiley	2013
Reference Book				
1.	Ruud M. SharathPankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell Bolle	Guide to Biometrics	Springer	2009

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

SEC - VII	B.Sc.ComputerScience with (AI & DS)	Credits : 2
Course code: M23UADS05	SEC – VII - WEB DESIGNING	Contact Hours per week : 2

Objectives

- To understand the basics of HTML and its components.
- To study about the Graphics in HTML.
- To understand and apply the concepts of XML and DHTML
- To understand the concept of JavaScript
- To identify and understand the goals and objectives of the Ajax

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Remember the basic HTML tags.	K1
CO2	Describe the ability to develop and publish Web pages using Hypertext Markup Language (HTML).	K2
CO3	Use page styles and layout with Cascading Style Sheets (CSS).	K3
CO4	Apply client side scripting using java script.	K3
CO5	Design forms and validations.	K4

UNIT I   6 Hours

HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test-heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.

UNIT II   6 Hours

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.

UNIT III   6 Hours

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).

UNIT IV   6

Hours

      Dynamic HTML: Document object model (DCOM)- Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, what is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.

UNIT V   **6**

Hours

      Advance script, JavaScri

      pt and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.

Text Books				
S.No	Author	Title of the book	Publisher	Year of publication
1.	Pankaj Sharma	Web Technology	SkKataria & Sons Bangalore	2011
2.	Mike Mcgrath	Java Script	Dream Tech Press	2006, 1st Edition
3.	Achyut S Godbole & AtulKahate	Web Technologies	-	2002, 2nd Edition
Reference Book				
1.	Laura Lemay, Rafe Colburn , Jennifer Kyrnin	Mastering HTML, CSS & Java script	Web Publishing	4th Edition

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

      S- Strong; **M**-Medium

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Core Course -V	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Course code: M23UAD05	Ethics of Artificial Intelligence	Contact Hours per week : 6

Objectives

➢ To understand the need for ensuring ethics in AI
➢ To understand ethical issues with the development of AI agents
➢ To apply the ethical considerations in different AI applications
➢ To evaluate the relation of ethics with nature
➢ To overcome the risk for Human rights and other fundamental values.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recite the ethical issues in the development of AI agents.	K1
CO2	Discuss the ethical considerations of AI with perspectives on ethical values	K2
CO3	Apply the ethical policies in AI based applications and Robot development	K1
CO4	Simplify the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights	K4
CO5	Create the evil genesis in the concepts of AI.	K3

UNIT I   **18 Hours**

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities.

UNIT II   **18 Hours**

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral AI governance and Strategies.

UNIT III   **18 Hours**

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder.

UNIT IV   **18 Hours**

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a 15 Binary approach, Machine learning values, Artificial Moral Agents.

UNIT V   **18 Hours**

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, and Smart City Ethics.

Text Books

S.No	Author	Title of the book	Publisher	Year of publication
1.	Paula Boddington	Towards a Code of Ethics for Artificial Intelligence	Springer	2017
2.	Markus D. Dubber Frank Pasquale, Sunit Das	The Oxford Handbook of Ethics of AI	Oxford University Press Edited book,	2020
3.	S. Matthew Liao	Ethics of Artificial Intelligence	Oxford University Press Edited Book	2020

Reference Books

S.No	Author	Title of the book	Publisher	Year of publication
1.	N. Bostrom and E. Yudkowsky	The ethics of artificial intelligence	‖. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press	2014
2.	Wallach, W., & Allen, C,	Moral machines: ceaching robots right from wrong	Oxford University Press	2008

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

SEMESTER – V

Core Course - VI	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Course code: M23UAD06	Database Design and Management	Contact Hours per week : 6

Objectives

- ➢ To introduce database development life cycle and conceptual modeling
- ➢ To learn SQL for data definition, manipulation and querying a database
- ➢ To learn relational database design using conceptual mapping and normalization.
- ➢ To learn transaction concepts and serialize ability of schedules.
- ➢ To learn data model and querying in object-relational and No-SQL databases.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the database development life cycle .	K1
CO2	Categorize the programming in SQL to create, manipulate and query the database.	K4
CO3	Apply the conceptual-to-relational mapping and normalization to design relational database(DML).	K3
CO4	Determine the serialize ability of any non-serial schedule using concurrency techniques multiple tables.	K2

UNIT I   **18 Hours**

Database environment –Database system development lifecycle – Requirements collection – Database design - -Entity-Relationship model – Enhanced-ER model – UML class diagrams – Database Architecture.

UNIT II   **18 Hours**

Database languages - Relational model concepts -Integrity constraints - SQL Data manipulation –SQL Data definition –Views -SQL Commands.

UNIT III   **18 Hours**

ER and EER-to-Relational mapping –Update anomalies –Functional dependencies-Inference rules – Minimal cover –Properties of relational decomposition –Normalization upto BCNF - BJNF.

UNIT IV   **18 Hours**

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques.

UNIT V   **18 Hours**

Mapping EER to ODB schema – Object identifier – reference types –row types –UDTs –Subtypes and super types –user-defined routines –Collection types – Object Query Language.

Text Books

S.No	Author	Title of the book	Publisher	Year of publication
1.	Thomas M. Connolly, Carolyn E. Begg.	Database Systems – A Practical Approach to Design, Implementation and Management	Pearson Education	Sixth Edition, Global Edition 2015
2.	Ramez Elmasri, Shamkant B. Navathe, ,	Fundamental of Database Systems	Pearson	2017

Reference Books

S.No	Author	Title of the book	Publisher	Year of publication
1.	Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish,	DATABASE MODELING AND DESIGN -Logical Design	Morgan Kaufmann Publishers	Fifth Edition 2011
2.	Carlos Coronel, Steven Morris, and Peter Rob	Database Systems: Design, Implementation, and Management	Cengage learning	Ninth Edition 2012
3.	Abraham Silberschatz, Henry F Korth, S Sudharshan	Database System Concepts	Tata Mc Graw Hill	6th Page 37 of 84 Edition, , 2011
4.	Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom	Database Systems:The Complete Book	Pearson.	2nd edition,
5.	S Sumathi, S Esakkirajan	Fundamentals of Relational Database Management Systems (Studies in Computational Intelligence)	Springer-Verlag	2007
6.	Raghu Ramakrishnan	Database Management Systems	Tata Mc Graw Hill	4th Edition 2010

Mapping with Programme Specific Outcomes

Co's /PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	S
CO2	S	M	S	S	M
CO3	S	M	M	S	S
CO4	M	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium

SEMESTER –V

CorePractical - V	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Coursecode: M23UADP05	PRACTICAL–V - Data Science Lab	Contact Hours per week : 5

Objectives

- To understand the Programming Language.
- To prepare data for data analysis through understanding its distribution.
- To exposure on data processing using excel
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and regression model.

CourseOutcomes

Onthe successful completion of the course, students will be able to

CO Number	COStatement	Knowledge Level
CO1	Understand the Programming Language.	
CO2	To prepare data for data analysis through understanding its distribution.	
CO3	Exposure on data processing using excel	K3 & K4
CO4	To acquire knowledge in plotting using visualization tools.	
CO5	To understand and implement classification and regression model.	

List of Exercises

1. Study of Basic function in Excel.
2. Working with Range Names and Tables
3. Cleaning Data with Text Functions
4. Working with VLOOKUP functions and Pivot Table.
5. Demonstration of Data Visualization in Excel.
6. Importing Data from External Source Using Excel
7. Create a dashboard for a given requirement
8. Implement a data analytics for the real time data set
9. Chi – square calculation.
10. K- Means Clustering.

DISCIPLINE SPECIFIC ELECTIVE - I	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE1	GRID COMPUTING	Contact Hour per week : 6

Objectives

- To learn the basic construction and application of Grid computing.
- To learn grid computing organization and their Role.
- To learn Grid Computing Anatomy.
- To learn Grid Computing road map.
- To learn various type of Grid Architecture.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic elements and concepts of Grid computing	K2
CO2	Identify the Grid computing tool kits and Framework.	K1
CO3	Outline the concepts of Anatomy of Grid Computing..	K3
CO4	Choose the concept of service oriented architecture	K2
CO5	Modify the knowledge on grid and web service architecture.	K4

UNIT I   18Hours
Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.

UNIT II   18Hours
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.

UNIT III   18 Hours
Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.

UNITIV   **18Hours**
The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.

UNITV   **18Hours**
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.

TextBook				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Joshy Joseph and Craig Fellenstein,	Grid computing	Pearson / IBM Press,	2004
ReferenceBook				
1.	Charles River	Ahmer Abbas and Graig computing, A Practical Guide to technology and applications	Media,	2003

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

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SEMESTER –V

DISCIPLINE SPECIFIC ELECTIVE - II	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE2	ARTIFICIAL INTELLIGENCE	Contact Hours per week :5

Objectives

- To learn various concepts of AI Techniques
- To learn various Search Algorithm in AI.
- To learn probabilistic reasoning and models in AI.
- To learn about Markov Decision Process.
- To learn various type of Reinforcement learning.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the various concepts of AI Techniques	K2
CO2	Apply various Search Algorithm in AI.	K3
CO3	Evaluate probabilistic reasoning and models in AI.	K2
CO4	Build Markov Decision Process.	K1
CO5	Categorize various type of Reinforcement learning Techniques.	K4

UNIT I   15Hours

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

UNIT II   15Hours

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search A* algorithm, Game Search

UNIT III   15 Hours

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

UNITIV   15Hours

Markov Decision process: MDP formulation, utility theory, utility functions,

value iteration, policy iteration and partially observable MDPs.

UNITV   **15Hours**

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

TextBook				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	Stuart Russell and Peter Norvig	Artificial Intelligence: A Modern Approach	Prentice Hall	3rd Edition

ReferenceBooks				
1.	Trivedi, M.C	Classical Approach to Artifical Intelligence	Khanna Publishing House	2012
2.	Saroj Kaushik	Artificial Intelligence	Cengage Learning India	2011
3.	David Poole and Alan Mackworth	Artificial Intelligence: Foundations for Computational Agents	Cambridge University Press	2010

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - I	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE3	COMPUTATIONAL INTELLIGENCE	Contact Hours per week : 6

Objectives

- To identify and understand the basics of AI and its search.
- To study about the Fuzzy logic systems.
- To understand and apply the concepts of Neural Network and its functions.
- To understand the concepts of Artificial Neural Network.
- To study about the Genetic Algorithm.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the fundamentals of artificial intelligence concepts and searching techniques.	K2
CO2	Develop the fuzzy logic sets and membership function and defuzzification techniques.	K1
CO3	Understand the concepts of Neural Network and analyze and apply the learning techniques.	K2
CO4	Paraphrase the artificial neural networks and its applications.	K3
CO5	Illustrate the concept of Genetic Algorithm and Analyze the optimization problems using GAs.	K4

UNIT I   **18Hours**

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.

UNIT II   **18Hours**

Fuzzy Logic Systems: Notion of fuzziness – Operations on fuzzy sets – Tnorms 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.

UNIT III   **18 Hours**

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (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

UNITIV   **18Hours**

Artificial Neural Networks: Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network**.**

UNITV   **18Hours**

Genetic Algorithm: Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.

TextBooks

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	S.N. Sivanandam and S.N. Deepa,	Principles of Soft Computing	Wiley India Pvt	2nd Edition
2.	Stuart Russell and Peter Norvig,	Artificial Intelligence - A Modern Approach	Pearson Education in Asia	2nd Edition,
3.	S. Rajasekaran, G. A. Vijayalakshmi,	Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications	PHI	2010
ReferenceBooks				
1.	F. Martin, Mcneill, and Ellen Thro, 2000. Chin Teng Lin, C. S. George Lee	Fuzzy Logic: A Practical approach AP Professional	PHI	2009
2.	Chin Teng Lin, C. S. George Lee	Neuro-Fuzzy Systems	PHI	2011

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - I	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE4	**CRYPTOGRAPHY**	Contact Hours per week : 6

Objectives

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

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	K4
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	K1
CO3	Apply the different cryptographic operations of public key cryptography	K4
CO4	Illustrate the various Authentication schemes to simulate different applications.	K3
CO5	Understand various Security practices and System security standards.	K2

UNIT I   **18Hours**

Introduction: The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.

UNIT II   **18Hours**

Classical Encryption Techniques: Symmetric cipher model – Substitution Techniques: Caesar Cipher – Mono alphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography.

UNIT III   **18 Hours**
Block Cipher and DES: Block Cipher Principles – DES – The Strength of DES – RSA: The RSA algorithm.

UNITIV   **18Hou**rs

Network Security Practices: IP Security overview - IP Security architecture
– Authentication Header. **Web Security:** Secure Socket Layer and Transport
Layer Security – Secure Electronic Transaction**.**

UNITV   **18Hours**

Intruders – Malicious – software – Firewalls.

TextBook				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	William Stallings	Cryptography and Network Security Principles andPractices	Tata McGraw-Hill	2007
ReferenceBooks				
1.	Behrouz A. Foruzan	Cryptography and Network Security	Tata McGraw-Hill	2007
2.	AtulKahate, TMH	Cryptography and Network Security	Tata McGraw-Hill	Second Edition, 2003
3.	M.V. Arun Kumar	Network Security	USP	First Edition 2011

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - II	B.Sc.ComputerScience with (AI & DS)	Credits :3
Coursecode: M23UADDSE5	INTRODUCTION TO DATA SCIENCE	Contact Hours per week :5

Objectives

- To learn about basics of Data Science and Big data..
- To learn about overview and building process of Data Science.
- To learn about various Algorithms in Data Science.
- To learn about Hadoop Framework
- To learn about case study about Data Science.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics in Data Science and Big data.	K1
CO2	Understand overview and building process in Data Science.	K2
CO3	Apply various Algorithms in Data Science.	K3
CO4	Evaluate Hadoop Framework in Data Science.	K2
CO5	Develop Case study in Data Science.	K4

NIT I **15Hours**

Introduction: Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science

UNIT II **15Hours**

The Data science process: Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building**.**

UNIT III **15 Hours**

Algorithms: Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised.

UNITIV **15Hou**rs

Introduction to Hadoop: Hadoop framework – Spark – replacing Map Reduce– No SQL – ACID – CAP – BASE – types**.**

UNITV   **15Hours**

Case Study: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation

TextBooks

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali	Introducing Data Science	manning publications	2016

ReferenceBooks

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Roger Peng	The Art of Data Science	lulu.com	2016
2.	Murtaza Haider	Getting Started with Data Science – Making Sense of Data with Analytics	IBM press	E-book
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali	Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools	Dream tech Press	2016
4.	Annalyn Ng, Kenneth Soo	Num sense! Data Science for the Layman: No Math Added	-	2017,1st Edition
5.	Cathy O'Neil, Rachel Schutt,	Doing Data Science Straight Talk from the Frontline	O'Reilly Media	2013
6.	Lillian Pierson,	Data Science for Dummies	-	2017 II Edition

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong   M-Medium

DISCIPLINE SPECIFIC ELECTIVE - I	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE6	ANALYTICS FOR SERVICE INDUSTRY	Contact Hours per week : 6

Objectives

- To recognize challenges in dealing with data sets in service industry.
- To identify and apply appropriate algorithms for analyzing the healthcare, human resource, hospitality and tourism data.
- To make choices for a model for new machine learning tasks..
- To identify employees with high attrition risk.
- To prioritizing various talent management initiatives for your organization.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand and critically apply the concepts and methods of business analytics.	K4
CO2	Identify, model and solve decision problems in different settings.	K1
CO3	Label appropriate courses of action for a given managerial situation whether a problem or an opportunity.	K2
CO4	Create viable solutions to decision making problems.	K4
CO5	Determine a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	K3

UNIT I   **18Hours**

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.

UNIT II   **18Hours**
Healthcare Analytics Applications : Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Health

care Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

UNIT III   **18 Hours**

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.

UNITIV   **18Hours**

Performance Analysis: Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions..

UNITV   **18Hours**

Tourism and Hospitality Analytics: Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Chandan K. Reddy and Charu C Aggarwal,	Healthcare data analytics	Taylor & Francis	2015
2.	Edwards Martin R, Edwards Kirsten	Predictive HR Analytics: Mastering the HR Metric	Kogan Page Publishers ISBN-0749473924	2016
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	2010
ReferenceBooks				
1.	Hui Yang and Eva K. Lee	Healthcare Analytics: From Data to Knowledge to Healt	Wiley	2016
2.	Fitz-enzJac, Mattox II John	Predictive Analytics for Human Resources	Wiley, ISBN1118940709	2014

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

SEMESTER –V

DISCIPLINE SPECIFIC ELECTIVE - II	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE7	**SOFTWARE PROJECT MANAGEMENT**	**Contact Hours per week : 5**

Objectives

- To define and highlight importance of software project management.
- To formulate and define the software management metrics & strategy in managing projects.
- To familiarize in Software Project planning.
- To learn about Markov Decision Process.
- To understand to apply software testing techniques in commercial environment

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the principles and concepts of project management	K2
CO2	Develop knowledge gained to train software project managers	K1
CO3	Apply software project management methodologies.	K3
CO4	Support to create comprehensive project plans	K4
CO5	Evaluate and mitigate risks associated with software development process.	K4

UNIT I   **15Hours**

Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.

UNIT II   **15Hours**

Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones -

Work Packages - Building a WBS for Software.

UNIT III   **15 Hours**

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.

 UNITIV   **15Hou**rs

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.

UNITV   **15Hours**

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.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Robert T. Futrell, Donald F. Shafer, Linda I. Safer	Quality Software Project Management	Pearson Education Asia	2002
ReferenceBooks				
1.	PankajJalote	Software Project Management in Practice	Addison Wesley	2002
2.	Hughes	Software Project Management	Tata McGraw Hill	2004, 3rd Edition

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - II	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE8	IMAGE PROCESSING	Contact Hours per week : 5

Objectives

- To learn fundamentals of digital image processing
- To learn about various 2D Image transformations.
- To learn about various image enhancement processing methods and filters
- To learn about various classification of Image segmentation techniques
- To learn about various image compression techniques

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental concepts of digital image processing	K4
CO2	Discuss various 2D Image transformations	K2
CO3	Remember image enhancement processing techniques and filters.	K1
CO4	Explain the classification of Image segmentation techniques	K4
CO5	Use various image compression techniques	K3

UNIT I   15Hours

Digital Image Fundamentals: Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis.

UNIT II   15Hours

2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform Karhunen - Loeve Transform -Singular Value Decomposition.

UNIT III   15 Hours

Image Enhancement: Spatial domain methods- Point processing Intensity transformations - Histogram processing- Spatial filtering smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphism filter.

UNITIV **15Hours**

Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour..

UNITV **15Hours**

Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic codingDictionary based compression –Transform based compression.

TextBooks				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	S Jayaraman, S Esakkirajan, T Veerakumar	Digital image processing	Tata McGraw Hill	2016
2.	Gonzalez Rafel C,	Digital Image Processing	Pearson Education	2009
ReferenceBooks				
1.	Jain Anil,	Fundamentals of digital image processing	PHI	1988
2.	Kenneth R Castleman	Digital image processing	Pearson Education	2003, 2rd Edition
3.	Pratt William K	Digital Image Processing	John Wiley	2007

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

SEMESTER –VI

Core Course - VII	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Coursecode: M23UAD07	ROBOTIC PROCESS AUTOMATION	Contact Hours per week : 6

Objectives

- To get a knowledge in dissecting the myths from the facts and realize the true benefits of RPA
- To create Acquire knowledge of fundamental UI automation concept.
- To gain ability to create and debug workflows using UiPath.
- To implement Master installation of UiPath Studio on Windows.
- To gain ability to implement error exception handling..

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand business functionalities in Robotics Process Automation	K2
CO2	Apply RPA functions across the Organizations to boost revenues.	K3
CO3	Demonstrate the basics of robotic process automation using UI Path.	K1
CO4	Analyze RPA solutions to ensure lasting results.	K4
CO5	Develop software to solve real-world problems using UI PATH.	K1

UNIT I 18Hours

Robotic Process Automation (RPA): Fundamentals of RPA – Programming basics from RPA perspective – Applying RPA – RPA development methodology – Architecture of RPA – RPA and emerging ecosystem.

UNIT II 18Hours

Basics of RPA - RPA Benefits - Processes that can be automated – Types of Robots. Automation and RPA Concepts: Business models for implementing RPA – Centre of Excellence - Types and their applications – Building an RPA team - Approach for implementing RPA initiatives.

UNIT III 18 Hours
Automation stages and the role of a Business Manager - Guidelines for

tracking the implementation success – Metrics /Parameters to be considered for gauging success- Choosing the right licensing option.

UNITIV   18Hours

Introduction - Automation debugging – Automation library – Activities Packages – Basic automation tasks - Text and image automation. Setting up the UiPath environment -– Introduction to UiPath - The User Interface - Keyboard Shortcuts.

UNITV   18Hours

Tables in RPA - Data Manipulation in excel - Extracting Data from PDF – Using anchors in PDF.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison Prescott.	Robotic Process Automation using UiPath StudioX: A Citizen Developer‟s Guide to Hyperautomation	Paperback	June 2021
2.	Alok Mani Tripathi	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool	UiPath Paperback	March 2018

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

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Core Course - VIII	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Coursecode: M23UAD08	NATURAL LANGUAGE PROCESSING	Contact Hours per week :5

Objectives

- To introduce the fundamental concept sand techniques of natural language processing (NLP).
- To develop speech-based applications that use speech analysis (phonetics, speech recognition, and syn.
- To analyze the syntax, semantics, and pragmatics of a statement written in a natural language.
- To develop a conversational agent that uses natural language understanding and generation.
- To evaluate the performance of NLP tools and systems.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Remember the fundamental concepts and techniques of natural language processing (NLP).	K1
CO2	Understand the models and algorithm sin the field of NLP.	K2
CO3	Demonstrate the computational properties of natural languages and the commonly used Algorithms.	K3
CO4	Simplify semantics and pragmatics of languages for processing.	K4
CO5	Develop NLP Application.	K4

UNIT I   15Hours

Introduction : Application of NLP technique sand 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.

UNIT II   15Hours

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.

UNIT III   15 Hours
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 parsing grammar formalisms and tree banks-efficient parsing for context free grammars (CFGs)-statistical Parsing and probabilistic CFGs(PCFGs)-lexicalized PCFG se...

UNITIV   15Hours
   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 semantic role labeling and semantic parsing**.**

UNITV   15Hours
Pragmatic level: knowledge representation-reasoning-plan/goalrecognition–speechacts/intentions – belief models- discourse- reference. **Natural language generation**: content determination – sentence planning- surface realization, subjectivity and sentiment analysis.

TextBooks

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Daniel Jurafsky, James H. Martin	Speech & language processing	Pearson publications	2010
2.	Allen, James.	Natural language understanding	Pearson	1995

ReferenceBook

	Pierre M. Nugues	An Introduction to Language Processing with Perl and Prolog	Springer	2009
1.				

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

SEMESTER –VI

Core Practical - V I	B.Sc.ComputerScience with (AI & DS)	Credits : 4
Coursecode: M23UADP06	Practical – VI PROGRAMMING IN UI PATH AUTOMATION LAB	Contact Hours per week : 5

Objectives

- To get a knowledge in dissecting the myths from the facts and realize the true benefits of RPA.
- To create Acquire knowledge of fundamental UI automation concepts.
- To gain ability to create and debug workflows using UiPath.
- To implement Master installation of UiPath Studio on Windows.
- To gain ability to implement error exception handling

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand business functionalities in Robotics Process Automation	
CO2	Apply RPA functions across the Organizations to boost revenues.	
CO3	Demonstrate the basics of robotic process automation using UI Path.	K3 & K4
CO4	Analyze RPA solutions to ensure lasting results.	
CO5	Develop software to solve real-world problems using UI PATH.	

List of Exercises

1. Robotic Process Automation – Introduction, Working.

2. UiPath – Basics, Installation and Understanding User Interface Components.

3. Keyboard Shortcuts & Customization.

4. Visual workflow automation straightforward and intuitive

5. UiPath is providing automated workflow design, Which can be used without programming knowledge.

6. Recording are important functionality of UiPath studio, enables us to capture user"s action on the screen and translate them into sequences

7. Excel Automation.

8. Email Automation

DISCIPLINE SPECIFIC ELECTIVE - III	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE9	AGILE PROJECT MANAGEMENT	Contact Hours per week : 4

Objectives

- To learn software design, software technologies and APIs.
- To detailed demonstration about Agile development and testing techniques.
- To learn about various Algorithms in Data Science.
- To learn about Hadoop Framework.
- To learn about case study about Data Science.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand of software design, software technologies and APIs using Agile Management.	K1
CO2	Give example of Agile development and testing techniques.	K2
CO3	Generate Agile Planning and Execution using Sprint.	K4
CO4	Analyze Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check	K4
CO5	Classify Agile development and testing techniques.	K3

UNIT I   12Hours

Introduction: Modernizing Project Management: Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better**: Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile**.**

UNIT II   12Hours

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

UNIT III   **12 Hours**

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.

UNITIV   **12Hours**

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 different about Agile risk management –
Managing Agile risk.

UNITV   **12Hours**

     Implementing Agile Building a Foundation: Organizational and
individual commitment – Choosing the right pilot team members – Creating
and environment that enables Agility – Support Agility initially and over time.
Being a Change Agent: Becoming Agile requires change – why change
doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding
pitfalls – Signs your changes are slipping**. Benefits, Factors for Success
and Metrics:** Ten key benefits of Agile project management – Ten key factors
for project success – Ten metrics for Agile Organizations.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Mark C. Layton, Steven J. Ostermiller,	Agile Project Management for Dummies	Wiley India Pvt. Ltd.,	2nd Edition, 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	Wiley India Pvt. Ltd.	2nd Edition 2018
2.	Mike Cohn, 2010.	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, , Shroff/,.	Learning Agile: Understanding Scrum, XP, Lean, and Kanban	O'Reilly Media	First Edition, 2014

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - III	B.Sc.ComputerScience with (AI & DS)	Credits :3
Coursecode: M23UADDSE10	Big Data Analytics	Contact Hours per week :4

Objectives

- To understand the Big Data Platform and its Use cases, Map Reduce Jobs.
- To identify and understand the basics of cluster and decision tree.
- To study about the Association Rules, Recommendation System.
- To learn about the concept of stream.
- To understand the concepts of NoSQL Databases.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline with big data tools and its analysis techniques	K1
CO2	Create data by utilizing clustering and classification algorithms.	K4
CO3	Use different mining algorithms and recommendation systems for large volumes of data.	K2
CO4	Perform analytics on data streams.	K3
CO5	Build NoSQL databases and management.	K4

UNIT I   **12Hours**

Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — 12 The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model.

UNIT II   **12Hours**

Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- **Classification:** Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier.

UNIT III   **12 Hours**

Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — **Recommendation System:** Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNITIV   **12Hours**

Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

UNITV   **12Hours**

NoSQL Databases : **Schema-less Models** : Increasing Flexibility for Data Manipulation-Key Value Stores12 Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for ECommerce Big data for blogs — Review of Basic Data Analytic Methods using R.

TextBook

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	AnandRajaraman and Jeffrey David Ullman	Mining of Massive Datasets	Cambridge University Press	2012

ReferenceBooks

	Author	TitleoftheBook	Publisher	YearofPublications
1.	David Loshin	Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph	Morgan Kaufmann/Elsevier Publishers	2013
2.	EMC Education Services	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data	Wiley publishers	2015

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UAD11	Cloud Computing	Contact Hours per week :4

Objectives

- To learning fundamental concepts and Technologies of Cloud Computing.
- To learning various cloud service types and their uses and pitfalls.
- To learn about Cloud Architecture and Application design.
- To know the various aspects of application design, benchmarking and security on the Cloud.
- To learn the various Case Studies in Cloud Computing.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental concepts and Technologies in Cloud Computing	K2
CO2	Develop various cloud service types and their uses and pitfalls	K1
CO3	Apply Cloud Architecture and Application design	K3
CO4	Justify the various aspects of application design, benchmarking and security in the Cloud	K1
CO5	Perform the Case Studies in Cloud Computing.	K4

UNIT I   12Hours

Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. **Cloud Concepts and Technologies:** Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.

UNIT II   12Hours

Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - **Windows Azure Virtual Machines Storage Services**: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage **Database Services**: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure

12 SQL Database - **Windows Azure Table Service Application Services**: Application Runtimes and Frameworks - Queuing Services - Email Services –

Notifiction Services - Media Services Content Delivery Services: Amazon CloudFront - **Windows Azure Content Delivery Network Analytics Services:** Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - **Windows Azure HDInsight Deployment and Management Services**: Amazon Elastic Beanstack - Amazon Cloud Formation Identity and Access Management Services: Amazon Identiy and Access Management - **Windows Azure Active Directory Open Source Private Cloud Software:** CloudStack – Eucalyptus – OpenStack

UNIT III   **12 Hours**

Cloud Application Design: Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Up gradation – Performance – Reference Architectures for Cloud Applications – **Cloud Application Design Methodologies**: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – **Data Storage Approaches:** Relational Approach (SQL), Non Relational Approach (NoSQL).

UNITIV   **12Hours**

Cloud Application Benchmarking and Tuning: Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – **Data Security** : Securing data atrest, securing data in motion – Key Management – Auditing

UNITV   **12Hours**

Case Studies: Cloud Computing for Healthcare – Cloud Computing for 12 Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.

TextBook				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Arshdeep Bahga, Vijay Madisetti	Cloud Computing – A Hands On Approach	Universities Press (India) Pvt. Ltd	2018
ReferenceBooks				
1.	Anthony T Velte, Toby J Velte,	Cloud Computing: A Practical Approach	Tata McGraw-Hill,	2013

	Robert Elsenpeter			
2.	Barrie Sosinsky	Cloud Computing Bible	Wiley India Pvt. Ltd.,	2013
3.	David Crookes	Cloud Computing in Easy Steps	Tata McGraw Hill	2015

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - III	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE12	Human Computer Interaction	Contact Hours per week : 4

Objectives

- To learn about the foundations of Human Computer Interaction..
- To learn the design and software process technologies.
- To learn HCI models and theories.
- To learn Mobile Ecosystem.
- To learn the various types of Web Interface Design.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamentals of HCI.	K2
CO2	Develop interactive design in HCI.	K1
CO3	Apply HCI models and theories.	K3
CO4	Relate Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	K2
CO5	Determine the various types of Web Interface Design.	K4

UNIT I   12 Hours

FOUNDATIONS OF HCI: The Human: I/O channels – Memory Reasoning and problem solving; The Computer: Devices –Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles –elements – interactivity- Paradigms. - Case Studies.

UNIT II   12Hours

DESIGN & SOFTWARE PROCESS: Interactive Design: Basics – process – **scenarios Navigation**: screen design Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III   12 Hours

MODELS AND THEORIES: **HCI Models: Cognitive models**:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.

UNITIV   12Hours

Mobile HCI: Mobile Ecosystem: Platforms, Application frameworks Types **of Mobile Applications**: Widgets, Applications, Games Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. -

Case Studies

WEB INTERFACE DESIGN: Designing Web Interfaces – Drag & Drop, Direct
Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow
- Case Studies.

TextBooks				
S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale,	Human -Computer Interaction	Edition, Pearson Education,	2004
2.	Brian Fling	Mobile Design and Development	O - Reilly Media Inc	I Edition, 2009
3.	Bill Scott and Theresa Neil,	Designing Web Interfaces	O_Reilly	First Edition 2009
ReferenceBook				
1.	Shneiderman	Designing the User Interface: Strategies for Effective Human-Computer Interaction	Pearson Education	V Edition

MappingwithProgramme Specific Outcomes:

CO's/ PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - III	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE13	Robotics and its Applications	Contact Hours per week : 4

Objectives
- To understand the robotics fundamentals.
- To understand the sensors and matrix methods.
- To understand the Localization: Self-localizations and mapping.
- To study about the concept of Path Planning, Vision system.
- To learn about the concept of robot artificial intelligence.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the different physical forms of robot architectures.	K2
CO2	Design Kinematically model simple manipulator and mobile robots.	K1
CO3	Apply a kinematic robot system.	K3
CO4	Associate manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	K4
CO5	Select robotics algorithms related to kinematics, control, optimization, and uncertainty.	K2

UNIT I   12Hours
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.

UNIT II   12Hours
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 12 tachometers-strain gauge based force torque sensor proximity and distance measuring sensors **Kinematics of robots:** Representation of joints and frames, frames transformation, homogeneous matrix, DH matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). **Mobile robot Kinematics**: Differential wheel mobile robot.

UNIT III   **12 Hours**
Localization: Self-localizations and mapping - Challenges in localizations –
IR based localizations – vision based localizations – Ultrasonic based
localizations - GPS localization systems.

UNITIV   **12Hours**

Path Planning: Introduction, path planning-overview road map path
planning-cell decomposition path planning potential field path planning-
obstacle avoidance-**case studies Vision system**: Robotic vision systems-
image representation-object recognition-and categorization depth
measurement- image data compression-visual inspection-software
considerations.

UNITV   **12Hours**

Application: Ariel robots-collision avoidance robots for agriculture-mining-
exploration-underwater-civilian- and military applications-nuclear
applications-space Applications-Industrial robots-artificial intelligence in
robots-application of robots in material handling continuous arc welding-
spot welding-spray painting assembly operation-cleaning-etc.

TextBooks				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
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	WileyIndia	2 nd edition 2011
ReferenceBooks				
1.	M.P.Groover	Industrial robotic technology-programming and applicatio	Mc Grawhil	2008
2.	S.R.Deb	Robotics technology and flexible automation	THH	2009

MappingwithProgramme Specific Outcomes:

CO's/P SO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE14	IOT and its Applications	Contact Hours per week : 4

Objectives

- To use Devices, Gateways and Data Management in IoT.
- To design IoT applications in different domain and be able to analyze their performance.
- To implement basic IoT applications on embedded platform.
- To gain knowledge on Industry Internet of Things.
- To learn about the privacy and Security issues in IoT.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Give Example of big data tools and its analysis techniques	K2
CO2	Analyze data by utilizing clustering and classification algorithms.	K4
CO3	Apply different mining algorithms and recommendation systems for large volumes of data.	K3
CO4	Perform analytics on data streams.	K1
CO5	Choose NoSQL databases and management	K2

UNIT I   12Hours

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT II   12Hours

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural 12 Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III   12 Hours

IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNITIV   12Hours

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management.

UNITV   12Hours

Internet of Things Privacy: Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities, Security.

TextBook				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	Vijay Madisetti and ArshdeepBahga, ― Universities Press (INDIA) Private Limited 2014,	Internet of Things: (A Hands-on Approach)	Universities Press (India) Pvt. Ltd	2014 1st Edition.
ReferenceBooks				
1.	Michael Miller	The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World	kindle version	2010
2.	Francis daCosta,	Internet of Things: A Scalable Approach to Connecting Everything	Apress Publications	1st Edition 2013
3.	Waltenegus Dargie, Christian Poellabauer	Fundamentals of Wireless Sensor Networks: Theory and Practice	Tata McGraw Hill	2011
4.	CunoPfister	Getting Started with the Internet of Things	O‟Reilly Media	2011

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE15	Artificial Neural Networks	Contact Hours per week : 4

Objectives

- To understand the Error Correction and various learning algorithms and tasks.
- To identify the various Single Layer Perception Learning Algorithm.
- To identify the various Multi-Layer Perception Network.
- To analyze the Deep Learning of various Neural network and its Applications.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the basics of artificial neural networks with single layer and multi-layer perception networks.	K1
CO2	Apply Error Correction and various learning algorithms and tasks.	K4
CO3	Present Perception Learning Algorithm.	K3
CO4	Understand the various Multi-Layer Perception Network.	K2
CO5	Select Deep Learning of various Neural network and its Applications.	K1

UNIT I   **12Hours**

Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Nonlinear Separable Problem - Multilayer Networks. Learning Algorithms Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.

UNIT II   **12Hours**

Introduction: Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit 12 assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation**.**

UNIT III   **12 Hours**
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.

UNITIV   **12Hou**rs

Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm.

UNITV   **12Hours**
Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications.

TextBooks				
S.No	**Author**	**TitleoftheBook**	**Publisher**	**YearofPublications**
1.	Satish Kumar	Neural Networks A Classroom Approach	McGraw Hill	Second Edition
2.	Simon Haykins	Neural Network- A Comprehensive Foundation	Pearson Prentice Hall	2nd Edition, 1999
ReferenceBook				
1.	B. Yegnanarayana	Artificial Neural Networks	PHI, New Delhi	1998

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong M-Medium

DISCIPLINE SPECIFIC ELECTIVE - IV	B.Sc.ComputerScience with (AI & DS)	Credits : 3
Coursecode: M23UADDSE16	Virtual Reality	Contact Hours per week : 4

Objectives

- To provide knowledge on basic principles of virtual & augmented reality.
- To have the ability to use its technology as a platform for real-world applications.

CourseOutcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the basic terminologies, techniques and applications of VR and AR	K1
CO2	Describe different architectures and principles of VR and AR systems	K2
CO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications	K3
CO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition.	K4
CO5	Develop the importance of VR/AR content and interactions to implement for the real-world problem	K1

UNIT I   12Hours

Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces

UNIT II   12Hours

Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR

UNIT III   12 Hours

Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience

UNITIV   **12Hours**

Augmented Reality Hardware – Augmented Reality Software– Software to create content for AR Application – Tools and Technologies.

UNITV   **12Hours**

Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality.

TextBooks

S.No	Author	TitleoftheBook	Publisher	YearofPublications
1.	Grigore C. Burdea and Philippe Coiffet,	Virtual Reality Technology	Wiley	Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)
2.	Alan B. Craig	Understanding Augmented Reality Concepts and Applications	-	(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)
3.	Jon Peddie	Augmented Reality: Where We Will All Live	Springer,	Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)

ReferenceBooks

S.No	Author	Title	Publisher	Year
1.	Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann,	Developing Virtual Reality Applications: Foundations of Effective Design	Elsevier(Morgan Kaufmann Publishers	2009
2.	Paul Mealy	Virtual and Augmented Reality	Wiley	2018
3.	Bruno Arnaldi & Pascal Guitton & Guillaume Moreau	Virtual Reality and Augmented Reality: Myths and Realities	Wiley	2018

MappingwithProgramme Specific Outcomes:

CO's/PSO's	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S - Strong M - Medium