B. Sc. Artificial Intelligence and Machine Learning

Syllabus

AFFILIATEDCOLLEGES

Program Code:*

2021–2024 Batch

BHARATHIARUNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,Ranked13th amongIndianUniversitiesby MHRD-NIRF,

WorldRanking:Times-801-1000,Shanghai-901-1000,URAP-982)

Coimbatore-641046,TamilNadu, India

ProgrammeEducationalObjectives(PEOs)	
TheB.Sc.ArtificialIntelligenceandMachineLearningprogramdescribeaccomplishmentsthatgraduates areexpected toattain within fiveto sevenyears aftergraduation	
PEO1	ExpertizedwiththeprinciplesofArtificialIntelligenceandproblemsolving,inference,perception,knowledgerepresentation, and learning
PEO2	ExhibithighstandardswithregardtoapplicationofAItechniquesinintelligentagents,expertsystems, artificial neuralnetworks and other machinelearningmodels
PEO3	Investigatewithamachinelearningmodelforsimulationandanalysisandexplorethescope,potential,limitations, andimplications of intelligentsystems.

ProgrammeSpecificOutcomes(PSOs)	
After the successful completion ofB.Sc. Artificial Intelligence and MachineLearningprogramthestudents areexpected to	
PSO1	ExhibitgooddomainknowledgeandcompletestheassignedresponsibilitieseffectivelyandefficientlyinparwiththeexpectedqualitystandardsforArtificial IntelligenceandMachineLearningprofessional
PSO2	Applythetechnicalandcriticalthinkingskillsinthedisciplineofartificial intelligence andmachine learningtofindsolutionsforcomplexproblems.
PSO3	Designanddevelopresearch-basedsolutionsforcomplexproblemsinartificialintelligenceandmachinelearningindustrythroughappropriateconsiderationforthe publichealth,safety, cultural,societal,andenvironmentalconcerns.
PSO4	EstablishtheabilitytoListen,read,proficientlycommunicateandarticulatecomplex ideaswithrespecttotheneedsand abilitiesofdiverseaudiences.
PSO5	Provideinnovativeideastoinstigate newbusiness ventures inthehospitalityindustry

ProgrammeOutcomes(POs)	
Onsuccessfulcompletion oftheB.Sc.ArtificialIntelligenceandMachineLearning	
PO1	Exhibitgood**domainknowledge**andcompletestheassignedresponsibilities effectivelyand efficientlyinpar with the expectedqualitystandards.
PO2	Apply**analyticalandcriticalthinking**toidentify,formulate,analyze,andsolve complex problemsinordertoreachauthenticated conclusions
PO3	**Designanddevelopresearchbasedsolutions**forcomplexproblemswithspecifiedneedsthr oughappropriateconsiderationforthepublichealth,safety,cultural,societal, andenvironmentalconcerns.
PO4	Establishtheabilityto**Listen,read,proficientlycommunicateandarticulate complexideas** withrespecttotheneedsandabilitiesofdiverse audiences.
PO5	**Deliverinnovativeideastoinstigatenewbusinessventures**andpossessthe qualitiesofagood entrepreneur
PO6	Acquirethequalities ofa **goodleaderandengagein efficientdecisionmaking.**
PO7	Graduateswillbeabletoundertakeanyresponsibilityasan**individual/memberof multidisciplinaryteamsandhaveanunderstandingofteamleadership**
PO8	Functionass**ociallyresponsibleindividual**withethicalvaluesandaccountableto ethicallyvalidateanyactionsordecisionsbeforeproceedingandactivelycontributetothesoci etal concerns.
PO9	Identify and **address own educational needs i**n a changing world in ways sufficient tomaintainthecompetenceandtoallowthemtocontributeto theadvancementof knowledge
PO10	**Demonstrateknowledgeandunderstandingofmanagementprinciplesa**ndapply thesetoone ownwork tomanageprojects andinmultidisciplinaryenvironment.

BHARATHIARUNIVERSITY::COIMBATORE641046

B.Sc.ArtificialIntelligenceandMachineLearning(CBCSPATTERN)

(*Forthestudentsadmittedfromtheacademicyear**2021-2022**andonwards*)

SchemeofExamination

Part	TitleoftheCourse	Hours/ Week	Examination				Credits
			Duration inHours	MaximumMarks			
				CIA	CEE	Total	
	SemesterI						
I	Language-I	6	3	50	50	100	4
II	English-I	6	3	50	50	100	4
III	Core1:ObjectOriented ProgramminginC++	4	3	50	50	100	4
III	Core2:DataStructures	4	3	50	50	100	4
III	CoreLab1: ProgrammingLab– C++	3	3	50	50	100	4
III	Allied1:DiscreteMathematics	5	3	50	50	100	4
IV	EnvironmentalStudies*	2	3	-	50	50	2
	Total	**30**		**300**	**350**	**650**	**26**
	SemesterII						
I	Language–II	6	3	50	50	100	4
II	English–II	6	3	50	50	100	4
III	Core3:JavaProgramming	5	3	50	50	100	4
III	CoreLab2:ProgrammingLab -Java	4	3	50	50	100	4
III	CoreLab3:InternetBasicsLab	2	3	25	25	50	2
III	Allied2:AppliedMathematics	5	3	50	50	100	4
IV	ValueEducation– HumanRights*	2	3	-	50	50	2
	Total	**30**		**275**	**325**	**600**	**24**
	SemesterIII						
III	Core4:Programmingin Python	6	3	50	50	100	4
III	Core5: FuzzylogicandNeuralNetworks	6	3	50	50	100	4
III	CoreLab4:PythonProgrammingLab	5	3	50	50	100	4
III	Allied3:DesignandAnalysisofAlgorithms	6	3	50	50	100	4
III	SkillbasedSubject1:InternetofThings	5	3	30	45	75	3
IV	Tamil**/ AdvancedTamil*(OR)Non-majorelective-I(YogaforHumanExcellence)*/ Women's Rights*	2	3	-	50	50	2
	Total	**30**		**230**	**295**	**525**	**21**
	SemesterIV						
III	Core6:ArtificialIntelligence&KnowledgeRepresentation	6	3	50	50	100	4
III	Core7:RProgramming	6	3	50	50	100	4
III	CoreLab 5:RProgrammingLab	3	3	25	25	50	2
	Naan Muthalvan- Skill Course Office Fundamentals - Lab http://kb.naanmudhalvan.in/Bharathiar_University_(BU)	3		25	25	50	2
III	Allied4:MachineLearning -Basics	6	3	50	50	100	4
III	SkillbasedSubject2Lab:CapstoneProject Work(Based on AI&Machine Learning)	4	3	30	45	75	3
IV	Tamil**/Advanced Tamil* (OR) Non-majorelective-II(GeneralAwareness*)	2	3	-	50	100	2
	Total	**30**		**230**	**295**	**525**	**21**

	SemesterV						
III	Core8: MachineLearningTechniques	6	3	50	50	100	4
III	Core9: DeepLearning	6	3	50	50	100	4
III	CoreLab6:Machine LearningLab	6	3	50	50	100	4
III	Elective-IBusiness DataAnalytics/Social NetworkAnalysis/SoftwareAgents	6	3	50	50	100	4
III	SkillbasedSubject 3:EthicalHacking	6	3	30	45	75	3
	Total	**30**		**230**	**245**	**475**	**19**
	SemesterVI						
III	Core10:NaturalLanguageProcessing	6	3	50	50	100	4
III	CorePaperXIProject WorkLab%%	4	-	60	90	150	6
III	Core Practical –VII :Natural LanguageProcessingLab	5	3	50	50	100	4
III	Elective – II : Artificial Neural NetworksandFuzzySystems/WebApplication Security/FundamentalsofRobotics	5	3	50	50	100	4
III	Elective–III:Embedded Systems /PrinciplesofSecureCoding/ Open SourceSoftware	5	3	50	50	100	4
III	SkillBasedSubject4CapstoneProject Work Phase II (Based on AI & MachineLearning)	3	3	30	45	75	3
	Naan Muthalvan- Skill Course Cyber Security @ http://kb.naanmudhalvan.in/images/7/71/Cybersecurity.pdf (or) Machine Learning # http://kb.naanmudhalvan.in/images/1/19/PBL_Google.pdf (or) Android APP Development $ http://kb.naanmudhalvan.in/images/0/08/Android_App_Dev.pdf	2		25	25	50	2
V	ExtensionActivities**		-	50	-	50	2
	Total	**30**		**365**	**360**	**725**	**29**
	GrandTotal	**180**		**1630**	**1870**	**3500**	**140**

- *NoContinuousInternalAssessment(CIA).OnlyUniversityExaminations.
- **NoUniversityExaminations. OnlyContinuousInternalAssessment(CIA).

- # Govt – Non-Autonomous Colleges, $ Aided – Non-Autonomous Colleges, @ Self - Financing **(**Non – Autonomous).
- NaanMudhalvan – skill courses- external 25 marks will be assessed by Industry and internal will be offered by respective course teacher.


First
Semester

CourseCode		ObjectOriented ProgramminginC++	L	T	P	C
Core/elective/Supportive		Core:1	4	0	0	4
Pre- requisite		• BasicknowledgeofProcedureOriented Programmingconcepts • BasicknowledgeinCProgramming	Syllabus version		2021-22 Onward	

CourseObjectives		
TointroduceheconceptsofObjectOrientedProgrammingParadigmandtheprogrammingconstructs ofC++		
ExpectedCourseOutcomes		
1	Describetheproceduralandobjectorientedparadigmwithconceptsofstreams, classes,functions,data andobjects	K1
2	Demonstratethe various basic programming constructs like decision making statements. Loopingstatementsandfunctions	K2
3	Explainthe objectorientedconceptslikeoverloading,inheritance,polymorphism, virtualfunctions,constructorsanddestructors	K3
4	Explainthevariousfilestreamclasses;filetypes,usageoftemplatesandexception handlingmechanisms.	K3
5	Comparetheprosandconsofprocedureorientedlanguagewiththeconceptsofobject orientedlanguage	K5
6	Developprogramsincorporatingtheprogrammingconstructsofobjectoriented programmingconcepts	K5
K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create		

UNIT –I	INTRODUCTION	12 Hours
IntroductiontoC++-keyconceptsofObject-OrientedProgramming–Advantages– ObjectOrientedLanguages–I/O inC++- C++Declarations. ControlStructures:- DecisionMakingandStatements:If ...else,jump,goto,break,continue,Switchcasestatements-LoopsinC++:for,while,do-functionsinC++- inline functions– Function Overloading.		
UNITII	**CLASSESANDOBJECTS**	**12 Hours**
ClassesandObjects:DeclaringObjects–DefiningMemberFunctions–StaticMembervariablesandfunctions– arrayofobjects–friendfunctions–Overloadingmemberfunctions–Bitfieldsandclasses –Constructoranddestructorwithstaticmembers.		
UNIT-III	**OPERATOROVERLOADING**	**12 Hours**
Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – typeconversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid,Multipath inheritance –Virtual baseClasses–Abstract Classes.		

UNIT-IV	POINTERS	12 Hours
Pointers–Declaration–PointertoClass,Object–thispointer–PointerstoderivedclassesandBaseclasses–Arrays–Characteristics–arrayofclasses–Memorymodels–newanddeleteoperators–dynamicobject –Binding,PolymorphismandVirtualFunctions.		
UNIT-V	**FILESTREAMCLASSES**	**12 Hours**
Files–Filestreamclasses–file modes–SequentialRead/Writeoperations–BinaryandASCIIFiles –RandomAccessOperation–Templates–ExceptionHandling-String–DeclaringandInitializingstringobjects– StringAttributes– Miscellaneousfunctions.		
	TotalLectureHours	**60 Hours**
TextBook(s)		
1	AshokNKamthane,Object-OrientedProgrammingwithAnsiandTurbo C++,Pearson Education,2003.	
REFERENCEBOOKS:		
1	E.Balagurusamy,Object-OrientedProgrammingwithC++,TMH,1998	
2	MariaLitvin&GrayLitvin,C++foryou,Vikaspublication,2002.	
3	JohnRHubbard, ProgrammingwithC, 2ndEdition,TMH publication,2002.	
4		
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L
CO5	S	M	L	L	L	L	L	L	L	L
CO6	S	M	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		Programmingin LabC++	L	T	P	C
Core/elective/Supportive		CoreLab :1	-	-	3	4
Pre- requisite		• BasicknowledgeofProcedureOrientedProgrammingconcepts • BasicknowledgeinCProgramming	Syllabus version		2021-22 Onward	

CourseObjectives

- TointroduceheconceptsofObject-OrientedProgrammingParadigmandtheprogrammingconstructsofC++

ExpectedCourseOutcomes

1	Applythevariousbasicprogrammingconstructs likedecisionmakingstatements. Loopingstatements,functions,conceptslikeoverloading,inheritance,polymorphism,virtualfunctions , constructors and destructors	K3
2	IllustratetheconceptofVirtualClasses,inlinefunctionsandfriendfunctions	K4
3	Comparethevariousfilestreamclasses;filetypes,usageoftemplatesandexception handlingmechanisms.	K5
4	Comparetheprosandconsofprocedureorientedlanguagewiththeconceptsofobject orientedlanguage	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

PROGRAM-1		**3**

Write a C++ Program to create a class to implement the data structure STACK. Write a constructor toinitialize the TOP of the STACK. Write a member function PUSH () to insert an element and memberfunctionPOP ()to delete an element check for overflowandunderflowconditions.

PROGRAM-2		**3**

Write a C++ Program to create a class ARITHMETIC which consists of a FLOAT and an INTEGERvariable. Write member functions ADD (), SUB (), MUL (), DIV () to perform addition, subtraction,multiplication,division respectively. Writeamember functiontoget and displayvalues.

PROGRAM-3		**3**

WriteaC++Programtoreadanintegernumberandfindthesumofallthedigitsuntilitreducestoa singledigitusingconstructors,destructorsandinlinememberfunctions.

PROGRAM-4		**3**

WriteaC++ProgramtocreateaclassFLOATthatcontainsonefloatdata member.OverloadallthefourArithmetic operatorsso that theyoperate on theobject FLOAT.

PROGRAM-5		**3**

Write a C++ Programtocreate a classSTRING. Write a Member Functiontoinitialize,getanddisplay stings. Overloadthe operators ++and == to concatenate two Strings and to compare twostringsrespectively.

PROGRAM-6		**4**
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. Derive a classPAYfromtheaboveclassandwriteamemberfunctiontocalculateDA,HRAandPFdependingon thegrade.		
PROGRAM-7		**5**
WriteaC++ProgramtocreateaclassSHAPEwhichconsistsoftwoVIRTUALFUNCTIONSCalculate_Area( )andCalculate_Perimeter()tocalculateareaandperimeterofvariousfigures.Derive threeclassesSQUARE,RECTANGLE,TRIANGEfromclassShapeandCalculateAreaandPerimeterofeach class separatelyand displaytheresult.		
PROGRAM-8		**3**
Write a C++ Program to create two classes each class consists of two private variables, a integer and afloat variable. Write member functions to get and display them. Write a FRIEND Function common tobothclasses,whichtakestheobjectofabovetwo classesasargumentsandtheintegerandfloatvalues ofboth objects separatelyand displaytheresult.		
PROGRAM-9		**3**
WriteaC++ProgramusingFunctionOverloadingtoreadtwoMatricesofdifferentDataTypessuch asintegersandfloatingpointnumbers.Findoutthesumoftheabovetwomatricesseparatelyanddisplaythe sum of thesearrays individually.		
PROGRAM-10		**5**
WriteaC++Programtocheckwhetherthe givenstringis apalindromeor notusingPointers.		
PROGRAM-11		**5**
WriteaC++Programtocreatea Fileand todisplaythecontentsof that filewith line numbers.		
PROGRAM-12		**5**
WriteaC++Programtomergetwofilesintoasingle file.		
	TotalHours	**45 Hours**

TextBook(s)	
1	AshokNKamthane,Object-OrientedProgrammingwithAnsiandTurbo C++,Pearson Education,2003.
ReferenceBook(s)	
1	E.Balagurusamy,Object-OrientedProgrammingwithC++,TMH,1998

CourseDesignedby :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		DataStructures	L	T	P	C
Core/elective/Supportive		Core:2	4	0	-	4
Pre- requisite		• Basic knowledge of ProgrammingConstructs	Syllabus version		2021-22 Onward	

CourseObjectives

- Tointroducetheconceptofdatastructuresandthe typesofdatastructures
- Todemonstratehowvariousdatastructurescanbeimplementedandusedin variousapplications

ExpectedCourseOutcomes

1	DefinetheconceptofDatastructureandlistthevariousclassificationsofdata structures.	K1
2	Demonstratehowarrays,stacks,queues,linkedlists,trees,heaps,GraphsandHashTablesarer epresentedinthemainmemoryandvariousoperationsareperformedon thosedatastructures.	K2
3	Illustratethe various file organizations like Sequential, Random and Linked organizations.	K2
4	Discovertherealtimeapplicationsofthevariousdatastructures	K3
5	Designalgorithmsforvarioussortingandsearchingtechniques	K4

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	INTRODUCTION	12 Hours

Introduction:IntroductionofAlgorithms,AnalyzingAlgorithms.Arrays:SparseMatrices-RepresentationofArrays.StacksandQueues.Fundamentals-EvaluationofExpressionInfixto Postfix Conversion -MultipleStacksandQueues

UNITII	LINKEDLIST	12Hours

Linked List: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - More on LinkedLists -SparseMatrices- DoublyLinkedListandDynamic-StorageManagement-Garbage CollectionandCompaction.

UNITIII	NONLINEARDATASTRUCTURES	12 Hours

Trees: Basic Terminology - Binary Trees - Binary Tree Representations - Binary Trees -Traversal - More on Binary Trees - Threaded Binary Trees - Binary Tree Representation of Trees - CountingBinaryTrees.Graphs:TerminologyandRepresentations-Traversals,ConnectedComponentsand SpanningTrees,ShortestPathsandTransitiveClosure

UNITIV	EXTERNAL-SORTING	12 Hours

External Sorting: Storage Devices -Sorting with Disks: K-Way Merging - Sorting with Tapes SymbolTables: Static Tree Tables - Dynamic Tree Tables - Hash Tables: Hashing Functions - OverflowHandling.

UNITV	INTERNAL-SORTING	12 Hours
Internal Sorting: Insertion Sort - Quick Sort - 2 Way Merge Sort - Heap Sort - Shell Sort - Sorting onSeveralKeys.Files:Files,QueriesandSequentialorganizations-IndexTechniques-FileOrganizations.		
	TotalLectureHours	**60 Hours**
TextBook(s)		
1	EllisHorowitz,SartajShani,DataStructures,GalgotiaPublication.	
ReferenceBook(s)		
1	EllisHorowitz,SartajShani,SanguthevarRajasekaran,ComputerAlgorithms,GalgotiaPublication.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		DiscreteMathematics	L	T	P	C
Core/elective/Supportive		Allied:1	4	1	-	4
Pre- requisite		Basicknowledgein Mathematics	Syllabus version		2021-22 Onward	

CourseObjectives

- Introducestudentstothetechniques,algorithms,andreasoningprocessesinvolvedinthestudyofdiscrete mathematicalstructures.
- Introducestudentstosettheory,inductivereasoning,elementaryandadvancedcountingtechniques,equivalencerelations, recurrencerelations, graphs, and trees.
- Introducestudents to provemathematical statementsbymeans of inductivereasoning

ExpectedCourseOutcomes

1	Understanddiscretemathematicalpreliminariesand applydiscretemathematicsin formalrepresentationof variouscomputingconstructs	K1
2	Demonstrateanunderstandingofrelations,functions,Combinatoricsandlattices	K2
3	Applythetechniquesofdiscretestructuresandlogicalreasoningtosolveavarietyof problemsandwriteanargumentusinglogicalnotation	K3
4	Analyzeandconstructmathematicalargumentsthatrelatetothestudyofdiscrete structures	K3
5	Developand model problems with the concepts and techniques of discrete mathematics.	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	MATHEMATICALLOGIC	15

Proposition–LogicalOperators–TruthTables–Laws ofLogic–Equivalances–Rules ofinterface–validityArguments–ConsistencyofSpecifications–PropositonalCalculus–Quantifiersanduniverseofdiscourse

UNITII	PROOFTECHNIQUES	19

Introduction – Methods of proving theorems – Direct Proofs, Proof by Contraposition, Vacuous andtrivialproofs,Proofsbycontradiction–MistakesinProofs–Mathematicalinduction–StrongMathematicalinduction–Strongmathematicalinductionand wellordering–ProgramCorrectness.

RELATIONS AND FUNCTIONS: Definition and properties of binary relations–RepresentingRelations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions andCoveringofsets–PartialOrderings–n-arrayRelationsandtheirapplications.Functions–Injective,
Surjective,Bijectivefunctions,Composition,identityandinverse.

UNITIII	COMBINATORICS	14

BasicsofCounting–ThePigeonholeprinciple–PermutationsandCombinationswithandwithoutrepetition,Permutationswithindistinguishableelements–distributionsofobjects–Generating
permutationsandcombinationsinlexicographicorder.

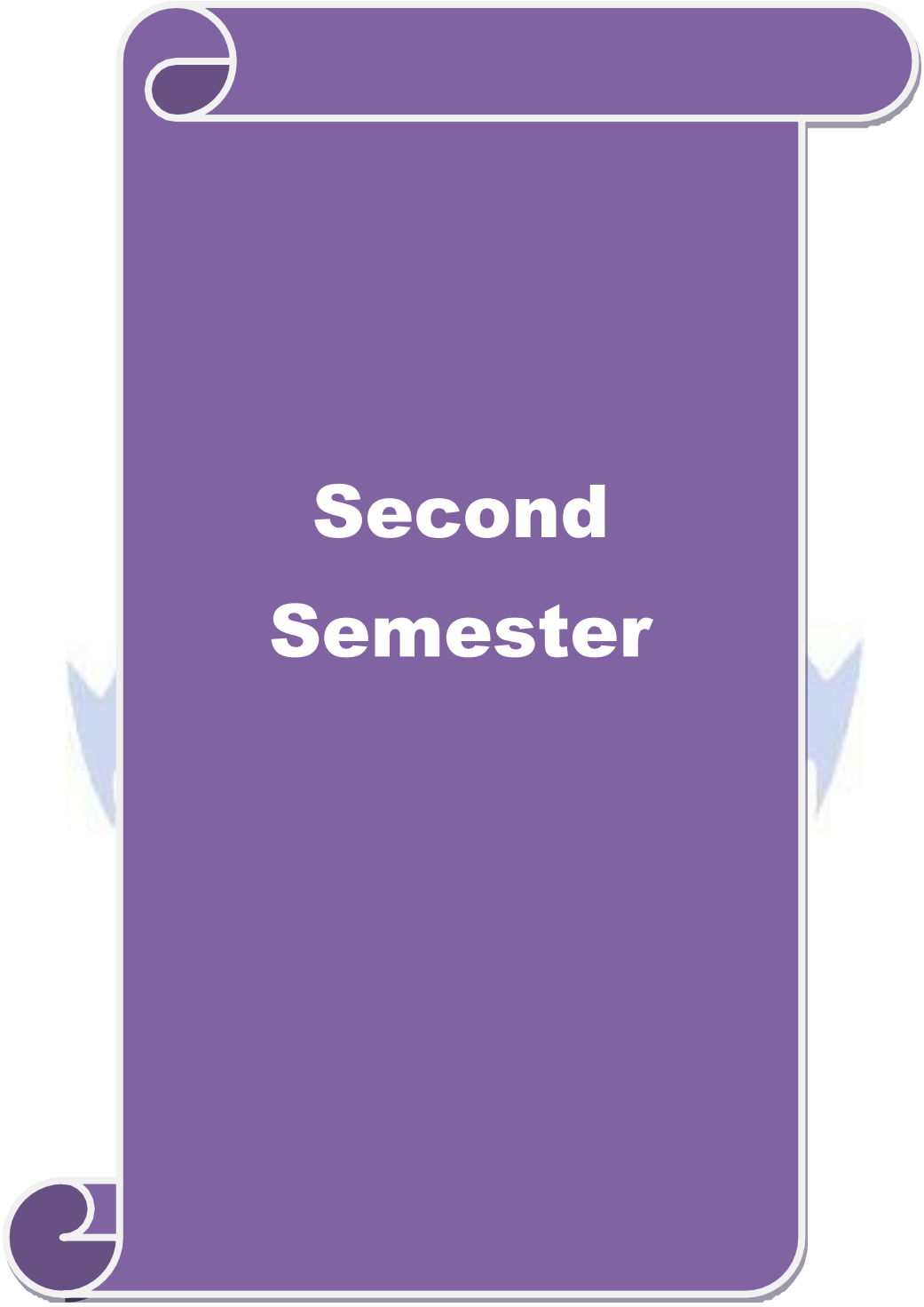
UNITIV	RECURRENCERELATIONS	14

SomeRecurrenceRelationModels–
Solutionoflinearhomogeneousrecurrencerelationswithconstantcoefficients–solutionoflinearnon-homogeneousrecurrencerelationsbythemethodof
characteristicroots –Divideandconquerrecurrencerelations.

UNITV	LATTICES	13
Latticesaspartiallyorderedset–PropertiesofLattices–Latticesasalgebraicsystem–Sublattices–DirectProductand Homomorphism–Somespeciallattices		
	TotalLectureHours	**75**
	TextBook(s)	
1	Kenneth H.Rosen,-Discrete Mathematicsanditsapplications‖,McGrawHill, 2011.	
2	JudithL.Gersting, -Mathematical StructuresforComputer Science‖, W.H>Freeman and Company,2014.	
3	TremblayJ.P. and Manohar R., -Discrete and Combinatorial Mathamatics– AnIntroduction‖, AddisonWesley,2009	
	ReferenceBook(s)	
1	DoerrAlan andLevasseur K., -Applied Discrete StructuresforComputer Science‖, Galgotia Publications,2002.	
2	BenardKolman,RobertC.BusbyandSharanRoss,—DiscreteMathematicalStructures‖, PearsonEducation,2014.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low


Second
Semester

CourseCode		JavaProgramming	L	T	P	C
Core/elective/Supportive		Core:3	5	0	-	4
Pre- requisite		• Basic knowledge of ProgrammingConstructs. • Knowledge on Object OrientedProgrammingConcepts.	Syllabus version		2021-22 Onward	

CourseObjectives

- TointroducetheconceptsofObjectOrientedProgrammingParadigmandtheprogrammingconstructsofJAVA

ExpectedCourseOutcomes

1	Recitethe historyofJAVA and its evolution	K1
2	Explainthevariousprogramminglanguageconstructs,objectorientedconceptslike overloading,inheritance,polymorphism,Interfaces,threads,exceptionhandlingandpackages	K2
3	Illustratetheconceptsof Applets, filesandtheconcept ofstreamclasses.	K3
4	Outlinethebenefitsandapplicationsofobjectsorientedprogrammingconceptsand defendhowJAVAdiffersfromotherprogramminglanguages	K3
5	Judgetheprosandconsofother objectorientedlanguagewiththeconceptsofJAVA	K4

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	FundamentalsofOOP	16

Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm – Basic Concepts ofObject-Oriented Programming – Benefits of Object-Oriented Programming – Application of Object-OrientedProgramming.JavaEvolution:History–Features –HowJavadiffers fromC andC++ –Java and Internet –Javaandwww–WebBrowsers.OverviewofJava:simpleJavaprogram –Structure – JavaTokens – Statements – JavaVirtual Machine.

UNITII	Variables&ControlStructures	15

Constants, Variables, Data Types - Operators and Expressions – Decision Making and Branching: if,if...else,nestedif, switch? :Operator-DecisionMakingandLooping:while, do,for– JumpsinLoops - Labeled Loops–Classes,ObjectsandMethods.

UNITIII	Arrays&Classes	14

Arrays,StringsandVectors–Interfaces:MultipleInheritance–Packages:PuttingClassestogether–MultithreadedProgramming.

UNITIV	ErrorHandling&Graphics	13

ManagingErrorsandExceptions–AppletProgramming–GraphicsProgramming.

UNITV	I/OStreams	17

ManagingInput/OutputFilesinJava:ConceptsofStreams-StreamClasses–ByteStreamclasses–Characterstreamclasses–Usingstreams–I/OClasses–FileClass–I/Oexceptions–Creationof files–Reading/Writingcharacters,Byte-HandlingPrimitiveDataTypes–RandomAccessFiles.

TotalLectureHours	75

TextBook(s)		
1	ProgrammingwithJava–APrimer-E. Balagurusamy,3rd Edition,TMH.	
ReferenceBook(s)		
1	TheComplete ReferenceJava2-PatrickNaughton&Hebert Schildt, 3rdEdition, TMH	
2	Programmingwith Java– JohnR. Hubbard, 2ndEdition, TMH.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		Programming Lab-JAVA	L	T	P	C
Core/elective/Supportive		CoreLab:2	-	-	4	4
Pre- requisite		• Basic knowledge of ProgrammingConstructs • Knowledge on Object OrientedProgrammingConcepts	Syllabus version		2021-22 Onward	

CourseObjectives

- TointroducetheconceptsofObjectOrientedProgrammingParadigmandtheprogrammingconstructsofJAVA

ExpectedCourseOutcomes

1	ApplythevariousbasicprogrammingconstructsofJAVAlikedecisionmakingstatements.Looopingstatements,overloading,inheritance,polymorphism,constructors anddestructors	K3
2	Illustratetheconceptsofthreadingandmulti-threading	K4
3	Designprogramsusingvariousfilestreamclasses;filetypes,andframes	K4

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

PROGRAM1	**3**
WriteaJavaApplicationsto extractaportion ofacharacterstringandprinttheextractedstring.	
PROGRAM2	**3**
WriteaJavaProgramtoimplementtheconceptof multipleinheritanceusingInterfaces.	
PROGRAM3	**3**
WriteaJavaProgram tocreatean Exceptioncalledpayout-of-boundsand throwtheexception	
PROGRAM4	**3**
WriteaJavaProgramtoimplementtheconceptof multithreadingwiththe use ofanythreemultiplicationtables andassign threedifferentpriorities to them.	
PROGRAM5	**6**
WriteaJavaProgramtodrawseveralshapesinthecreatedwindows	
PROGRAM6	**6**
WriteaJavaProgramtocreateaframewithfourtextfieldsname,street,cityandpincodewithsuitabletables.Alsoaddabuttoncalledmydetails.Whenthebuttonisclickeditscorresponding valuesareto beappearedin thetext fields.	
PROGRAM7	**6**
WriteaJavaProgramtodemonstratetheMultipleSelectionList-box.	
PROGRAM8	**6**
WriteaJavaProgram tocreateaframe withthree textfields forname,age and qualificationandatext fieldformultiplelinefor address	
PROGRAM9	**6**
WriteaJavaProgramtocreateMenuBars andpulldownmenus.	
PROGRAM10	**6**
Write a JavaProgramtocreate frameswhichrespondtothe mouseclicks.Foreacheventswithmouse suchas mouseup, mousedown,etc., thecorrespondingmessagetobe displayed.	

PROGRAM11	**6**
WriteaJavaProgramtodrawcircle,square,ellipseandrectangle atthemouseclickpositions.	
PROGRAM12	**6**
WriteaJavaProgramwhich openanexistingfile and appendtextto thatfile.	
TotalLectureHours	**60 Hours**

TextBook(s)	
1	ProgrammingwithJava–APrimer-E. Balagurusamy,3rd Edition,TMH.
ReferenceBook(s)	
1	TheComplete ReferenceJava2-PatrickNaughton&Hebert Schildt,3rd Edition, TMH

CourseDesignedby :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		InternetBasicsLaboratory	L	T	P	C
Core/elective/Supportive		CoreLab:3	-	0	2	2
Pre- requisite		• BasicknowledgeinComputers	Syllabus		2021-22 Onward	

CourseObjectives

1. IntroducethefundamentalsofInternet andtheWebfunctions.
2. Impartknowledgeandessentialskillsnecessarytousetheinternetanditsvariouscomponents.
3. Find,evaluate,anduse onlineinformationresources.
4. UseGoogleAppsforeducationeffectively.

ExpectedCourseOutcomes

1	Applythepredefinedprocedurestocreate Gmailaccount,checkandreceivemessages	K3
2	Applythepredefinedprocedures toperform variousbasicoperationsoninternet	K3
3	UtilizevariousGoogleapplicationslikedocs, Googleclassroom,Googledrive,Google forms,Googlemeetandslides	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

PROGRAM-1	**2**
Create an email account in Gmail. Using the account created compose a mail to invite other collegestudents for your college fest, enclose the invitation as attachment and send the mail to at least 50recipients.Use CC andBCC optionsaccordingly	
PROGRAM-2	**2**
Open your inbox in the Gmail account created, check the mail received from your peer from othercollege inviting you for his college fest, and download the invitation. Reply to the mail with a thankyounoteforthe inviteandforward themail to otherfriends	
PROGRAM-3	**2**
Assumethatyouarestudyinginfinalyearofyourgraduationandareeagerlylookingforajob.Visit anyjobportalanduploadyour resume.	
PROGRAM-4	**2**
CreateameetingusingGoogle calendarandsharemeetingidtothe attendees.TransfertheownershiptotheManager oncethemeetingid isgenerated.	
PROGRAM-5	**2**
Createalabel anduploadbulkcontacts usingimport optionin GoogleContacts	
PROGRAM-6	**2**
CreateyourownGoogleclassroomandinviteallyourfriendsthroughemailid.Poststudymaterialin GoogleclassroomusingGoogledrive.Createaseparatefolderforeverysubjectanduploadallunitwise E-Content Materials.	
PROGRAM-7	**2**
CreateandshareafolderinGoogleDriveusing_sharealink‘optionandsetthepermissiontoaccess thatfolderbyyourfriends only.	
PROGRAM-8	**2**
Createone-pagestoryinyourmother tonguebyusingvoicerecognition facilityof Google Docs	

PROGRAM-9	**2**
Createaregistrationformfor yourDepartmentSeminarorConferenceusingGoogleForms.	
PROGRAM-10	**2**
Createaquestionpaperwithmultiplechoicetypesofquestionsforasubjectofyourchoice,using GoogleForms.	
PROGRAM-11	**2**
CreateameetusingGoogleCalendar andrecordthemeetusingGoogleMeet. CreateaGoogleslidesfor atopicandsharethesamewithyour friends.	
PROGRAM-12	**4**
Createtemplate foraseminarcertificate usingGoogleSlides.	
PROGRAM-13	
Createasheettoillustratesimplemathematicalcalculationsusing Google Sheets. Createstudent'sinternalmarkstatementandsharetheGooglesheetsvialink.	**4**
TotalLectureHours	**30 Hours**

TextBook(s)	
1	IanLamont,GoogleDrive&Docsin30Minutes, 2nd Edition.
ReferenceBook(s)	
1	SherryKinkoph Gunter,MyGoogleApps, 2014.
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		AppliedMathematics	L	T	P	C
Core/elective/Supportive		Allied:2	5	0	0	4
Pre- requisite		BasicKnowledgeinMathematics	Syllabus version		2021-22 Onward	

CourseObjectives

Tointroducetheconcepts ofNumbers,Quantification, sets,logicalreasoning,probabilityand calculus

ExpectedCourseOutcomes

1	DemonstratetheconceptsofNumbers,Quantification,sets,logicalreasoning, probabilityandcalculus	K2
2	Applythe learnedconceptstosolvevariousmathematicalproblemsrelatedtothe domain	K3
3	Applyvariouslawsrelatedtologarithmsandsetstosolvevariousmathematical problems	K4
4	Solveproblemsrelatedtopermutation,combinations,mathematicalandlogical reasoningandcalculus.	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	Numbers,QuantificationandNumericalApplications	15

Numbers, Quantification and Numerical Applications - Prime Numbers, Encryptions using PrimeNumbers-Binary Numbers-Complex Numbers (Preliminary idea only) -Indices, Logarithm andAntilogarithm-Lawsandpropertiesoflogarithms-Simpleapplicationsoflogarithmandantilogarithm-Numericalproblemsonaverages,calendar,clock,time,workanddistance, menstruation,seatingarrangement

UNITII	Algebra	16

Algebra - Sets- Types of sets-Venn diagram-De Morgan's laws-Problem solving using Venndiagram 4-Relations and types of relations-Introduction of Sequences, Series-Arithmetic andGeometric progression-Relationship between AM and GM-Basic concepts of Permutations andCombinations-Permutations,CircularPermutations,Permutationswithrestrictions-Combinations withstandardresults.

UNITIII	MathematicalandLogicalReasoning	16

Mathematical and Logical Reasoning-Mathematically acceptable statements-Connecting words/phrases in Mathematical statement consolidating the understanding of "if and only if (necessary andsufficient) condition","implies", "and/or","implied by", "and","or","there exists" and their usethroughvarietyofexamplesrelatedtoreallifeandMathematics-Problemsbasedonlogical reasoning(coding-decoding,oddmanout,bloodrelation,syllogismetc).

UNITIV	Functions	14

Calculus-Introducingfunctions-DomainandRangeofafunction-Typesoffunctions(Polynomialfunction;Rationalfunction;Compositefunction;Logarithmfunction;Exponentialfunction; Modulus function; Greatest Integer function, Signum function -Graphical representation offunctions-Concept of limits and continuity of a function-Instantaneous rates of change-Differentiationasa process offindingderivative- Derivativesofalgebraic functionsusing Chainrule
-Tangentlineandequationsoftangents.

UNITV	Probability	14
Probability-Randomexperiment,samplespace,events,mutuallyexclusiveevents-Independent andDependentEvents-LawofTotal Probability-Bayes'Theorem.		
TotalLectureHours		**75 Hours**
TextBook(s)		
1	AppliedMathematics – DanSimpson,BurningEye books	
ReferenceBook(s)		
2	AppliedMathematics -Dr.HariArora,PublishingDate Is2019.PublisherIsS.k.Kataria& Sons	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low


Third
Semester

CourseCode		PythonProgramming	L	T	P	C
Core/elective/Supportive		Core:4	6	0	0	4
Pre- requisite		• Knowledgein BasicsofObjectOrientedProgramming	Syllabu		2021-22 Onward	

CourseObjectives

Tointroducethe conceptsof thevariousprogrammingconstructsof Pythonprogramming

ExpectedCourseOutcomes

1	Applythevariousbasicprogrammingconstructslikeoperators,expressions,decision makingstatementsandLoopingstatements	K2
2	Summarizetheconcept oflists,tuples ,functionsand errorhandling	K2
3	ApplytheconceptofDecisionmakingstatements,loopingconstructs,functionsfor solvingbasicprograms	K3
4	Analyzethe conceptsofLists,tuplesanderrorhandlingmechanisms	K4
5	Evaluateaprogramincorporatingallthepythonlanguage constructs	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	BASICS	18

Python-Variables-ExecutingPythonfromtheCommandLine-EditingPythonFiles-PythonReservedWords-BasicSyntax-Comments-StandardDataTypes–RelationalOperators-Logical Operators -BitWiseOperators -Simple Inputand Output.

UNITII	CONTROLSTATEMENTS,LISTS,TUPLES	18

CONTROLSTATEMENTS: ControlFlowandSyntax-Indenting-ifStatement-statementsandexpressions-stringoperations-BooleanExpressions -whileLoop-breakandcontinue -for Loop.

LISTS: List-list slices - list methods - list loop–mutability–aliasing - cloning lists - list parameters.**TUPLES:**Tupleassignment, tupleasreturn value -Sets–Dictionaries.

UNITIII	FUNCTIONS:	17

Definition-PassingparameterstoaFunction-Built-infunctions-VariableNumberofArguments-Scope–Typeconversion-Typecoercion-PassingFunctionstoaFunction–MappingFunctionsinaDictionary–Lambda- Modules-StandardModules – sys– math – time-dir –help Function.

UNITIV	ERRORHANDLING:	19

RunTimeErrors-ExceptionModel-ExceptionHierarchy-HandlingMultipleExceptions-Data Streams-AccessModesWriting-DatatoaFileReading-DataFromaFile-AdditionalFileMethods-UsingPipesasData Streams-HandlingIOExceptions-WorkingwithDirectories.

UNITV	OBJECTORIENTEDFEATURES:	18

Classes Principles of Object Orientation - Creating Classes -Instance Methods - File Organization - Special Methods - Class Variables – Inheritance – Polymorphism - Type Identification - SimpleCharacter Matches - Special Characters – Character Classes – Quantifiers - Dot Character - GreedyMatches – Grouping - Matching at Beginning or End - Match Objects – Substituting - Splitting aString-CompilingRegular Expressions.

TotalLectureHours	90Hours

TextBook(s)	
1	MarkSummerfield.—ProgramminginPython3:ACompleteintroductiontothePython Language,Addison-WesleyProfessional,2009.
2	MartinC.Brown,—PYTHON:TheCompleteReference‖,McGraw-Hill,2001
ReferenceBook(s)	
1	AllenB.Downey,``ThinkPython:HowtoThinkLikeaComputerScientist__,2ndedition, UpdatedforPython3,Shroff/O_ReillyPublishers,2016
2	GuidovanRossumandFredL.DrakeJr,—AnIntroductiontoPython–Revisedandupdated forPython 3.2,NetworkTheoryLtd., 2011.
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		PythonProgrammingLab	L	T	P	C
Core/elective/Supportive		CoreLab :4	0	0	5	4
Pre- requisite		• KnowledgeinbasicProgramming	Syllabus		2021-22 Onward	

CourseObjectives		
Tointroducetheconceptsofpythonprogrammingconstructsof C++		
ExpectedCourseOutcomes		
1	ApplytheconceptofDecisionmakingstatements,loopingconstructs,functionsfor solvingbasicprograms	K3
2	Analyzethe conceptsofLists,tuplesanderrorhandlingmechanisms	K4
3	Evaluateaprogramincorporatingallthepythonlanguage constructs	K5
K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create		

PROGRAM-1		5
Writeapythonprogramthat displaysthefollowinginformation:Yourname,FulladdressMobile number,Collegename, Coursesubjects.		
PROGRAM-2		5
Writeapython programto findthelargest threeintegers usingif-else and conditionaloperator.		
PROGRAM-3		9
Write a python program that asks the user to enter a series of positive numbers (The user should enteranegativenumberto signal theend oftheseries)andthe programshould displaythenumbers inorder andtheirsum.		
PROGRAM-4		9
Writeapython programtofind theproductof two matrices [A]mxpand[B]pxr		
PROGRAM-5		9
Writerecursivefunctions forGCD oftwo integers.		
PROGRAM-6		5
Writerecursivefunctionsforthefactorialofpositiveinteger.		
PROGRAM-7		5
WriterecursivefunctionsforFibonacciSequence uptogivennumber n.		
PROGRAM-8		5
Writerecursive functionsto displayprimenumber from 2to n.		
PROGRAM-9		5
Writeapython programthatwrites aseries ofrandomnumbers toafilefrom1 ton anddisplay.		
PROGRAM-10		6
Writeapythonprogramtosortagivensequence:String, Listand Tuple.		
PROGRAM-11		6
Writeapython programto makeasimplecalculator.		
PROGRAM-12		6
Writeapythonprogramfor LinearSearchandBinarySearch.		
	TotalHours	**75 Hours**

TextBook(s)	
1	MarkSummerfield.—ProgramminginPython3:ACompleteintroductiontothePython Language,Addison-WesleyProfessional,2009.
ReferenceBook(s)	
2	MartinC.Brown,—PYTHON:TheCompleteReference‖,McGraw-Hill,2001
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	L	L	L	L	L	L	L	L
CO2	S	M	M	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		FuzzyLogicand NeuralNetworks	L	T	P	C
Core/elective/Supportive		Core:5	6	0	0	4
Pre- requisite		• KnowledgeinBasicsofObjectOrientedProgramming	Syllabu		2021-22 Onward	

CourseObjectives

- Tointroducetheconceptsof neuralnetworksandfuzzysystems
- To explain thebasic mathematical elements ofthetheoryof fuzzysets.

1	Explain thebasicconcepts of fuzzysetsand fuzzylogic	K2
2	Understandingof thebasic mathematicalelements ofthe theoryoffuzzysets.	K2
3	Explainthefundamentals and historyof neural networks	K2
4	Outlineaboutthemappingandrecurrentnetworks	K2
5	Analyzethe applicationsoffuzzylogic andneuralnetworkforvariousapplications	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	FuzzySetTheoryandFuzzyLogicControl:	18

Basicconceptsoffuzzysets-Operationsonfuzzysets-Fuzzyrelationequations-Fuzzylogiccontrol Fuzzification–Defuzzificatiuon-Knowledgebase-Decisionmakinglogic-Membershipfunctions–Rulebase.

UNITII	AdaptiveFuzzySystems	18

Performanceindex-Modificationofrulebase0-Modificationofmembershipfunctions-Simultaneous modificationofrulebaseandmembershipfunctions-Geneticalgorithms-AdaptivefuzzysystemNeuro fuzzysystems.

UNITIII	ArtificialNeuralNetworks:	18

Introduction-Historyofneuralnetworks-multilayerperceptions-Backpropagationalgorithmandits Variants-Differenttypes oflearning,examples.

UNITIV	MappingandRecurrentNetworks:	18

Counterpropagation–SelforganizationMap-CongnitronandNeocognitron-HopfieldNet-Kohonnen Nets-GrossbergNets- Art-I, Art-IIreinforcementlearning

UNITV	CaseStudies	18

Applicationoffuzzylogicand neuralnetworkstoMeasurement-Control- AdaptiveNeural Controllers –SignalProcessingandImageProcessing

TotalLectureHours	90 Hours

TextBook(s)

1	VallumB.RAndHayagrivaV.RC++,NeuralnetworksandFuzzylogic, BPBPublications, NewDelhi,1996

ReferenceBook(s)

1	Fuzzylogic &NeuralNetworks/ChennakesavaR.Alavala/NewAgeInternational,2008
2	NeuralNetworks for control,Millon W. T,SuttonR.S and Werbos P.J, MIT Press1992
3	FuzzysetsFuzzylogic, Klir, G.JanfdYuan B.BPrenticeHalloifIndiaPvt.Ltd.,,NewDelhi

4	NeuralNetworksand Fuzzysystems,Kosko..Prenticehallof IndiaPvt.Ltd.,,NewDelhi1994
5	IntroductiontoFuzzycontrol,DirankovD.HellendoornH,ReinfrankM.,NarosaPublications House,New Delhi1996
6	IntroductiontoArtificialNeuralsystems,ZuradaJ.MJaicoPublishingHouse,NewDelhi1994
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		DesignandAnalysisofAlgorithms	L	T	P	C
Core/elective/Supportive		Allied:3	6	0	0	4
Pre- requisite		• Foundationindesigningalgorithms • Basic knowledge on data structuralconcepts	Syllabus version		2021-22 Onward	

CourseObjectives

- Toemphasizetheimportanceof analysisofalgorithmsandfindingthetimecomplexity.
- Toexplainvariousalgorithmdesigntechniques

ExpectedCourseOutcomes

1	Explainthe importanceof algorithm analysisand thenotation used	K2
2	Applythevariousframeworksforanalyzingrecursiveandnon-recursivealgorithmsto find thetime complexity	K3
3	Illustratethevariousalgorithmdesigntechniqueslikedivideandconquer,greedy algorithms,brute forceanddynamicprogramming	K4
4	IllustratethevariousiterativemethodlikeSimplexMethod,Maximum-FlowProblem, MaximumMatchinginBipartiteGraphs,StablemarriageProblem..	K4
5	ComparetheP,NP,NP –CompleteandNP-Hardtypeofproblems	K4
6	Comparealgorithmsbycalculatingtheirtimeefficiencyusingtheprescribed framework	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	INTRODUCTION	18

Notion of Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem types– FundamentalsoftheAnalysisofAlgorithmicEfficiency– AsymptoticNotationsandtheirproperties.Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursivealgorithms

UNITII	BRUTEFORCEANDDIVIDE-AND-CONQUER	18

Brute Force – Computing an– String Matching – Closest Pair and Convex-Hull Problems - ExhaustiveSearch –Travelling Salesman Problem– Knapsack Problem– Assignment problem. Divide andConquerMethodology–BinarySearch–Mergesort–Quicksort–HeapSort-Multiplicationof LargeIntegers–Closest-PairandConvex–HullProblems.

UNITIII	DYNAMIC PROGRAMMINGAND GREEDYTECHNIQUE	19

Dynamic programming – Principle of optimality – Coin changing problem, Computing a BinomialCoefficient – Floyd_s algorithm – Multi stage graph – Optimal Binary Search Trees – KnapsackProblem and Memory functions. GreedyTechnique–Containerloadingproblem–Prim_salgorithmandKruskal‘sAlgorithm.

UNITIV	ITERATIVEIMPROVEMENT	17

TheSimplex Method –TheMaximum-Flow Problem –Maximum MatchinginBipartiteGraphs,StablemarriageProblem.

UNITV	COPINGWITH THE LIMITATIONS OFALGORITHMPOWER	18
Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queenproblem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – Assignmentproblem–KnapsackProblem–TravellingSalesmanProblem– ApproximationAlgorithmsforNP-HardProblems –TravellingSalesmanproblem–Knapsackproblem.		
TotalLectureHours		**90Hours**
TextBook(s)		
1	AnanyLevitin, ―Introduction to the Design andAnalysis of Algorithms‖, Third Edition, PearsonEducation,2012.	
ReferenceBook(s)		
1	Thomas H.Cormen, Charles E.Leiserson, RonaldL. Rivestand Clifford Stein, ―Introduction to Algorithms‖,ThirdEdition,PHILearning PrivateLimited,2012	
2	Alfred V. Aho, John E. Hopcroft and JeffreyD.Ullman, ―Data Structuresand Algorithms‖, PearsonEducation,Reprint2006.	
3	Donald E. Knuth,―TheArt of ComputerProgramming‖, Volumes1&3Pearson Education, 2009. Steven S. Skiena, ―TheAlgorithm Design Manual‖,Second Edition,Springer, 2008.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	M	M	L	L	L	L	L	L	L
CO6	S	S	S	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		Internetof Things(IoT)	L	T	P	C
Core/elective/Supportive		SkillbasedSubject :1	5	0	0	3
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Toexplainaboutthedefinitionandusageof Internetofthings
- ToexplainthekeycomponentsofIoT system

ExpectedCourseOutcomes

1	Explain the definition and usageof theterm –Internet of Things‖in different contexts	K2
2	Understandthekeycomponents thatmakeupanIoTsystem	K2
3	DifferentiatebetweenthelevelsoftheIoTstackandbefamiliarwiththekey technologiesandprotocolsemployedateachlayer ofthestack	K3
4	Applytheknowledgeandskillsacquiredduringthecoursetobuildandtesta complete,workingIoTsysteminvolvingprototyping,programminganddataanalysis	K3
5	DiscoverwheretheIoTconceptfitswithinthebroaderICTindustryandpossible futuretrends	K4

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNIT I	IntroductiontoIoT	16

Introduction–DefinitionandCharacteristicsofIoT,PhysicalDesignofIoT;ThingsinIOT,Logical DesignofIoT;IoTFunctionalBlocks,IoTCommunicationAPIs,IoTEnablingTechnologies;WSN,CloudCo mputing, BigData Analysis, CommunicationProtocols, EmbeddedSystems

UNITII	IoT Hardware	15

IoTHardware,DevicesandPlatforms– BasicsofArduinoHardware,TheArduinoIDE,BasicArduinoProgramming,BasicsofRaspberrypi;Introduc tiontoRaspberrypi,Programmingwith Raspberrypi, CDACIoTdevices: Ubimote, Wi-Fi mote,BLEMote, WINGZgateway,Introduction toIoTPlatforms,IoT Sensors and actuators

UNITIII	IoTProtocols	16

IoTProtocols– IoTDatalinkProtocols,NetworkLayerRoutingProtocols,NetworkLayerEncapsulationProtocols,SessionLa yerProtocols,IoTSecurityProtocols,ServiceDiscovery Protocols,InfrastructureProtocols.

UNITIV	IoTProgramming	14

IoT Programming – Arduino Programming: Serial Communications – Getting Input from Sensors,Visual,PhysicalandAudioOutputs,RemotelyControllingExternalDevices,WirelessCommunicat ion,ProgrammingwithRaspberrypi:BasicsofpythonProgramming,PythonPackages ofIoT, IoTProgrammingwithCADCIoTdevices.

UNITV	DomainSpecificIoT	14

Domain Specific IoT – Home automation, smart cities, Smart Environment, IoT in Energy, Logistics,Agriculture, industry and Health & Life style sensors, Case Studies: ACase Study of Internet ofThingsUsingWirelessSensorNetworksandSmartPhones,SecurityAnalysisofInternet-of-Things: ACaseStudyofAugustSmart Lock,Open IoTPlatform.

TotalLectureHours	75Hours

TextBook(s)	
1	VijayMadisetti andArshdeepBahga,–Internet ofThings(AHands-on-Approach)‖, 1st Edition,VPT, 2014.
ReferenceBook(s)	
1	Margolis, Michael. –ArduinoCooKbook: Receipestobegin, Expand and Enhance Your Projects‖.O'ReillyMediaInc.2011.
2	Monk,Simon.RaspberryPiCookbook:SoftwareandhardwareproblemsandSolutions. O'ReillyMedia,Inc.2016.
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low


Fourth
Semester

CourseCode		Artificial Intelligence and KnowledgeRepresentation	L	T	P	C
Core/elective/Supportive		Core:6	6	0	0	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Toexposethestudentsotthefundamentalconceptsof ArtificialIntelligenceanditsapplications.

ExpectedCourseOutcomes

1	Demonstratefundamentalunderstandingofthehistoryofartificialintelligence(AI) anditsfoundations.	K2
2	UnderstandingaboutthebasicconceptsofSoftwareagentsadrepresentationof knowledge	K2
3	DemonstrateawarenessandafundamentalunderstandingofvariousapplicationsofAItechniquesinintelligentagents,expertsystems,artificialneuralnetworksandother machinelearningmodels.	K2
4	ApplybasicprinciplesofAIinsolutionsthatrequireproblemsolving,inference, perception,knowledgerepresentation,andlearning.	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	Introduction	18

Introduction–Definition–FutureofArtificialIntelligence–CharacteristicsofIntelligentAgents– Typical IntelligentAgents–ProblemSolvingApproachtoTypicalAIProblems.

UNITII	ProblemSolvingMethods	19

Problem Solving Methods – Search Strategies – Uninformed – Informed – Heuristics – Local SearchAlgorithmsandOptimizationProblems–SearchingwithPartialObservations– ConstraintSatisfactionProblems–ConstraintPropagation–BacktrackingSearch–GamePlaying–Optimal DecisionsinGames –Alpha–BetaPruning–StochasticGames.

UNITIII	KnowledgeRepresentation	18

Knowledge Representation – First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining – Backward – Chaining – Resolution – Knowledge Representation – OntologicalEngineering–CategoriesandObjects–Events–MentalEventsandMentalObjects–Reasoning SystemsforCategories–ReasoningwithDefault Information.

UNITIV	SoftwareAgents	17

SoftwareAgents–ArchitectureforIntelligentAgents–AgentCommunication–Negotiationand Bargaining–ArgumentationamongAgents–TrustandReputationinMulti-agentSystems.

UNITV	AIApplications	18

AI Applications–LanguageModels–InformationRetrieval–InformationExtraction– NaturalLanguageProcessing–MachineTranslation–SpeechRecognition–Robot–Hardware–Perception –Planning-Moving.

TotalLectureHours	90Hours

	TextBook(s)
1	S.RussellandP.Norvig,–ArtificialIntelligence:AModernApproach‖,PrenticeHall,Third Edition, 2009.
2	I. Bratko,-Prolog:Programmingfor Artificial Intelligence,FourthEdition,Addison-Wesley EducationalPublishers Inc.,2011.
	ReferenceBook(s)
1	M.TimJones,-ArtificialIntelligence:ASystemsApproach(ComputerScience),Jonesand BartlettPublishers Inc.; FirstEdition,2008.
2	NilsJ.Nilsson,-TheQuestforArtificialIntelligence,CambridgeUniversityPress,2009.
3	WilliamF.ClocksinandChristopherSMellish,ProgramminginProlog:UsingtheISO Standard,FifthEdition,Springer,2003.
4	GerhardWelss,-MultiAgentsSystems,SecondEdition,2013.
5	DavidL. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of ComputationalAgents, CambridgeUniversityPress, 2010.
6	Implement anapplicationthatstoresbigdatainHbase/MongoDB/PigUsingHadoop
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		RProgramming	L	T	P	C
Core/elective/Supportive		Core:7	6	0	0	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Toexposethestudent sotthefundamental conceptsof RProgramming

ExpectedCourseOutcomes

1	UnderstandthebasicsinRprogrammingintermsofconstructs,controlstatements, stringfunctions	K2
2	UnderstandtheuseofRforBigDataanalytics	K2
3	ApplyR programmingfor Text processing	K3
4	Appreciateandapplythe Rprogrammingfromastatistical perspective	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNIT I	IntroducingtoR	18

IntroducingtoR–RDataStructures–HelpFunctionsinR–Vectors–Scalars–Declarations–Recycling–CommonVectorOperations–Usingallandany–Vectorizedoperations–NAandNULLvalues – Filtering– Victoriesed if-then else– Vector Element names.(9).

UNITII	Matrices	18

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Addingand deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – HigherDimensionalarrays–lists–Creatinglists–Generallistoperations–Accessinglistcomponentsand values–applyingfunctionsto lists–recursivelists.

UNITIII	DataFrames	18

CreatingDataFrames–Matrix-likeoperationsinframes–mergingDataframes–Applyingfunctions to Data Frames – Factors and Tables – Factors and levels – Common Functions used withfactors – Working with tables – Other factors and table related functions – Control statements –Arithmetic and Boolean operators and values – Default Values for arguments – Returning BooleanValues– Functionsareobjects–Environmentandscopeissues–WritingUpstairs–Recursion– Replacementfunctions–Tools forComposingfunction code– Mathand Simulationin R.

UNITIV	Classes	18

S3Classes–S4Classes–Managingyourobjects–Input/output–accessingkeyboardandmonitor–readingandwritingfiles–accessingtheinternet–StringManipulation–Graphics–CreatingGraphs –CustomizingGraphs –SavingGraphstofiles –CreatingThree-Dimensionalplots.

UNITV	InterfacingR	18

InterfacingRtootherlanguages–ParallelR–BasicStatistics–LinearModel–GeneralizedLinear models–Non-linearModels –TimeSeriesandAuto-Correlation–Clustering.

TotalLectureHours	90Hours

TextBook(s)

1	Norman Matloff,–TheArt ofR Programming: ATourof Statistical SoftwareDesign‖, No StarchPress,2011.
2	Jared P.Lander, –R for Everyone: AdvancedAnalytics andGraphics‖, Addison-WesleyData &AnalyticsSeries,2013.

	ReferenceBook(s)	
1	Mark Gardner,-BeginningR– TheStatistical Programming Language‖,Wiley, 2013.	
2	Robert Knell, -IntroductoryR: ABeginner's Guideto Data Visualisation,Statistical Analysis and programmingin R‖,Amazon DigitalSouth Asia ServicesInc,2013. Richard Cotton(2013).LearningR,O'ReillyMedia.	
3	GarretGrolemund(2014).Hands-onProgrammingwithR.O'ReillyMedia, Inc.	
4	RogerD.Peng(2018).R ProgrammingforDataScience. LeanPublishing.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		RProgrammingLab	L	T	P	C
Core/elective/Supportive		CoreLab :5	0	0	3	2
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Toexposethestudent sotthefundamentalconcepts ofRProgramming

ExpectedCourseOutcomes

1	UnderstandthebasicsinRprogrammingintermsofconstructs,controlstatements, stringfunctions	K2
2	UnderstandtheuseofRforBigDataanalytics	K2
3	ApplyR programmingfor Text processing	K3
4	Appreciateandapplythe Rprogrammingfromastatistical perspective	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

ListofPrograms

1. RExpressionsandDataStructures
2. Manipulationofvectorsandmatrix
3. OperatorsonFactorsinR
4. DataFramesinR
5. ListsandOperators
6. Workingwith loopingstatements.
7. GraphsinR
8. 3D plotsin R

TotalLectureHours	**90Hours**

TextBook(s)

1	S.RussellandP.Norvig,–ArtificialIntelligence:AModernApproach‖,PrenticeHall,Third Edition, 2009.
2	I. Bratko,-Prolog:ProgrammingforArtificialIntelligence, FourthEdition,Addison-Wesley EducationalPublishers Inc.,2011.

ReferenceBook(s)

1	M.TimJones,-ArtificialIntelligence:ASystemsApproach(ComputerScience),Jonesand BartlettPublishers Inc.; FirstEdition,2008.
2	NilsJ.Nilsson,-TheQuestforArtificialIntelligence,CambridgeUniversityPress,2009.

3	WilliamF.ClocksinandChristopherSMellish,ProgramminginProlog:UsingtheISO Standard,FifthEdition,Springer,2003.	
4	GerhardWelss,-MultiAgentsSystems,SecondEdition,2013.	
5	DavidL. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of ComputationalAgents, CambridgeUniversityPress, 2010.	
6	Implement anapplicationthatstoresbigdatainHbase/MongoDB/PigUsingHadoop	
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1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		MachineLearning-Basics	L	T	P	C
Core/elective/Supportive		Allied:4	6	0	0	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Toexplain aboutthebasics ofmachine learning

ExpectedCourseOutcomes

1	Understandingofthefundamentalissuesandchallengesofmachinelearning:data, modelselection,modelcomplexity,etc.	K2
2	Understandingofthestrengthsandweaknessesofmanypopularmachinelearning approaches.	K2
3	Explainaboutheconceptsofcomputationallearningtheoryanddimensionality reduction	K2
4	AppreciatetheunderlyingmathematicalrelationshipswithinandacrossMachine Learningalgorithmsand theparadigmsofsupervisedandun-supervisedlearning.	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	IntroductiontoLearning	18

Algorithmicmodelsoflearning,Learningclassifiers,functions,relations,grammars,probabilistic models,valuefunctions,behaviorsandprogramsforexperience.Bayesian,maximumsomeposterior,andmin imum description length frameworks.

UNITII	ML-Models	18

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines,Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models,probabilisticrelationalmodels,associationrules,nearestneighborclassifiers,locallyweightedregres sion,ensembleclassifiers.

UNITIII	ComputationalLearning	17

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension,Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal componentAnalysis,featureselection and visualization.

UNITIV	UnsupervisedLearning	18

UnsupervisedLearning:Clustering,mixturemodels,k-meansclustering,hierarchicalclustering,distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data andknowledge.

UNITV	ApplicationsinDataMining	19

Selectedapplicationsindatamining,automatedknowledgeacquisition,patternrecognition,program synthesis,textandlanguageprocessing,internet-basedinformationsystems,humancomputerinteraction,semantic web, and bioinformaticsandcomputational biology.

TotalLectureHours	90Hours

	TextBook(s)
1	Bishop,C.(2006).PatternRecognitionandMachineLearning. Berlin:Springer-Verlag.
	ReferenceBook(s)
1	Russel,S.AndNorving, P.(2003).Artificial Intelligence:AModernApproach.2nd Edition, NewYork:Prentice-Hall.
2	Baldi,P.,Frasconi,P.,Smyth,P.(2002).Bioinformatics:AMachineLearningApproach. Cambridge,MA:MITPress.
3	Baldi,P.,Frasconi,P.,Smyth,P.(2003).Modelingthe InternetandtheWeb–Probabilistic MethodsandAlgorithms.NewYork:Wiley.
4	Bishop,C.M.NeuralNetworksforpatternrecognition.NewYork: OxfordUniversitypress (1995).
5	Hastie,T.,Tibshirani,R.,andFriedman,J.(2001).TheelementsofStatisticalLearning –Data mining, Inference,andPrediction,Berlin:Springer-Verlag.
6	Cohen,P.R.(1995)EmpiricalMethodsinArtificial Intelligence.Cambridge,MA:MITPress.
7	Cowell,R.G.,Dawid,A.P., Lauritzen,S.L., andSpiegelhalter.D.J.(1999). GraphicalModels andExpertSyatems. Berlin:Springer.
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		CapstoneProjectWork	L	T	P	C
Core/elective/Supportive		SkillBasedSubject2	0	0	4	3
Pre- requisite		• Students should have a goodunderstandingofsoftwareengineering • Studentshouldpossessstronganalyticalskills • Strong coding skills in any oneprogrammingpaper	Syllabus version		2021-22 Onward	

CourseObjectives

- Tounderstandand selectthetask basedontheircoreskills.
- Togettheknowledge aboutanalyticalskillforsolvingtheselectedtask.
- Togetconfidencefor implementingthetaskandsolvingthe realtimeproblems.

ExpectedCourseOutcomes

Onthesuccessful completionofthecourse,student willbe ableto:

1	Illustrate arealworld problemandidentifythelistofprojectrequirements	K3
2	Judgethefeaturesoftheprojectincludingforms, databasesandreports	K5
2	Designcodetomeettheinputrequirementsandtoachievetherequiredoutput	K6
3	Composeaprojectreport incorporatingthe featuresoftheproject	K6

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

Aimoftheproject work

1. Theaimof theprojectworkis toacquirepracticalknowledgeonthe implementationoftheprogrammingconcepts studied.

2. Each student should carry out individually one project work and it may be a work using thesoftware packages that they have learned or the implementation of concepts from the papers studiedorimplementation of anyinnovative ideafocusing on application oriented concepts.

3. Theprojectwork should be compulsorilydonein thecollegeonlyunderthe supervision of thedepartmentstaff concerned.

VivaVoce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) andExternalExaminers,after dulyverifyingthe AnnexureReportavailable intheCollege,foratotal of75marks at the last dayof thepractical session.

2. Outof75marks, 45 marksforproject reportand 30 MarksforVivaVoce.

ProjectWork Format

PROJECTWORK

TITLEOFTHEDISSERTATION

Bonafide Work Done

bySTUDENT

NAMEREG.NO.

Dissertationsubmittedin partialfulfillmentofthe requirementsfor theawardof
<NameoftheDegree>
ofBharathiar University,Coimbatore-46.

CollegeLogo

Signatureof theGuide Signature of the
HODSubmittedfortheViva-VoceExaminationheldon _____

InternalExaminer External ExaminerMonth– Year

CONTENTS

3.2 InputDesign

3.3 OutputDesign

3.4 DatabaseDesign

3.5 SystemDevelopment

3.5.1 DescriptionofModules(Detailedexplanation abouttheprojectwork)

4SoftwareTestingandImplementationC

onclusion

Bibliography

Appendices

A. DataFlow Diagram

B. TableStructure

C. SampleCoding

D. Sample Input

E. SampleOutput

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**L**	**L**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low


Fifth
Semester

CourseCode		MachineLearningTechniques	L	T	P	C
Core/elective/Supportive		Core:8	6	0	0	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Tointroducestudents totheconceptsandtechniques ofMachine Learning.

ExpectedCourseOutcomes

1	Understandthebasicconceptsandtechniques ofMachine Learning.	K2
2	Explaintheregressionmethods,classificationmethods,clusteringmethods.	K2
3	Understandtheinferenceandlearningalgorithmsforthehidden Markovmodel.	K2
4	DemonstrateDimensionalityreductionTechniques	K2
5	Appreciatetheunderlyingmathematicalrelationshipswithinandacross Machine Learningalgorithmsand theparadigmsofsupervisedandun-supervisedlearning.	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	IntroductiontoMachineLearning	18

Introduction – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search- Finding a Maximally Specific Hypothesis – Version Spaces and theCandidateEliminationAlgorithm–LinearDiscriminants–Perceptron–LinearSeparability–Linear Regression.

UNITII	MachineLearningModels	19

LinearModels–Multi-LayerPerceptron–GoingForwards–GoingBackwards:BackPropagationError– Multi-LayerPerceptroninPractice–ExamplesofusingtheMLP–Overview–Deriving Back-Propagation–RadialBasisFunctionsandSplines–Concepts–RBFNetwork–CurseofDimensionality– Interpolations and BasisFunctions– Support VectorMachines.

UNITIII	Tree& ProbabilisticModel	19

TreeandProbabilisticModels–LearningwithTrees–DecisionTrees–ConstructingDecisionTrees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways toCombine Classifiers - Probability and Learning – Data into Probabilities – Basic Statistics – GaussianMixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –VectorQuantization– Self Organizing FeatureMap.

UNITIV	DimensionalityReductionandEvolutionaryModels	17

DimensionalityReductionandEvolutionaryModels-DimensionalityReduction– LinearDiscriminantAnalysis–LocallyLinearEmbedding–Isomap–LeastSquaresOptimization– EvolutionaryLearning–GeneticAlgorithms–GeneticOffspring–GeneticOperators– UsingGeneticAlgorithms–ReinforcementsLearning–Overview–GettingLostExample–Markov DecisionProcess.

UNITV	GraphicalModel	17

Graphical Models – Markov Chain Monte Carlo Methods– Sampling – Proposal Distribution –Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – HiddenMarkovModels– TrackingMethods.

TotalLectureHours		**90Hours**
TextBook(s)		
1	EthemAlpaydin,-introductiontoMachine Learning3e (AdaptiveComputationandMachine LearningSeries),ThirdEdition,MITPress,2014.	
	ReferenceBook(s)	
1	JasonBell,-Machine Learning–HandsonforDevelopersandTechnicalprofessionals,First Edition,Wiley,2014.	
2	PeterFlach,-Machine Learning:TheArtand Scienceof AlgorithmsthatMakeSenseof Data, FirstEdition,Cambridge UniversityPress,2012.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		MachineLearningLab	L	T	P	C
Core/elective/Supportive		CoreLab :6	0	0	6	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Tointroducestudentsto theconceptsand techniquesofMachine Learning.

ExpectedCourseOutcomes

1	Understandthebasicconceptsandtechniquesof Machine Learning.	K2
2	Explaintheregressionmethods,classificationmethods,clusteringmethods.	K2
3	Understandtheinferenceandlearningalgorithmsforthehidden Markovmodel.	K2
4	DemonstrateDimensionalityreductionTechniques	K2
5	Appreciatetheunderlyingmathematicalrelationshipswithinandacross Machine Learningalgorithmsand theparadigmsofsupervisedandun-supervisedlearning.	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

ListofPrograms

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis basedonagiven set oftrainingdata samples. Readthe trainingdatafrom a.CSVfile

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

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use anappropriatedatasetforbuilding thedecisiontreeandapply thisknowledge toclassify a newsample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test thesameusing appropriatedata sets.

5. Writeaprogramtoimplementthenaïve Bayesianclassifierforasampletrainingdatasetstoredasa .CSV file.Compute theaccuracyoftheclassifier, consideringfewtestdata sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model toperformthistask.Built-inJavaclasses/APIcanbeusedtowritetheprogram.Calculatetheaccuracy,precision, andrecall foryour dataset.

TotalLectureHours	90Hours

TextBook(s)	
1	EthemAlpaydin,-introductiontoMachineLearning3e(AdaptiveComputationandMachineLearningSeries), Third Edition, MIT Press, 2014.
ReferenceBook(s)	
1	JasonBell,-Machine Learning–HandsonforDevelopersandTechnicalprofessionals,First Edition,Wiley,2014.
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CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		DeepLearning	L	T	P	C
Core/elective/Supportive		Core:9	6	0	0	4
Pre- requisite		None	Syllabus version		2021-22 Onward	

CourseObjectives

- Tointroducestudents tothebasic conceptsandtechniques of deepLearning.

ExpectedCourseOutcomes

1	UnderstandthebasicconceptsandtechniquesofDeep Learning.	K2
2	TounderstandandapplytheMachinelearningprinciples	K2
3	Tostudythe deeplearningarchitectures	K2
4	Exploreandcreatedeeplearningapplicationswith tensorflow	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	**IntroductiontoLearning**	**18**
TheNeuralNetwork–LimitsofTraditionalComputing–MachineLearning–Neuron–FFNeural Networks–TypesofNeurons –Softmax outputlayers		
UNITII	**DeepLearningModels**	**18**
Tensorflow–Variables–Operations–Placeholders–Sessions–SharingVariables–Graphs–Visualization		
UNITIII	**CNN**	**19**
ConvolutionNeuralNetwork–FeatureSelection–MaxPooling–FiltersandFeatureMaps–ConvolutionLayer–Applications		
UNITIV	**RNN**	**17**
RecurrentNeuralNetwork–Memorycells–sequenceanalysis–word2vec-LSTM—Memory augmentedNeuralNetworks–NTM—Application		
UNITV	**ReinforcementLearning**	**18**
Reinforcement Learning –MDP–Q Learning– Applications		
	TotalLectureHours	**90 Hours**

TextBook(s)

1	Nikhil Buduma, NicholasLocascio, ‑Fundamentals of DeepLearning: Designing NextGenerationMachineIntelligenceAlgorithms‖,O'ReillyMedia,2017.

	ReferenceBook(s)	
1	IanGoodfellow,YoshuaBengio,AaronCourville,‖DeepLearning(Adaptivecomputation andMachineLearningseries‖,MITPress,2017.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	

CourseDesignedby :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		BusinessDataAnalytics	L	T	P	C
Core/elective/Supportive		Elective:I	6	0	0	4
Pre-requisite		None	Syllabu		2021-22	
CourseObjectives					Onward	

- TointroducethefundamentalconceptsofBusinessdataanalyticsand associatedmethodologies

ExpectedCourseOutcomes

1	Understandandcriticallyapplytheconceptsand methods ofbusiness analytics	K2
2	Demonstrationthevariousmethodologiesofdescriptivestatistics	K2
3	Understandingofmodelinguncertaintyand statistical inference	K2
4	Understandingofanalyticalframeworks	K2

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	OVERVIEWOFBUSINESS ANALYTICS	18

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing andSales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support –SkillsRequiredforaBusinessAnalyst–Frameworkfor BusinessAnalyticsLifeCycleforBusiness AnalyticsProcess.

UNITII	ESSENTIALSOFBUSINESSANALYTICS	17

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean,Median,Mode,Range,Variance,StandardDeviation,Percentile,Quartile,z-Score,Covariance,Correlation– DataVisualization:Tables,Charts,LineCharts,BarandColumnChart,BubbleChart, HeatMap–DataDashboards.

UNITIII	MODELINGUNCERTAINTYANDSTATISTICALINFERENCE	19

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: DataSampling–SelectingaSample–PointEstimation–SamplingDistributions–IntervalEstimation– HypothesisTesting.

UNITIV	ANALYTICSUSING HADOOPAND MAPREDUCEFRAMEWORK	19

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed FileSystem) – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – AlgorithmsUsingMap-Reduce:Matrix-VectorMultiplication,RelationalAlgebraOperations, GroupingandAggregation–ExtensionstoMapReduce.

UNITV	OTHERDATAANALYTICALFRAMEWORKS	17

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive QueryLanguage(HQL)–IntroductiontoPentaho,JAQL– IntroductiontoApache:Sqoop,DrillandSpark,Cloudera Impala–Introduction to NoSQLDatabases– Hbase and MongoDB.

TotalLectureHours	90Hours

TextBook(s)	
1	VigneshPrajapati, -Big Data Analytics with R and Hadoop‖, Packt Publishing, 2013.
2	UmeshR Hodeghatta, UmeshaNayak,-BusinessAnalyticsUsingR– APractical Approach‖, Apress,2017.
ReferenceBook(s)	
1	AnandRajaraman, JeffreyDavid Ullman, -Miningof Massive Datasets‖,Cambridge UniversityPress, 2012.
2	JeffreyD. Camm,James J.Cochran, MichaelJ. Fry,JeffreyW.Ohlmann, DavidR. Anderson, -Essentials of BusinessAnalytics‖, CengageLearning,second Edition, 2016
3	U. Dinesh Kumar,-Business Analytics:The Scienceof Data-Driven DecisionMaking‖, Wiley,2017.
4	A. Ohri, –R for BusinessAnalytics‖, Springer, 2012 7. Rui Miguel Forte, -Mastering PredictiveAnalyticswithR‖,PacktPublication,2015.
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		SocialNetworkAnalysis	L	T	P	C
Core/elective/Supportive		Elective:I	6	0	0	4
Pre- requisite		None	Syllabus		2021-22 Onward	

CourseObjectives

- Toexplainthemethodologiesusedinsocial networkanalysis

ExpectedCourseOutcomes

1	Understandabroad rangeof network conceptsand theories.	K2
2	Appreciatehow networkanalysiscancontributetoincreasingknowledgeaboutdiverse aspectsofsociety.	K2
3	Usearelationalapproachtoanswerquestionsofinteresttothem(i.e.beabletoapply 'networkthinking').	K3
4	Analysesocialnetwork datausingvarious softwarepackages.	K3
5	Presentresultsfromsocialnetworkanalysis,bothorallyandinwriting.	K5

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	CLUSTERINGANDCLASSIFICATION	17

Supervised Learning–Decisiontree- Naïve BayesianTextClassification-SupportVectorMachines - Ensemble of Classifiers – Unsupervised Learning – K-means Clustering – Hierarchical Clustering – PartiallySupervisedLearning–Markov Models –Probability-BasedClustering–VectorSpaceModel

UNITII	SOCIALMEDIAMINING	17

DataMiningEssentials–DataMiningAlgorithms-WebContentMining–LatentsemanticIndexing–AutomaticTopicExtraction–OpinionMiningandSentimentAnalysis–DocumentSentimentClassification

UNITIII	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIALNETWORKS	18

Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities inSocial Networks – Definition of Community – Evaluating Communities – Methods for CommunityDetection&Mining–ApplicationsofCommunityMiningAlgorithms–ToolsforDetectingCommunities–SocialNetworkInfrastructureandCommunities–DecentralizedOnlineSocial Networks–Multi-RelationalCharacterizationofDynamicSocialNetworkCommunities

UNIT IV	HUMANBEHAVIORANALYSIS AND PRIVACYISSUES	19

Understanding and Predicting Human Behavior for Social Communities – Use Data Management,InferenceandDistribution–EnablingNewHumanExperiences–RealityMining–ContextAwareness – Privacy in Online Social Networks – Trust in Online Environment – Trust Models BasedonSubjectiveLogic–TrustNetworkAnalysis–TrustTransitivityAnalysis–CombiningTrustand Reputation–TrustDerivationBasedonTrustComparisons–AttackSpectrumandCountermeasures.

UNITV	VISUALIZATIONANDAPPLICATIONSOFSOCIALNETWORKS	19

Graph Theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – VisualizingOnline Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node-LinkDiagrams–HybridRepresentations–Applications–CovertNetworks–CommunityWelfare–CollaborationNetworks–Co-CitationNetworks–RecommendationinSocialMedia:Challenges–

ClassicalRecommendationAlgorithms–RecommendationUsingSocialContext–Evaluating Recommendations.		
TotalLectureHours		**90 Hours**
TextBook(s)		
1	PeterMika, -Social networks and the SemanticWeb‖, Springer, 2007.	
2	BorkoFurht,—HandbookofSocialNetworkTechnologiesandApplications‖,Springer,2010.	
ReferenceBook(s)		
1	BingLiu,-Web Data Mining: ExploringHyperlinks, Contents, and UsageData (DataCentric SystemsandApplications)‖,Springer;SecondEdition,2011.	
2	RezaZafarani,MohammadAliAbbasi,HuanLiu,‖SocialMediaMining‖,Cambridge UniversityPress, 2014.	
3	GuandongXu,YanchunZhangandLinLi,—WebMiningandSocialNetworkingTechniques andapplications‖,Springer,2011	
4	DionGohandSchubertFoo,-Socialinformationretrieval systems:emerging technologiesand Applicationsforsearching theWebeffectively‖,IdeaGroup,2007.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		SoftwareAgents	L	T	P	C
Core/elective/Supportive		Elective:I	6	0	0	4
Pre-requisite		None	Syllabus		2021-22	
CourseObjectives					Onward	
• Toexplainthefundamentalsofagentsandagentprogrammingparadigms.						
• Toexplainabout agentsandsecurity						
ExpectedCourseOutcomes						
1	Understandingthefundamentals ofagents and agentprogrammingparadigms.					K2
2	Discussingthe basics ofjavaagents.					K2
3	Learningtheconceptsof multivalentsystems.					K2
4	Understandingtheconceptsofintelligentsoftwareagents.					K2
5	Understandingtheagentsandsecurity.					K2
K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create						
UNITI	AGENTS–OVERVIEW					16
UNITIAgentDefinition–AgentProgrammingParadigms–AgentVsObject–Aglet–Mobile Agents–AgentFrameworks–AgentReasoning						
UNITII	JAVAAGENTS					17
UNITIIIProcesses–Threads–Daemons–Components–JavaBeans–ActiveX–Sockets–RPCs–DistributedComputing–AgletsProgramming–JiniArchitecture–ActorsandAgents–Typedand ProactiveMessages						
UNITIII	MULTIAGENTSYSTEMS					19
InteractionbetweenAgents–ReactiveAgents–CognitiveAgents–InteractionProtocols–Agent Coordination–Agentnegotiation–AgentCooperation–AgentOrganization–Self-InterestedAgentsinElectronicCommerceApplications						
UNITIV	INTELLIGENTSOFTWAREAGENTS					19
InterfaceAgents–AgentCommunicationLanguages–AgentKnowledgeRepresentation–Agent Adaptability–Belief DesireIntension–MobileAgentApplications						
UNITV	AGENTSANDSECURITY					19
AgentSecurityIssues– MobileAgentsSecurity–ProtectingAgents againstMaliciousHosts–UntrustedAgent – BlackBoxSecurity–AuthenticationforAgents–SecurityIssues forAglets						
TotalLectureHours						90 Hours

TextBook(s)	
1	1.Bigus&Bigus,―ConstructingIntelligentagentswithJava‖,Wiley,2010.
2	2. Bradshaw,-Software Agents‖,MIT Press,2012.
ReferenceBook(s)	
1	Russel&Norvig, -ArtificialIntelligenceamodernapproach‖, Prentice Hall,1994.
2	Richard Murchand TonyJohnson, -Intelligent SoftwareAgents‖, PrenticeHall, 2000.
3	Michael Wooldridge,-AnIntroduction to Multi Agent Systems‖,John Wiley, 2002.
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		EthicalHacking	L	T	P	C
Core/elective/Supportive		SkillBasedSubject:3	6	0	0	3
Pre- requisite		None	Syllabus		2021-22	
CourseObjectives					Onward	

- Tointroducetheconceptsofsecurityandcariouskinds ofattacks
- Toexplainaboutsystemhackingandpenetrationtesting

ExpectedCourseOutcomes

1	Explaintheimportanceofsecurityandvarioustypes ofattacks	K2
2	Understandthe conceptsofscanningandsystemhacking	K2
3	Explainabout penetration testingand its methodology	K2
4	Identifythe various programminglanguagesusedbysecurityprofessional	K4

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	**IntroductionToHacking**	**18**

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – InformationGatheringMethodology–FootprintingTools–WHOISTools–DNSInformation Tools– Locatingthe NetworkRange–MetaSearchEngines.

UNITII	**ScanningAndEnumeration**	**18**

Introductionto Scanning – Objectives – Scanning Methodology – Tools – Introduction toEnumeration–EnumerationTechniques –EnumerationProcedure–Tools.

UNITIII	**SystemHacking**	**18**

Introduction–CrackingPasswords–PasswordCrackingWebsites–PasswordGuessing–Password CrackingTools–PasswordCrackingCountermeasures–EscalatingPrivileges–ExecutingApplications– Keyloggers and Spyware.

UNITIV	**ProgrammingForSecurityProfessionals**	**18**

ProgrammingFundamentals–Clanguage–HTML–Perl–WindowsOSVulnerabilities–Toolsfor Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools forIdentifyingVulnerabilities– Countermeasures

UNITV	**PenetrationTesting**	**18**

Introduction–SecurityAssessments–TypesofPenetrationTesting-PhasesofPenetrationTesting– Tools–ChoosingDifferentTypes ofPen-TestTools–PenetrationTestingTools.

TotalLectureHours	**90Hours**

TextBook(s)

1	EC-Council, ‑Ethical Hacking and Countermeasures: Attack Phases‖, CengageLearning,2010.
2	Jon Erickson,‑Hacking,2nd Edition: TheArt of Exploitation‖,No StarchPressInc., 2008.
3	Michael T. Simpson, Kent Backman, James E. Corley,‑Hands-OnEthicalHacking andNetworkDefense‖,CengageLearning,2013.

ReferenceBook(s)

1	PatrickEngebretson,‑TheBasicsof HackingandPenetration Testing –Ethical Hackingand PenetrationTesting MadeEasy‖,SecondEdition,Elsevier,2013.
2	RafayBoloch, ‑Ethical Hackingand Penetration TestingGuide‖, CRC Press,2014

	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low


Sixth
Semester

CourseCode		NaturalLanguageProcessing	L	T	P	C
Core/elective/Supportive		Core:10	6	0	0	4
Pre-requisite		None	Syllabus		2021-22	
CourseObjectives					Onward	

- Tointroducethefundamentalconceptsandtechniquesofnaturallanguage processing(NLP)

ExpectedCourseOutcomes		
1	Understandthefundamentalconceptsandtechniquesofnaturallanguageprocessing (NLP)	K2
2	Understandingofthemodels andalgorithmsinthe fieldofNLP.	K2
3	Demonstratethe computational propertiesofnatural languagesandthecommonlyused algorithmsforprocessinglinguisticinformation.	K2
4	Understandingsemanticsandpragmaticsoflanguagesforprocessing	K2

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	IntroductiontoNLP	13

Introduction:applicationofNLPtechniquesandkey issues-MTgrammercheckers-dictation–document generation- NL interfaces- Natural language processing key issues- the different analysislevelusedforNLP:morpho-lexical-syntactic-semantic-pragmatic-markup(TEI,UNICODE)-finite
stateautomata-Recursiveand augmentedtransitionnetworks-openproblems

UNITII	LexicalLevel	14

Lexicallevel:errortolerantlexicalprocessing(spellingerrorcorrection)-transducersforthedesignofmorphologicanalyzersfeatures-towardssyntax: part-of-speechtagging(BRILL,HMM)-efficient representationsforlinguisticresources(lexica, grammars,….)triesandfinitestateautomata.

UNITIII	SyntacticLevel	16

Syntacticlevel:grammars(eg.formal/Chomskyhierarchy,DCSGs,systematiccase,unification,stochastic)-parsing(top-down,bottomup,char(earlyalgorithm),CYKalgorithm)-automatedestimationofprobabilisticmodelparameters(inside-outsidealgorithm)-dataorientedparsing-grammarformalismsandtreebanks-efficientpatsingforcontext-freegrammars(CFGs)-statistcial parsingandprobabilisticCFGs(PCFGs)-lexicilizedPCFGse.

UNITIV	SemanticLevel	15

Semanticlevel:logicalforms-ambiguityresolution-semanticnetworkandparsers-procedural semantics-montaguesemantics-vectorspaceapproaches-distributionalsemantics-lexicalsemanticsandword sensedisambiguation-compositional semanticssemantic rolelabelingandsematic parsing

UNITV	PragmaticLEvel	17

Pragmaticlevel:knowledgerepresentation-reasoning-plan/goalrecognition–speechacts/intentions – belief models- discourse- reference. Natural language generation:content determination – sentenceplanning- surfacerealization,subjectivity and sentiment analysis: information extraction – automaticsummarization-informationretrivevalandquestionanswering –namedentityrecognitionand relation extraction – IEusingsequencelabeling-machinetransilation:basicissuesinMT-statisticaltranslation-wordalignment-phrase-baseed translationand synchronousgrammars.

TotalLectureHours	75Hours

TextBook(s)		
1	DanielJandJamesH.Martin,‖speechandlanguageprocessing‖anintroductiontonatural languageprocessing,computationallinguistcs&speechrecognition‖prenticehall,2009.	
ReferenceBook(s)		
1	LanHWrittenandElbef,MarkA.Hall,‖datamining:practicalmachinelearningtoolsand techiniques‖,MorganKaufmann,2013	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		NaturalLanguageProcessingLab	L	T	P	C
Core/elective/Supportive		CoreLab :7	0	0	5	4
Pre-requisite		None	Syllabu		2021-22	
CourseObjectives					Onward	
• Tointroducethefundamentalconceptsandtechniquesofnaturallanguage processing(NLP)						
ExpectedCourseOutcomes						
1	Understandthefundamentalconceptsandtechniquesofnaturallanguageprocessing (NLP)					K2
2	Understandingofthemodels andalgorithmsinthe fieldofNLP.					K2
3	Demonstratethe computational propertiesofnatural languagesandthecommonlyused algorithmsforprocessinglinguisticinformation.					K2
4	Understandingsemanticsandpragmaticsoflanguagesforprocessing					K2
K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create						
LISTOFPROGRAMS						
1. Implementingword similarity 2. Implementingsimpleproblemsrelatedtoworddisambiguation 3. Simpledemonstrationofpartofspeechtagging. 4. Lexicalanalyzer. 5. SemanticAnalyzer. 6. SentimentAnalysis.						
TotalLectureHours						90Hours
TextBook(s)						
1	DanielJandJamesH.Martin,‖speechandlanguageprocessing‖anintroductiontonatural languageprocessing,computationallinguistcs&speechrecognition‖prenticehall,2009					
ReferenceBook(s)						
1	LanHWrittenandElbef,MarkA.Hall,‖datamining:practicalmachinelearningtoolsand techiniques‖,MorganKaufmann,2013					
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)					
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview					
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview					
CourseDesignedby :						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	L	L	L	L	L	L
CO2	S	M	M	L	L	L	L	L	L	L
CO3	S	S	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		ProjectWorkLab	L	T	P	C
Core/Elective/Supportive		Core-11	0	0	4	6
Pre- requisite		Studentsshouldhavethestrongknowledgeinany oneof theprogramminglanguages in this course.	Syllabus version		2021-22 Onward	

CourseObjectives

- Tounderstandand selectthetask basedontheircoreskills.
- Togettheknowledge aboutanalyticalskillforsolvingtheselectedtask.
- Togetconfidencefor implementingthetaskandsolvingthe realtimeproblems.
- Expresstechnicalandbehavioralideasandthoughtinoralsettings.
- Prepareandconductoralpresentations

ExpectedCourseOutcomes

Onthesuccessful completionofthecourse,student willbe ableto:

1	Formulate a real world problemanddevelopitsrequirementsdevelopa designsolution forasetofrequirements	K3
2	Testandvalidatetheconformanceofthedevelopedprototypeagainsttheoriginal requirementsof theproblem	K5
3	Workasaresponsiblememberandpossiblyaleaderofateamindevelopingsoftware solutions	K3
4	Expresstechnicalideas,strategiesandmethodologiesinwrittenform.Self-learn new tools,algorithmsandtechniquesthatcontributetothesoftwaresolutionof the project	K1-K4
5	Generatealternativesolutions,comparethemandselecttheoptimumone	K6

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

Aimoftheproject work

1. Theaimof theprojectworkis toacquirepracticalknowledgeonthe implementationoftheprogrammingconcepts studied.

2. Each student should carry out individually one project work and it may be a work using thesoftwarepackages that theyhavelearned or theimplementation of concepts from thepapers studiedorimplementation of anyinnovative ideafocusing on application oriented concepts.

3. The project work should be compulsorily done in the college only under the supervision of thedepartmentstaff concerned.

VivaVoce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) andExternalExaminers,afterdulyverifyingtheAnnexureReport availableinthe College,foratotal of 150 marks at thelast dayofthe practical session.

2. Out of 150 marks, 60 marks for CIA and 90 for CEE (60 evaluation of project report + 30 Viva Voce).

ProjectWork Format

PROJECTWORK

TITLEOFTHEDISSERTATION

Bonafide Work Done

bySTUDENT

NAMEREG.NO.

Dissertationsubmittedin partialfulfillmentofthe requirementsfor theawardof
<NameoftheDegree>
ofBharathiar University,Coimbatore-46.

CollegeLogo

Signatureof theGuide Signature of the
HODSubmittedfortheViva-VoceExaminationheldon _____

InternalExaminer External
ExaminerMonth– Year

CONTENTS

3. SystemDesign andDevelopment

3.1 FileDesign

3.2 InputDesign

3.3 OutputDesign

3.4 DatabaseDesign

3.5 SystemDevelopment

3.5.1 DescriptionofModules(Detailedexplanation abouttheprojectwork)

4. TestingandImplementation

5. ConclusionBibliographyAppendices

A. DataFlowDiagram

B. TableStructure

C. SampleCoding

D. Sample Input

E. SampleOutput

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	L	L	L	L	L
CO2	S	S	S	S	M	L	L	L	L	L
CO3	S	S	S	S	M	M	M	L	L	L
CO4	S	S	S	S	M	M	M	L	L	L
CO5	S	S	S	S	M	M	M	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		ArtificialNeuralNetworkandFuzzySystems	L	T	P	C
Core/elective/Supportive		Elective:II	5	0	0	4
Pre-requisite		None	Syllabu		2021-22	
CourseObjectives					Onward	

- Tointroducetheconcepts ofartificial neuralnetworks andfuzzysystems
- To explain thebasic mathematical elements ofthetheoryof fuzzysets.

ExpectedCourseOutcomes

1	Explaintheconceptsof neuralnetworksand ,fuzzylogic	K2
2	Understandingof thebasic mathematicalelements ofthe theoryoffuzzysets.	K2
3	Understandingthe differencesandsimilaritiesbetween fuzzysetsand classicalsets theories	K2
4	Solveproblems that areappropriatelysolved byneural networksand fuzzylogic	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	Introduction	14

Basicconcepts-singlelayerperceptron-Multilayerperceptron-Adaline-Madaline-Learningrules-Supervisedlearning-Backpropagationnetworks-Trainingalgorithm,Advancedalgorithms-Adaptive network-Radialbasis networkmodularnetwork-Applications

UNITII	Learning	16

Introduction-unsupervisedlearning-Competitivelearningnetworks-Kohonenselforganisingnetworks-Learning vector quantisation - Hebbian learning – Hopfield network-Content addressablenature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem-Adaptiveresonancetheory–BidirectionalAssociative Memory-Principlecomponent Analysis

UNITIII	FuzzySets	16

Introduction–crispsetsanoverview–thenotionoffuzzysets–Basicconceptsoffuzzysets–classicallogicanoverview–Fuzzylogic.Operationsonfuzzysets-fuzzycomplement–fuzzyunion –fuzzyintersection –combinationsofoperations–general aggregationoperations

UNITIV	Relations	14

Crispandfuzzy relations–binary relations–binary relationsonasingleset–equivalenceandsimilarityrelations–Compatibilityortolerancerelations–orderings–Membershipfunctions–methodsof generation – defuzzification methods

UNITV	TreeLearning	15

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress,Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountainclustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: FeedbackControl Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation throughReal –Time RecurrentLearning.

TotalLectureHours	75Hours

TextBook(s)	
1	-NeuroFuzzyand Soft computing‖, JangJ.S.R.,Sun C.T and Mizutani E–Pearson education, 2004
2	‖FundamentalsofNeuralNetworks‖,LaureneFauseett,PrenticeHallIndia,NewDelhi,1994.
ReferenceBook(s)	
1	‖FuzzyLogicEngineeringApplications‖,TimothyJ.Ross,McGrawHill,NewYork,1997.
2	-Neural networks,Fuzzylogics,andGeneticalgorithms‖, S.Rajasekaranand G.A.VijayalakshmiPaiPrenticeHallof India,2003
3	‖FuzzySetsandFuzzyLogic‖,GeorgeJ.KlirandBoYuan,PrenticeHallInc.,New Jersey,1995
4	-Principlesof SoftComputing‖S.N.Sivanandam,S.N.DeepaWileyIndia PvtLtd.
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
CourseDesignedby :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		WebApplicationSecurity	L	T	P	C
Core/elective/Supportive		Elective:II	5	0	0	4
Pre-requisite		None	Syllabus		2021-22 Onward	

CourseObjectives

- Tointroducethe conceptsof securityin webapplications
- Toexplainabout crimeprevention androutinedutiesinapolicestation

ExpectedCourseOutcomes

1	Illustrate abouttheconceptofHTML,DHTML,CSSandJavaScript	K2
2	Explainthehistory,characteristics,technologies,concepts,usageinweb2.0andweb 3.0	K2
3	Applythe core concepts ofwebapplicationstocreatewebpages	K3
4	Applytheconcepts ofservers sideprogramming	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	**IntroductiontoWeb**	**14**

Datawith URL- HTML - DHTML: Cascading Style Sheets, Common GatewayInterface: ProgrammingCG!Scripts-HTMLForms-:-CustomDatabaseQueryScripts-ServerSideIncludes-Server _securityissues.

UNITII	**XHTML**	**13**

XHTML:Introduction,CSS-Scriptinglanguages-JavaScript:Controlstatements,Functions,Arrays, Objects-DOM- Aiaxenablerichinternetapplications.

UNITIII	**ServerSideProgramming**	**15**

ServersideProgramming-Activeserverpages-Javaserverpages-JavaServlets:Servletcontainer-Exceptions-SessionsandSessionTracking_-UsingServletcontext-DynamicContentGeneration-ServletChainingandCommunications.

UNITIV	**HTML5**	**16**

HTMLreview,Featuredetection,TheHTML5new Elements,Canvas,Videoandaudio,Web storage,Geolocation,OfflineWebpages,Microdata,HTML5APLS,MigratingfromHTML4toHTML5,CSS 3 .

UNITV	**WEB2.0**	**17**

WEB2.0-
HISTORY,characteristics,technologies,concepts,usage,web2.0ineducation,philanthropy,socialwork.Web3.0-Theory-andhistoryunderstanding.basicwebartifactsandapplications,implementation.
MS share point - Share point 2013 overview ,share (Put social to work ,Share your stuff, Take sharepoint on the go), Discover (find experts, discover answers, find what you are looking for), Manage(cost,risk, time)

TotalLectureHours	**75 Hours**

TextBook(s)

1	1.Deitel,DeitelandNeita,-InternetandWorldWide_Web-Howtoprogramll,PearsonEducationAsia, 4th Edition, 2009.
2	ElliotteRustyHerold, -JavaNetworkProgrammingII,O'ReillyPublications,3rdEdition,2004.

ReferenceBook(s)		
1	JeffyDwight,MichaelErwinand RobertNikes-USINGCGIII, PH.IPublications,1997	
2	JasonHunter,WilliamCrawford-JavaServletProgrammingO'ReillyPublications,2nd Edition, 2001.	
3	EricLaddandJimO'Donnell,etal,-USINGHTML4,XML, andJAVA1.2,PrenticeHall, 2003	
4	JeremyKeith,-Html5forwebdesigners	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		FundamentalsofRobotics	L	T	P	C
Core/elective/Supportive		Elective:II	5	0	0	4
Pre-requisite		None	Syllabus		2021-22 Onward	

CourseObjectives

- Tointroducethebasicconceptsofroboticsanditscharacteristics

ExpectedCourseOutcomes

1	Describethedifferentphysicalformsofrobotarchitectures.	K2
2	Explainabouttheactuatorsandcharacteristicsofactuatingsystem	K2
3	Demonstratetomathematicallydescribea kinematicrobotsystem.	K2
4	Analyzemanipulationandnavigationproblemsusingknowledgeofcoordinateframes, kinematics,optimization,control,anduncertainty.	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	**IntroductiontoRobotics**	**14**

IntroductiontoRobotics:Classification,Components,Characteristics,Applications.

UNITII	**RoboticsKinematics**	**16**

Robotics Kinematics: Position Analysis, Robots as Mechanisms, Matrix Representation, TransformationMatrices, ForwardandInverseKinematics.

UNITIII	**Actuators**	**15**

Actuators:CharacteristicsofActuatingSystems, ActuatingDevicesandControl.

UNITIV	**Sensors**	**16**

Sensors:SensorCharacteristics,DescriptionofDifferentSensors.Dynamiccharacteristics-speedofmotion,loadcarryingcapacity&speedofresponse-Sensors-Internal sensors:Positionsensors,& Velocitysensors,External sensors:Proximitysensors, Tactile Sensors, & ForceorTorquesensors.

UNITV	**Kinematics**	**14**

Kinematics-ManipulatorsKinematics,RotationMatrix,HomogenousTransformationMatrix, D-Htransformationmatrix,D-Hmethodofassignmentofframes.DirectandInverse Kinematicsforindustrialrobots. Differential Kinematics forplanar serialrobots

TotalLectureHours	**75Hours**

TextBook(s)

1	SaeedB. Niku, IntroductiontoRoboticsAnalysis,Application,PearsonEducationAsia,2001

ReferenceBook(s)

1	R.K.MittalandIJNagrath, RoboticsandControl,TMH, 2003.
2	Computational Intelligence,DavisPoole,AlanMackwath,RandyCoehel,OxfordUniversity Press1998.
3	IndustrialRobotics/GrooverMP/McGraw Hill
4	IntroductiontoRobotics /JohnJ.Craig/Pearson

RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)

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

CourseDesignedby :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		EmbeddedSystems	L	T	P	C
Core/elective/Supportive		Elective:III	5	0	0	4
Pre-requisite		None	Syllabus		2021-22	
CourseObjectives					Onward	
• Tointroducetheconceptsofembeddedsystemsanditsarchitecture						
ExpectedCourseOutcomes						
1	Understandhardwareandsoftwaredesignrequirementsofembeddedsystems.					K2
2	Explainaboutthearchitectureofmicroprocessorandoperatingsystemsinembedded systems					K2
3	Analyzetheembeddedsystems'specificationand developsoftwareprograms.					K4
4	EvaluatetherequirementsofprogrammingEmbeddedSystems,relatedsoftware architecturesandtoolchainforEmbeddedSystems.					K5
K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create						
UNITI	IntroductiontoEmbeddedSystem					15
ExamplesofEmbeddedSystems–TypicalHardware–Memory–Microprocessors–Busses–Direct MemoryAccess– Introductionto8051Microcontroller–Architecture-Instructionset –Programming.						
UNITII	Microprocessor					16
MicroprocessorArchitecture–InterruptBasics–TheShared-Dataproblem–InterruptLatency-Round–RobinArchitecture-Round–RobinwithInterruptsArchitecture-Function-QueueScheduling Architecture–Real-TimeOperatingSystemsArchitecture –SelectionofArchitecture.						
UNITIII	Semaphores					14
TasksandTaskStates–TasksandData–SemaphoresandSharedData–SemaphoreProblems–Semaphorevariants.						
UNITIV	MessageQueues&RTOS					15
MessageQueues–Mailboxes–Pipes–TimerFunctions–Events–MemoryManagement–InterruptRoutinesin RTOS Environment. RTOSdesign–Principles–EncapsulationSemaphoresandQueues–HardReal-TimeSchedulingConsiderations – Saving MemorySpace– SavingPower.						
UNITV	Hostmachine&Testing					15
HostandTargetMachines–Linker/LocatorforEmbeddedSoftware-GettingEmbeddedSoftwareintothe Target System. TestingonyourHostMachine – InstructionSetSimulators–LaboratoryToolsusedforDebugging.						
TotalLectureHours						75Hours
TextBook(s)						
1	The8051Microcontroller Architecture,Programming&Applications,KennethJ.Ayala,PenramInternational.					
2	AnEmbeddedSoftwarePrimer,DavidE.Simon,PearsonEducation,2005.					
	ReferenceBook(s)					
1	Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-HillEducation,2008					

	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		PrinciplesofSecureCoding	L	T	P	C
Core/elective/Supportive		Elective:III	5	0	0	4
Pre-requisite		None	Syllabus		2021-22 Onward	

CourseObjectives

- Tounderstandthesecure softwaredevelopmentlifecycle
- Toexplain about thesecurecodingtechniques

ExpectedCourseOutcomes

1	Explainaboutthesecure softwaredevelopmentlifecycle	K2
2	Understandthesecurecodingtechniques	K2
3	Demonstratethethreatmodelingprocessand benefits	K2
4	Explainaboutthedatabaseandweb specificissues	K2

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	IntroductiontoSecurity	15

Need for secure systems: Proactive Security development process, Secure Software DevelopmentCycle (S-SDLC) , Security issues while writing SRS, Design phase security, Development Phase, TestPhase,MaintenancePhase,WritingSecureCode-BestPracticesSD3(Securebydesign,defaultand deployment),Securityprinciplesand SecureProductDevelopmentTimeline

UNITII	Threatmodellingprocessanditsbenefits	14

ThreatmodellingprocessanditsbenefitsIdentifyingtheThreatsbyUsingAttackTreesandrating threatsusingDREAD,RiskMitigationTechniquesandSecurityBestPractices.Securitytechniques,authentication,authorization. Defense in Depthand Principle of Least Privilege.

UNITIII	SecureCodingTechniques	16

SecureCodingTechniques:ProtectionagainstDoSattacks,ApplicationFailureAttacks,CPUStarvationAttacks,InsecureCodingPracticesInJavaTechnology.ARPSpoofinganditscountermeasures. Buffer Overrun-Stack overrun, Heap Overrun, Array Indexing Errors, Format StringBugs. Security Issues in C Language: String Handling, Avoiding Integer Overflows and UnderflowsandTypeConversionIssues-MemoryManagementIssues,CodeInjectionAttacks,Canarybased counter measures using Stack Guard and Propolice. Socket Security, Avoiding Server Hijacking,SecuringRPC.

UNITIV	DatabaseandWeb-specificissues	16

Database and Web-specific issues: SOL Injection Techniques and Remedies, Race conditions, Time ofCheckVersusTimeofUseanditsprotectionmechanisms.ValidatingInputandInterprocessCommunication,SecuringSignalHandlersandFileOperations.XSSscriptingattackanditstypes-PersistentandNonpersistentattackXSSCountermeasuresandBypassingtheXSSFilters.

UNITV	TestingSecureApplications	14

TestingSecureApplications: Securitycodeoverview, securesoftwareinstallation.TheRole ofthe Security Tester, Building the Security Test Plan. Testing HTTP- Based Applications, Testing File-BasedApplications, TestingClients with Rogue**Servers**

TotalLectureHours	75 Hours

TextBook(s)

1	WritingSecureCode,MichaelHowardandDavid LeBlanc,MicrosoftPress,2ndEdition,2004

ReferenceBook(s)		
1	ProgrammingPHP,RasmusLerdorfandLevinTatroe,O_Reilly,2002	
2	CorePythonProgramming,WesleyJ.Chun, PrenticeHall,2001	
3	Perl:TheComplete Reference,2nd Edn,MartinC. Brown,TMH, 2009	
4	MySQL:TheComplete Reference,2nd Edn,VikramVaswani,TMH,2009	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L

*S-Strong;M-Medium;L-Low

CourseCode		OpenSourceSoftware	L	T	P	C
Core/elective/Supportive		Elective:III	5	0	0	4
Pre-requisite		None	Syllabus		2021-22 Onward	

CourseObjectives

- Toexplain theneed andimportanceofopen sourcesoftware
- Tointroducethevariousopensourcesoftware‘slike Linux,MySQL,PHP andPython

ExpectedCourseOutcomes

1	Explainaboutthe needand importanceofopen sourcesoftware	K2
2	Demonstratetheconceptsofopensourcesoftware‘s	K2
3	Applytheprogrammingconstructsof MySQL,PHP,PythonandPERLtocreate programs	K3
4	Developsmallprograms usingopensourcesoftware‘s	K3

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

UNITI	**Introductiontoopensources**	**15**

Introduction to open sources–Need of open sources–advantages of open sources–application of opensources. Open source operating systems: LINUX: Introduction – general overview –Kernel mode andusermode–process–advancedconcepts–scheduling–personalities–cloning–signals–developmentwith Linux.

UNITII	**MySQL**	**15**

MySQL:Introduction–settingupaccount–starting,terminatingandwritingyourownSQLprograms-recordselectionTechnology–workingwithstrings–DateandTime–sortingQueryresults–generatingsummary–workingwith meta data–usingsequences– MySQLand Web.

UNITIII	**PHP**	**16**

PHP: Introduction–programming in web environment–variables- constants–data types –operators – statements – functions – arrays – OOP – string manipulations and regular expression – file handlinganddatastorage–PHPandSQLdatabase–PHPandLDAP–PHPconnectivity–sendingand receivingE-mails –debugginganderror handling– security–templates

UNITIV	**Python**	**15**

Syntaxandstyle–pythonobjects–numbers–sequences–strings–listsandtuples–dictionaries–conditionalloops–files–inputandoutput–errorsandexceptions–functions–modules–classesandOOP – execution environment

UNITV	**Pearl**	**14**

Pearlbackgrounder–pearloverview–pearlparsingrules–variablesanddata–statementsandcontrolstructures– subroutines-,packages andmodules– working withfiles– data manipulation.

TotalLectureHours	**75 Hours**

TextBook(s)

1	TheLinuxKernelBook,RemyCard,EricandFrank Mevel,WileyPublications2003
2	MySQLBible, SteveSuchring, JohnWiley2002.

ReferenceBook(s)

1	ProgrammingPHP,RasmusLerdorfandLevinTatroe,O_Reilly,2002
2	CorePythonProgramming,WesleyJ.Chun, PrenticeHall,2001

3	Perl:TheComplete Reference,2nd Edn,MartinC. Brown,TMH, 2009	
4	MySQL:TheComplete Reference,2nd Edn,VikramVaswani,TMH,2009	
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2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low

CourseCode		CapstoneProjectWorkPhaseII	L	T	P	C
Core/elective/Supportive		SkillBasedSubject:4	0	0	3	3
Pre- requisite		• StudentsshouldhavecompletedCapstoneProjectWork Phase –I • Strong coding skills in any oneprogrammingpaper	Syllabus version		2021-22 Onwards	

CourseObjectives

- Tounderstandand selectthetask basedontheircoreskills.
- Togettheknowledge aboutanalyticalskillforsolvingtheselectedtask.
- Togetconfidencefor implementingthetaskandsolvingthe realtimeproblems.

ExpectedCourseOutcomes

Onthesuccessful completionofthecourse,student willbe ableto:

1	Selectappropriateinput,output,formandtabledesign	K3
2	Designcodetomeettheinputrequirementsandtoachievetherequiredoutput	K6
3	Composeaprojectreportincorporatingthefeaturesof theproject	K6

K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create

Aimoftheproject work

1. Theaimof theprojectworkis toacquirepracticalknowledgeonthe implementationoftheprogrammingconcepts studied.

2. Each student should carry out individually one project work and it may be a work using thesoftware packages that they have learned or the implementation of concepts from the papers studiedorimplementation of anyinnovative ideafocusing on application oriented concepts.

3. Theprojectwork should be compulsorilydonein thecollegeonlyunderthe supervision of thedepartmentstaff concerned.

VivaVoce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) andExternalExaminers,afterdulyverifyingtheAnnexureReport availableinthe College,foratotal of75marks at the last dayof the practical session.

2. Outof75marks, 45 marksforproject reportand 30 MarksforVivaVoce.

ProjectWork Format

PROJECTWORK

TITLEOFTHEDISSERTATION

Bonafide Work Done

bySTUDENT

NAMEREG.NO.

Dissertationsubmittedin partialfulfillmentofthe requirementsfor theawardof

<NameoftheDegree>

ofBharathiar University,Coimbatore-46.

CollegeLogo

Signatureof theGuide Signature of the

HODSubmittedfortheViva-VoceExaminationheldon _____

InternalExaminer External ExaminerMonth– Year

CONTENTS

1.1 OrganizationProfile

1.2 SystemSpecification

1.2.1 HardwareConfiguration

1.2.2 SoftwareSpecification

2. SystemStudy

2.1 ExistingSystem

2.1.1 Drawbacks

2.2 ProposedSystem

2.2.1 Features

3. SystemDesign andDevelopment

3.1 FileDesign

3.2 InputDesign

3.3 OutputDesign

3.4 DatabaseDesign

3.5 SystemDevelopment

3.5.1 DescriptionofModules(Detailedexplanation abouttheprojectwork)

4SoftwareTestingandImplementationC

onclusion

Bibliography

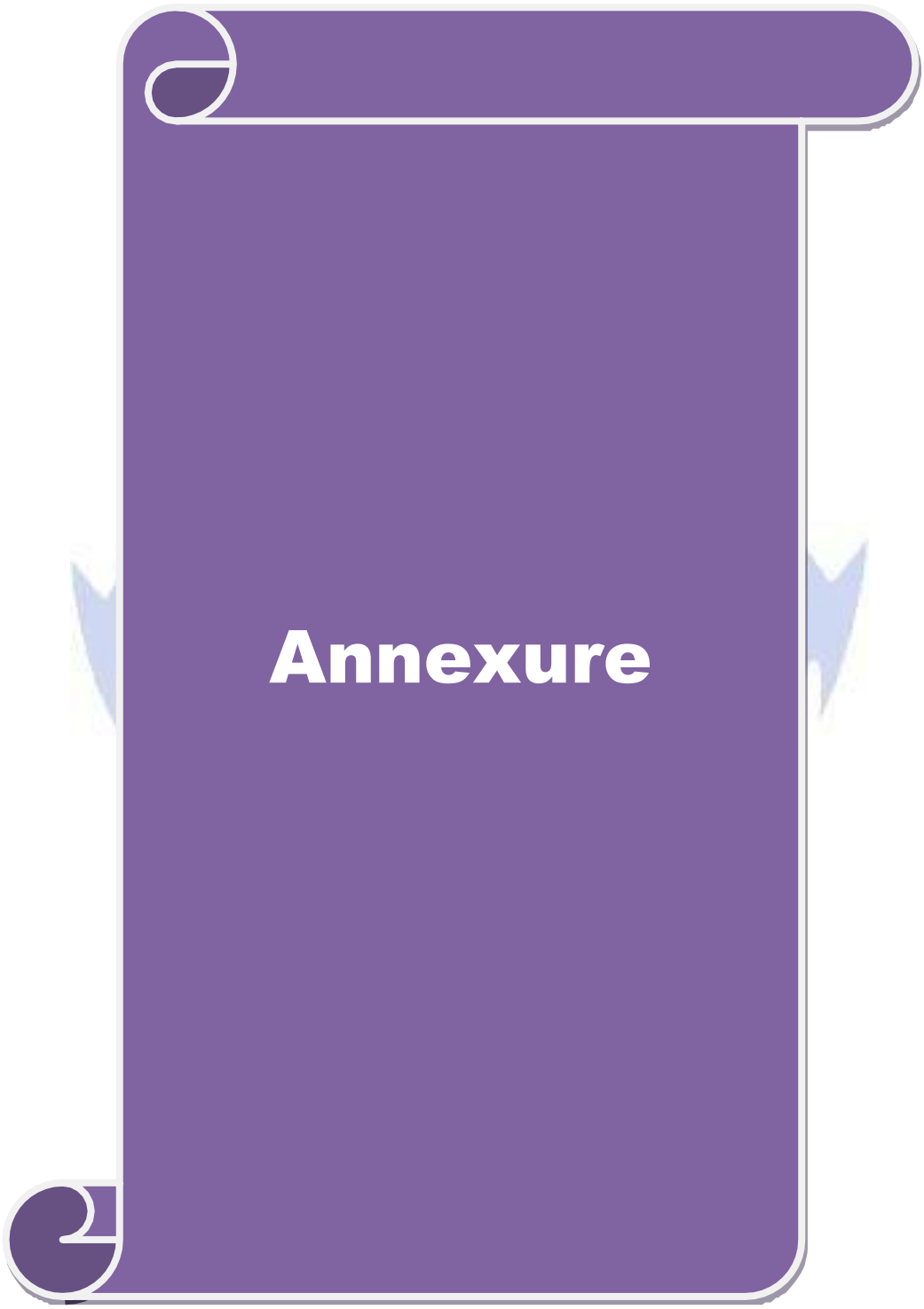
Appendices

A.DataFlow Diagram

B. TableStructure C. SampleCoding D. Sample Input E. SampleOutput

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**L**	**L**

*S-Strong;M-Medium;L-Low


Annexure

B.Sc.ArtificialIntelligenceandMachineLearning

Syllabus
(Witheffectfrom 2021-22)

ProgramCode:26G

DEPARTMENTOFARTIFICIALINTELLIGENCEANDMACHINELEARNING
BharathiarUniversity
(AStateUniversityAccreditedwith"a"byNAAACand13th Rank among Indian Universities by MHRD-NIRF)Coimbatore641046, INDIA