**B.Sc.ComputerSciencewithDataAnalytics**

Syllabus

AFFILIATEDCOLLEGES

**ProgramCode:\*\*\***

**2020–2021onwards**



**BHARATHIARUNIVERSITY**

**(A State University, Accredited with “A” Grade by NAAC,Ranked13thamongIndianUniversitiesby MHRD-NIRF,**

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

**Coimbatore-641046,TamilNadu, India**



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| **ProgrammeEducationalObjectives(PEOs)** | |
| **The B.Sc. Computer Science with Data Analytics** program describe accomplishments thatgraduates are expectedto attainwithin fiveto sevenyears after graduation. | |
| **PEO1** | Develop in depth understanding of the key technologies in data science andbusiness analytics: data mining, machine learning, visualization techniques,predictivemodeling, andstatistics |
| **PEO2** | ApplyprinciplesofDataSciencetotheanalysis of businessproblem |
| **PEO3** | Demonstrate knowledge of statistical data analysis techniques utilized inbusinessdecision making.. |



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| **ProgrammeSpecificOutcomes(PSOs)** | |
| **Afterthesuccessfulcompletion ofB.Sc.ComputerSciencewithDataAnalytics**programthestudents areexpectedto | |
| **PSO1** | Imparteducationwithdomainknowledgeeffectivelyandefficientlyinparwith  theexpectedqualitystandardsfor Dataanalyst professional. |
| **PSO2** | Abilitytoapplythemathematical,technicalandcriticalthinkingskillsinthedisciplineofData analyticsto findsolutions forcomplexproblems. |
| **PSO3** | Abilitytoengageinlife-longlearningandadoptfastchangingtechnologyto  prepareforprofessional development. |
| **PSO4** | Expose the students tokey technologies in data science and businessanalytics:data mining, machine learning, visualization techniques, predictive modeling, andstatistics. |
| **PSO5** | Inculcateeffectivecommunicationskillscombinedwithprofessional&ethical  attitude. |



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| **ProgrammeOutcomes(POs)** | |
| **On successfulcompletion ofthe B.Sc.ComputerSciencewithDataAnalytics** | |
| **PO1** | Exhibitgood **domain knowledge** and completes the assigned responsibilities  effectivelyand efficientlyin par withtheexpected qualitystandards. |
| **PO2** | Apply**analytical andcriticalthinking**toidentify,formulate,analyze,andsolve  complex problemsinordertoreachauthenticatedconclusions |
| **PO3** | **Designanddevelopresearchbasedsolutions**forcomplexproblemswithspecifiedneedsthroughappropriateconsiderationforthepublichealth,safety,cultural,societal,  andenvironmentalconcerns. |
| **PO4** | Establishtheabilityto**Listen,read,proficientlycommunicateandarticulate**  **complexideas** withrespecttotheneedsandabilitiesofdiverse audiences. |
| **PO5** | **Deliverinnovativeideastoinstigatenew businessventures**andpossessthequalities  ofa goodentrepreneur |
| **PO6** | Acquirethequalitiesofa**goodleaderandengagein efficientdecisionmaking.** |
| **PO7** | Graduateswillbeabletoundertakeanyresponsibilityasan**individual/memberof**  **multidisciplinaryteamsandhaveanunderstandingofteamleadership** |
| **PO8** | Functionass**ociallyresponsibleindividual**withethicalvaluesandaccountabletoethicallyvalidateanyactionsordecisionsbeforeproceedingandactivelycontributeto  thesocietalconcerns. |
| **PO9** | Identifyand**addressowneducationalneedsi**nachangingworldinwayssufficientto  maintainthecompetenceandtoallowthemtocontributetotheadvancementofknowledge |
| **PO10** | **Demonstrateknowledgeandunderstandingofmanagementprinciplesa**ndapply  thesetoone ownwork tomanageprojectsand inmultidisciplinaryenvironment. |



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| **Course**  **Code** | **TitleoftheCourse** | **Credits** | **Hours** | | **Maximummarks** | | |
|  |  |  | **Theory** | **Practical** | **CIA** | **ESE** | **Total** |
| **FIRSTSEMESTER** | | | | | | | |
|  | Language–I | 4 | 6 |  | 25 | 75 | 100 |
|  | English–I | 4 | 6 |  | 25 | 75 | 100 |
|  | Core1:ProgramminginC | 4 | 4 |  | 25 | 75 | 100 |
|  | CoreLab1:ProgrammingLab–C | 4 |  | 3 | 40 | 60 | 100 |
|  | Core2:Datastructures | 4 | 4 |  | 25 | 75 | 100 |
|  | Allied1:IntroductiontoLinear  algebra | 4 | 5 |  | 25 | 75 | 100 |
|  | EnvironmentalStudies# | 2 | 2 |  |  | 50 | 50 |
|  | **Total** | **26** | **27** | **3** | **165** | **485** | **650** |
| **SECONDSEMESTER** | | | | | | | |
|  | Language–II | 4 | 6 |  | 25 | 75 | 100 |
|  | English– II | 4 | 6 |  | 25 | 75 | 100 |
|  | Core3:Programmingin C++ | 4 | 5 |  | 25 | 75 | 100 |
|  | CoreLab2:ProgrammingLab–  C++ | 4 |  | 4 | 40 | 60 | 100 |
|  | CoreLab3:InternetBasics Lab | 2 |  | 2 | 20 | 30 | 50 |
|  | Allied2:DiscreteMathematics | 4 | 5 |  | 25 | 75 | 100 |
|  | ValueEducation –HumanRights  # | 2 | 2 |  |  | 50 | 50 |
|  | **Total** | **24** | **24** | **6** | **160** | **440** | **600** |
| **THIRDSEMESTER** | | | | | | | |
|  | Core4:JAVAProgramming | 4 | 6 |  | 25 | 75 | 100 |
|  | CoreLab4: JAVAProgramming  Lab | 4 |  | 5 | 40 | 60 | 100 |
|  | Core5:DatabaseManagement  Systems | 4 | 6 |  | 25 | 75 | 100 |
|  | Allied 3: Data CommunicationandNetworks | 4 | 6 |  | 25 | 75 | 100 |
|  | SkillbasedSubject1 :Data  Visualization | 3 | 5 |  | 20 | 55 | 75 |
|  | Tamil @/ Advanced Tamil(OR)Non-majorelective-1(Yoga  for Human Excellence)# /Women‟sRights# | 2 | 2 |  |  | 50 | 50 |
|  | **Total** | **21** | **25** | **5** | **135** | **390** | **525** |
| **FOURTHSEMESTER** | | | | | | | |



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|  | Core6:PythonProgramming | 4 | 6 |  | 25 | 75 | 100 |
|  | Core7:DataWarehousingand  DataMining | 4 | 6 |  | 25 | 75 | 100 |
|  | CoreLab5:Python  ProgrammingLab | 4 |  | 6 | 40 | 60 | 100 |
|  | Allied4:DeepLearning | 4 | 6 |  | 25 | 75 | 100 |
|  | SkillBasedSubject2:Capstone  ProjectWorkPhase I | 3 |  | 4 | 30 | 45 | 75 |
|  | Tamil @/ Advanced Tamil(OR)Non-majorelective–II  (GeneralAwareness)# | 2 | 2 |  |  | 50 | 50 |
|  | **Total** | **21** | **20** | **10** | **145** | **380** | **525** |
| **FIFTHSEMESTER** | | | | | | | |
|  | Core8:RProgramming | 4 | 6 |  | 25 | 75 | 100 |
|  | CoreLab6:RProgrammingLab | 4 |  | 6 | 40 | 60 | 100 |
|  | Core9:BigDataAnalytics | 4 | 6 |  | 25 | 75 | 100 |
|  | Elective- I  BusinessDataAnalytics/SocialNetwork Analysis/t/ArtificialNeuralNetworkandFuzzySystems | 4 | 6 |  | 25 | 75 | 100 |
|  | SkillBasedSubject3:Capstone  ProjectWorkPhase II | 3 |  | 6 | 30 | 45 | 75 |
|  | **Total** | **19** | **18** | **12** | **145** | **330** | **475** |
| **SIXTHSEMESTER** | | | | | | | |
|  | Core10 :LinuxandShell  Programming | 4 | 6 |  | 25 | 75 | 100 |
|  | CoreLab7:LinuxandShell  ProgrammingLab | 4 |  | 5 | 40 | 60 | 100 |
|  | Core11:ProjectWorkLab | 6 |  | 3 | 60 | 90 | 150 |
|  | Elective- II  WebApplicationSecurity/  Software Agents/Embeddedsystems | 4 | 5 |  | 25 | 75 | 100 |
|  | Elective- III  Client Server Computing/Opensource Software/Principles ofSecureCoding | 4 | 5 |  | 25 | 75 | 100 |
|  | SkillbasedSubject4:Machine  Learning | 3 | 4 |  | 30 | 45 | 75 |
|  | ExtensionActivities | 2 |  |  | 50 | - | 50 |
|  | 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 | 2 | - | 25 | 25 | 50\*\* |
|  | **Total** | **29** | **22** | **8** | **280** | **445** | **725** |
|  | **GrandTotal** | **140** | **136** | **44** | **1030** | **2470** | **3500** |
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|  | **ONLINE COURSES** | | | | |  |  |

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



First Semester



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| **CourseCode** | | |  | **ProgramminginC** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:1** | **4** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | * Basicknowledgeincomputers | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| TointroducetheconceptsofProcedure OrientedProgrammingandthe variousprogramming  constructsofCprogramming | | | | | | | | | | |
|  | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Describeabouttheaboutthefundamentalsofcomputers,historyandvarioustypesof  softwareandhardwaredevices. | | | | | | | | K1 | |
| 2 | InterprettheconceptsofVariables,Constant,Operatorsandvarioustypesof  expressions | | | | | | | | K2 | |
| 3 | ApplytheconceptofDecisionmakingstatementsandloopingconstructsforsolving  basicprograms | | | | | | | | K3 | |
| 4 | Usetheconcepts offilesandpointers insideaCprogram | | | | | | | | K3 | |
| 5 | DevelopprogramsincorporatingalltheClanguageconstructs | | | | | | | | K4 | |
| 6 | Testthecorrectnessoftheprogramsandidentifylogicalandsyntax errors | | | | | | | | K5 | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
|  | | | | | | | | | | |
| **UNITI** | | **FundamentalsofComputers** | | | | | **12** | | | |
| FundamentalsofComputers:Introduction–HistoryofComputers-GenerationsofComputers-Classification of Computers-Basic Anatomy of a Computer System-Input Devices-Processor-OutputDevices-MemoryManagement–TypesofSoftware-OverviewofOperatingSystem-Programming  Languages-TranslatorPrograms-ProblemSolvingTechniques-OverviewofC. | | | | | | | | | | |
| **UNITII** | | **Overview of C** | | | | | **11** | | | |
| Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants -Variables - Data types - Declaration of variables - Assigning values to variables - Defining SymbolicConstants- Arithmetic,Relational,Logical,Assignment, Conditional, Bitwise, Special,IncrementandDecrementoperators-ArithmeticExpressions-Evaluationofexpression-precedenceof  arithmeticoperators-Typeconversioninexpression–operatorprecedence&associativity-Mathematicalfunctions-Reading&Writing acharacter-Formatted inputand output. | | | | | | | | | | |
| **UNITIII** | | **DecisionMakingandBranching** | | | | | **12** | | | |
| Decision Making and Branching: Introduction – if, if….else, nesting of if …else statements- else ifladder – The switch statement, The?: Operator – The goto Statement. Decision Making and Looping:Introduction-Thewhilestatement-thedostatement–theforstatement-jumpsinloops.Arrays–  CharacterArraysandStrings | | | | | | | | | | |
| **UNITIV** | | **Functions** | | | | | **12** | | | |
| User-DefinedFunctions:Introduction– Needand Elements of User-Defined Functions- Definition-ReturnValuesandtheirtypes-FunctionCalls–Declarations–CategoryofFunctions-Nestingof  Functions-Recursion–Passing ArraysandStringstoFunctions-TheScope,VisibilityandLifetimeofVariables-Multi filePrograms-Structures andUnions. | | | | | | | | | | |
| **UNITV** | | **Pointers** | | | | | **13** | | | |

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| Pointers: Introduction-Understanding pointers-Accessing the address of a variable-Declaration andInitialization of pointer Variable – Accessing a variable through its pointer-Chain of pointers- PointerExpressions–PointerIncrementsandScalefactor-PointersandArrays-PointersandStrings–Array  of pointers – Pointers as Function Arguments- Functions returning pointers – Pointers to Functions –Pointersand Structures.FileManagement in C. | | |
| **TotalLectureHours** | | **60**  **Hours** |
| **TextBook(S)** | | |
| **1** | EBalagurusamy:ComputingFundamentals&CProgramming –TataMcGraw-Hill,Second  Reprint2008. | |
| **ReferenceBook(s):** | | |
| **1** | AshokNKamthane: Programmingwith ANSIand Turbo C, Pearson,2002. 2. Henry  Mullish&HubertL.Cooper:TheSpritof C,Jaico, 1996. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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** | **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



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| **CourseCode** | | |  | **ProgrammingLab -C** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **CoreLab :1** | **0** | **0** | **3** | | | **4** |
| **Pre- requisite** | | | | * Basicknowledgeincomputers | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| TointroducetheconceptsofProcedureOrientedProgrammingand thevariousprogramming  constructsofCprogramming. | | | | | | | | | | |
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| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Applythevariousbasicprogrammingconstructslikedecisionmakingstatements.  Loopingstatements,functions,structures,pointersandfiles | | | | | | | | **K3** | |
| 2 | Designprograms usingtheconcept offilesin C and beable tosimulate operations | | | | | | | | **K4** | |
| 3 | Determinetheefficienttechniquesinprogrammingtosolvevariousscientific  problems | | | | | | | | **K5** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **EXERCISE1** | | **ImplementationofControlstructures** | | | | | **6** | | | |
| DevelopvariousC ProgramsusingControlStructures | | | | | | | | | | |
| DevelopvariousC programs usingSwitchcase. | | | | | | | | | | |
| **EXERCISE2** | | **ImplementationofLoopings** | | | | | **6** | | | |
| Developvarious C program forthe implementationof looping | | | | | | | | | | |
| DevelopvariousC programfortheimplementationoflooping&Conrtol Structures | | | | | | | | | | |
| **EXERCISE3** | | **ImplementationofFunctions** | | | | | **9** | | | |
| DevelopaCprogramtoillustraterecursivefunction. | | | | | | | | | | |
| DevelopaCprogramtofind thepalindromeina given sentence | | | | | | | | | | |
| Developa Cprogram to manipulatestrings usingstringfunctions. | | | | | | | | | | |
| DevelopaCProgramusingFunctions | | | | | | | | | | |
| **EXERCISE4** | | **ImplementationofPointers** | | | | | **6** | | | |
| DevelopaCprogramto swaptwointegersusingpointers. | | | | | | | | | | |
| Developa C programusingArrayof Pointers. | | | | | | | | | | |
| **EXERCISE5** | | **ImplementationofStructures** | | | | | **6** | | | |
| DevelopaCprogramusingthestructures. | | | | | | | | | | |
| DevelopaC programusingArrayof Structures. | | | | | | | | | | |
| **EXERCISE6** | | **ImplementationofFiles** | | | | | **6** | | | |
| DevelopaCprogramto calculate electricitybillusingfiles | | | | | | | | | | |
| **EXERCISE7** | | **ImplementationofSecurity** | | | | | **6** | | | |
| DevelopaCprogramtoencryptanddecryptastring | | | | | | | | | | |
| DevelopaGprogramto encryptanddecryptFiles | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **45**  **Hours** | | | |
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| **TextBook(S)** | |
| **1** | EBalagurusamy:ComputingFundamentals&CProgramming –TataMcGraw-Hill,Second  Reprint2008. |
| **ReferenceBook(s)** | |
| **1** | AshokNKamthane: Programmingwith ANSIand TurboC, Pearson, 2002. 2.Henry  Mullish&HubertL.Cooper: TheSprit of C,Jaico, 1996. |
| **CourseDesignedby :** | |

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|  | **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** | **S** | **S** | **L** | **L** | **L** | **L** | **L** | **L** | **L** |

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



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| **CourseCode** | | |  | **DataStructures** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:2** | **4** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | * Basic knowledge of ProgrammingConstructs | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconceptofdatastructuresandthetypesofdatastructures | | | | | | | | | |  |
| * Todemonstratehowvariousdata structurescanbeimplemented andusedinvariousapplications | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | DefinetheconceptofDatastructureandlistthevariousclassificationsofdata  structures. | | | | | | | | **K1** | |
| 2 | Demonstratehowarrays, stacks,queues,linkedlists,trees,heaps,  GraphsandHashTablesarerepresentedinthemainmemoryandvariousoperationsareperformed on thosedata structures. | | | | | | | | **K2** | |
| 3 | Illustratethe various file organizations like Sequential, Random and Linked  organizations. | | | | | | | | **K2** | |
| 4 | Discovertherealtimeapplicationsofthe variousdatastructures | | | | | | | | **K3** | |
| 5 | Designalgorithmsforvarioussortingandsearchingtechniques | | | | | | | | **K4** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **INTRODUCTION** | | | | | **12**  **Hours** | | | |
| Introduction:IntroductionofAlgorithms,AnalyzingAlgorithms.Arrays:SparseMatrices-RepresentationofArrays.StacksandQueues.Fundamentals-EvaluationofExpressionInfixto  Postfix Conversion-MultipleStacksandQueues | | | | | | | | | | |
| **UNITII** | | **LINKEDLIST** | | | | | **12** | | | |
| Linked List: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - More on LinkedLists-SparseMatrices-DoublyLinkedListandDynamic -StorageManagement-Garbage  CollectionandCompaction. | | | | | | | | | | |
| **UNITIII** | | **NONLINEARDATA STRUCTURES** | | | | | **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:StaticTreeTables -DynamicTreeTables-Hash Tables:HashingFunctions-Overflow  Handling. | | | | | | | | | | |
| **UNITV** | | **INTERNAL -SORTING** | | | | | **12**  **Hours** | | | |
| InternalSorting:InsertionSort-QuickSort-2WayMergeSort-HeapSort-ShellSort-Sortingon | | | | | | | | | | |

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| SeveralKeys.Files:Files,QueriesandSequentialorganizations-IndexTechniques-File  Organizations. | | |
| **TotalHours** | | **60**  **Hours** |
| **TextBook(s)** | | |
|  | | |
| **1** | EllisHorowitz,SartajShani,DataStructures,GalgotiaPublication. | |
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| **ReferenceBook(s)** | | |
| **1** | EllisHorowitz,SartajShani,SanguthevarRajasekaran,ComputerAlgorithms,Galgotia  Publication. | |
|  |  |  |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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** | **M** | **L** | **L** | **L** | **L** | **L** | **L** | **L** |

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



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| **CourseCode** | | |  | **IntroductiontoLinearAlgebra** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Allied:1** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | None | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| Tointroducethecomputational techniquesandalgebraicskills essentialfor thestudyofsystems of  linearequations,matrixalgebra,andvectorspaces | | | | | | | | | | |
|  | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Explaintheconcept/theoryinlinearalgebra,todevelopdynamicandgraphicalviews  totherelatedissuesofthechosentopicsasoutlinedin“coursecontent,”andtoformallyprovetheorems | | | | | | | | K2 | |
| 2 | Recognizethebasicapplicationsofthechosentopicsandtheirimportanceinthe  modernscience | | | | | | | | K3 | |
| 3 | Developsimplemathematicalmodels,andapplybasiclinearalgebratechniques  learned fromthechosentopicstosolvesimpleproblems | | | | | | | | K3 | |
| 4 | Reportandcommunicateeffectivelywithothersandpresentmathematicalresultsina  logical andcoherentfashion | | | | | | | | K4 | |
| 5 | Appraisethepowerandbeautyofmathematics,andsolveproblemsindependentlyand  collaborativelyas part ofateam | | | | | | | | K5 | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | |  | | | | | **15** | | | |
| Introduction–VectorsandMatrices–LengthandDotProducts–SolvingLinearEquations–LinearEquations–TheIdeaofElimination–EliminationUsingMatrices–RulesforMatrixOperations–  InverseMatrices–Elimination=Factorization:A=LU –TransposesandPermutations | | | | | | | | | | |
| **UNITII** | |  | | | | | **15** | | | |
| Vector Spaces and Subspaces – Spaces of Vectors – The Null space of A: Solving Ax = 0– TheRank and the Row Reduced Form – The complete solution to Ax=b – Independence, Basis, andDimensions–DimensionsofthefourSubspaces–Orthogonality–OrthogonalityoftheFour  Subspaces–Projections– LeastSquaresApproximations –Orthogonal BasesandGram–Schmidt. | | | | | | | | | | |
| **UNITIII** | |  | | | | | **15** | | | |
| Determinants – The Properties of Determinants – Permutations and Cofactors – Cramer‟s Rule,Inverse,andVolumes–EigenvaluesandEigenvectors–IntroductiontoEigenvalues–DiagonalizingaMatrix–ApplicationstoDifferentialEquations–SymmetricMatrices–Positive  DefiniteMatrices–SimilarMatrices–TheSingularValueDecomposition | | | | | | | | | | |
| **UNITIV** | |  | | | | | **15** | | | |
| SingularvalueDecomposition–LinearTransformations–TheIdeaofaLinearTransformation–  TheMatrixofaLinearTransformation–Change ofBasis–DiagonalizationandthePseudoinverse. | | | | | | | | | | |
| **UNITV** | |  | | | | | **15** | | | |
| ComplexVectorsandComplexMatrices–ComplexNumbers–HermitianandUnitaryMatrices– | | | | | | | | | | |

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| TheFast FourierTransform–Applications–Numerical LinearAlgebra. | | |
| **TotalLectureHours** | | **75**  **Hours** |
| **TextBook(s)** | | |
| **1** | GilbertStrang(2016).Introductionto LinearAlgebra,5th Edition.Wellesley–Cambridge  Press | |
|  | **ReferenceBooks** |  |
| **1** | S.Lang(1997).Introductionto LinearAlgebra.SecondEdition.Springer. | |
| **2** | GilbertStrang(2006).LinearAlgebraand ItsApllications.FourthEdition.CengageLearning. | |
| **3** | DavidC. Lay,StevenR.Lay,andJudiJ.McDonald(2014). Linear Algebraand Its  Applications.5th Edition.Pearson. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby:** | | |

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|  | **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** | **M** | **L** | **L** | **L** | **L** | **L** | **L** | **L** |

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



SecondSemester



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| **CourseCode** | | |  | **ProgramminginC++** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:3** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | * BasicknowledgeofProcedureOrientedProgrammingconcepts * BasicknowledgeinCProgramming | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| TointroduceheconceptsofObjectOrientedProgrammingParadigmandtheprogrammingconstructs  ofC++ | | | | | | | | | | |
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| **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** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoC++** | | | | | **12** | | | |
| Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object OrientedLanguages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements :If..else,jump,goto,break,continue,Switchcasestatements-LoopsinC++:for,while,do-  functionsinC++-inline functions–FunctionOverloading. | | | | | | | | | | |
| **UNITII** | | **ClassesandObjects** | | | | | **14** | | | |
| ClassesandObjects:DeclaringObjects–DefiningMemberFunctions–StaticMembervariablesandfunctions–arrayofobjects–friendfunctions–Overloadingmemberfunctions–Bitfieldsandclasses  –Constructoranddestructorwithstaticmembers. | | | | | | | | | | |
| **UNITIII** | | **OperatorOverloading andInheritance** | | | | | **16** | | | |
| OperatorOverloading:Overloadingunary,binaryoperators–OverloadingFriendfunctions–type  conversion–Inheritance:TypesofInheritance–Single,Multilevel,Multiple,Hierarchal,Hybrid,Multipathinheritance–Virtual baseClasses– Abstract Classes. | | | | | | | | | | |
| **UNITIV** | | **PointersandPolymorphism** | | | | | **18** | | | |
| Pointers–Declaration–PointertoClass,Object–thispointer–PointerstoderivedclassesandBase  classes–Arrays–Characteristics–arrayofclasses–Memorymodels–newanddeleteoperators– | | | | | | | | | | |

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| dynamicobject –Binding,PolymorphismandVirtualFunctions. | | | |
| **UNITV** | | **FileandExceptionHandling** | **15** |
| Files–Filestreamclasses–file modes–SequentialRead/Writeoperations–BinaryandASCIIFiles  –RandomAccessOperation–Templates–ExceptionHandling-String–DeclaringandInitializingstringobjects – StringAttributes– Miscellaneousfunctions . | | | |
| **TotalLectureHours** | | | **75**  **Hours** |
| **TextBook(s)** | | | |
| **1** | AshokNKamthane,Object-OrientedProgrammingwithAnsiAndTurboC++,Pearson  Education,2003. | | |
| **ReferenceBooks** | | | |
| **1** | E.Balagurusamy,Object-OrientedProgrammingwithC++,TMH,1998. | | |
| **2** | MariaLitvin&GrayLitvin,C++foryou,Vikaspublication,2002. | | |
| **3** | JohnR Hubbard,Programmingwith C,2nd Edition, TMHpublication, 2002 | | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | |  |
| **CourseDesignedby :** | | | |

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



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| **CourseCode** | | |  | **ProgrammingLab–C++** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **CoreLab :2** | **0** | **0** | **4** | | | **4** |
| **Pre- requisite** | | | | * BasicknowledgeofProcedureOrientedProgrammingconcepts * BasicknowledgeinCProgramming | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| Tointroducehe conceptsofObjectOrientedProgrammingParadigmandtheprogrammingconstructs  ofC++ | | | | | | | | | | |
|  | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Applythevariousbasicprogrammingconstructslikedecisionmakingstatements.Loopingstatements,functions,conceptslikeoverloading,inheritance,polymorphism,  virtualfunctions,constructorsanddestructors | | | | | | | | **K3** | |
| 2 | IllustratetheconceptofVirtualClasses,inlinefunctionsandfriendfunctions | | | | | | | | **K4** | |
| 3 | Comparethevariousfilestreamclasses;filetypes,usageoftemplatesandexception  handlingmechanisms. | | | | | | | | **K5** | |
| 4 | Comparetheprosandconsofprocedureorientedlanguagewiththeconceptsofobject  orientedlanguage | | | | | | | | **K5** | |
| **K1–Remember K2 –Understand K3 –applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **PROGRAM-**  **1** | |  | | | | | **5** | | | |
| WriteaC++ProgramtocreateaclasstoimplementthedatastructureSTACK.WriteaconstructortoinitializetheTOPoftheSTACK.WriteamemberfunctionPUSH()toinsertanelementandmember  functionPOP()todelete an elementcheck foroverflowand underflowconditions. | | | | | | | | | | |
| **PROGRAM-2** | |  | | | | | **5** | | | |
| WriteaC++ProgramtocreateaclassARITHMETICwhichconsistsofaFLOATandanINTEGER  variable.WritememberfunctionsADD(),SUB(),MUL(),DIV()toperformaddition,subtraction,multiplication,division respectively.Write amemberfunction togetand displayvalues. | | | | | | | | | | |
| **PROGRAM-3** | |  | | | | | **5** | | | |
| WriteaC++Programtoreadanintegernumberandfindthesumofallthedigitsuntilitreducestoa  singledigitusingconstructors,destructorsandinlinememberfunctions. | | | | | | | | | | |
| **PROGRAM-4** | |  | | | | | **5** | | | |
| WriteaC++ProgramtocreateaclassFLOAT thatcontains onefloatdatamember.Overload allthe  fourArithmeticoperatorssothat theyoperate ontheobjectFLOAT. | | | | | | | | | | |
| **PROGRAM-5** | |  | | | | | **5** | | | |
| WriteaC++ProgramtocreateaclassSTRING.WriteaMemberFunctiontoinitialize,getand | | | | | | | | | | |



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| displaystings.Overloadtheoperators++and==toconcatenatetwoStringsandtocomparetwo  stringsrespectively. | | | | |
| **PROGRAM-6** | | |  | **5** |
| WriteaC++Programtocreateclass,whichconsistsofEMPLOYEEDetaillikeE\_Number,E\_Name,Department,Basic,Salary,Grade.Writeamemberfunctiontogetanddisplaythem.Deriveaclass  PAYfromtheaboveclassandwriteamemberfunctiontocalculateDA,HRAandPFdependingonthegrade. | | | | |
| **PROGRAM -7** | |  | | **5** |
| WriteaC++ProgramtocreateaclassSHAPEwhichconsistsoftwoVIRTUALFUNCTIONSCalculate\_Area()andCalculate\_Perimeter()tocalculateareaandperimeterofvariousfigures.Derive  threeclassesSQUARE,RECTANGLE,TRIANGEfromclassShapeandCalculateAreaandPerimeterofeachclass separatelyand displaytheresult. | | | | |
| **PROGRAM -8** | |  | | **5** |
| 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,whichtakestheobjectofabovetwoclassesasargumentsandtheintegerandfloatvalues  ofboth objects separatelyand displaytheresult. | | | | |
| **PROGRAM -9** | |  | | **5** |
| WriteaC++ProgramusingFunctionOverloadingtoreadtwoMatricesofdifferentDataTypessuch  asintegersandfloatingpointnumbers.Findoutthesumoftheabovetwomatricesseparatelyanddisplaythe sum of thesearrays individually. | | | | |
| **PROGRAM-**  **10** | |  | | **5** |
| WriteaC++Program tocheck whetherthe givenstringis apalindromeornotusingPointers. | | | | |
| **PROGRAM-**  **11** | |  | | **5** |
| WriteaC++Programtocreatea Fileand todisplaythecontentsof that filewith line numbers. | | | | |
| **PROGRAM -12** | |  | | **5** |
| WriteaC++Programtomergetwofilesintoasingle file. | | | | |
| **TotalLectureHours** | | | | **60**  **Hours** |
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| **TextBook(s)** | | | | |
| **1** | AshokNKamthane, Object-OrientedProgrammingwithAnsiAndTurbo C++,Pearson  Education,2003. | | | |
|  | **ReferenceBooks** | | | |
| **1** | E.Balagurusamy,Object-OrientedProgrammingwithC++,TMH,1998. | | | |
| **2** | Maria Litvin&GrayLitvin,C++foryou,Vikaspublication, 2002. | | | |
| **3** | JohnRHubbard, ProgrammingwithC, 2ndEdition,TMH publication,2002 | | | |
| **CourseDesignedby :** | | | | |

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|  | **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** | **S** | **L** | **L** | **L** | **L** | **L** | **L** | **L** |

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



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| **CourseCode** | |  | **InternetBasics -Lab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | **CoreLab :3** | **0** | **0** | **2** | | | **2** |
| **Pre- requisite** | | | * BasicknowledgeinComputers | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| 1. IntroducethefundamentalsofInternet andtheWebfunctions. 2. Impartknowledgeandessentialskillsnecessarytousetheinternetanditsvariouscomponents. 3. Find,evaluate,anduse onlineinformationresources. 4. UseGoogleAppsforeducationeffectively. | | | | | | | | | |
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| **ExpectedCourseOutcomes** | | | | | | | | | |
| 1 | ApplythepredefinedprocedurestocreateGmailaccount,checkandreceivemessages | | | | | | | **K3** | |
| 2 | Applythe predefinedprocedures toperform variousbasic operationson internet | | | | | | | **K3** | |
| 3 | Utilizevariousgoogleapplicationslikedocs,googleclassroom,googledrive,google  forms,googlemeetandslides | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | |
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| **PROGRAM-1** | | | | | | **2** | | | |
| CreateanemailaccountinGmail.Usingtheaccountcreatedcomposeamailtoinviteothercollege  studentsforyourcollegefest,enclosetheinvitationasattachmentandsendthemailtoatleast50recipients.Use CC andBCC options accordingly | | | | | | | | | |
| **PROGRAM-2** | | | | | | **2** | | | |
| OpenyourinboxintheGmailaccountcreated,checkthemailreceivedfromyourpeerfromothercollegeinvitingyouforhiscollegefest,anddownloadtheinvitation.Replytothemailwithathank  younote fortheinviteandforwardthemailto otherfriends | | | | | | | | | |
| **PROGRAM-3** | | | | | | **2** | | | |
| Assumethatyouarestudyinginfinalyearofyourgraduationandareeagerlylookingforajob.Visit  anyjobportalanduploadyour resume. | | | | | | | | | |
| **PROGRAM-4** | | | | | | **2** | | | |
| CreateameetingusingGoogle calendarand sharemeetingid totheattendees. Transfertheownership  totheManageroncethe meetingidisgenerated. | | | | | | | | | |
| **PROGRAM-5** | | | | | | **2** | | | |
| Createalabel anduploadbulk contactsusingimportoptionin GoogleContacts | | | | | | | | | |
| **PROGRAM-6** | | | | | | **4** | | | |
| CreateyourownGoogleclassroomandinviteallyourfriendsthroughemailid.Poststudymaterialin  GoogleclassroomusingGoogledrive.CreateaseparatefolderforeverysubjectanduploadallunitwiseE-Content Materials. | | | | | | | | | |
| **PROGRAM-7** | | | | | |  | | | |
| CreateandshareafolderinGoogleDriveusing„sharealink‟optionandsetthepermissiontoaccess  thatfolderbyyourfriends only. | | | | | | | | | |
| **PROGRAM-8** | | | | | |  | | | |
| Createone-pagestoryinyourmother tonguebyusingvoicerecognition facilityof Google Docs | | | | | | | | | |

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| **PROGRAM-9** | | **2** |
| CreatearegistrationformforyourDepartmentSeminarorConferenceusingGoogleForms. | | |
| **PROGRAM-10** | | **2** |
| Createaquestionpaperwithmultiplechoicetypesofquestionsforasubjectofyourchoice,using  GoogleForms. | | |
| **PROGRAM-11** | | **4** |
| CreateameetusingGoogleCalendar andrecordthemeetusingGoogleMeet.  CreateaGoogleslidesfor atopicandsharethesamewithyour friends. | | |
| **PROGRAM-12** | | **4** |
| Createtemplate foraseminarcertificate usingGoogleSlides. | |  |
| **PROGRAM-13** | |  |
| CreateasheettoillustratesimplemathematicalcalculationsusingGoogle Sheets.  Createstudent‟sinternalmarkstatementandsharetheGooglesheetsvialink. | | **4** |
|  | | |
| **TotalLectureHours** | | **30**  **Hours** |
|  | |  |
| **TextBook(s)** | | |
| 1 | IanLamont,Google Drive&Docsin30 Minutes,2ndEdition. | |
| **ReferenceBook(s)** | | |
| 1 | SherryKinkoph Gunter,MyGoogleApps, 2014. | |
| **CourseDesignedby :** | | |

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

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



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| **CourseCode** | | |  | **DiscreteMathematics** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Allied:2** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | BasicknowledgeinMathematics | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | |  | | | | | | |
| * Introducestudentstothetechniques,algorithms,andreasoningprocessesinvolvedinthestudyofdiscrete mathematicalstructures. * Introducestudentstosettheory,inductivereasoning,elementaryandadvancedcountingtechniques,equivalencerelations, recurrencerelations, graphs, and trees. * Introducestudents toprovemathematicalstatements bymeans ofinductivereasoning | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understanddiscretemathematicalpreliminariesand applydiscretemathematicsin  formalrepresentationof variouscomputingconstructs | | | | | | | | **K2** | |
| 2 | Demonstrateanunderstandingofrelations,functions,Combinatoricsandlattices | | | | | | | | **K2** | |
| 3 | Applythetechniquesofdiscretestructuresandlogicalreasoningtosolveavarietyof  problemsandwriteanargumentusinglogicalnotation | | | | | | | | **K3** | |
| 4 | Analyzeandconstructmathematicalargumentsthatrelatetothestudyofdiscrete  structures | | | | | | | | **K4** | |
| 5 | Developand model problems with the concepts and techniques of discrete  mathematics. | | | | | | | | **K4** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **MATHEMATICALLOGIC** | | | | | **15** | | | |
| Proposition –LogicalOperators–TruthTables–Laws ofLogic–Equivalances–Rules ofinterface–  validityArguments–ConsistencyofSpecifications**–**PropositonalCalculus–Quantifiersanduniverseof discourse. | | | | | | | | | | |
| **UNITII** | | **PROOFTECHNIQUES &RELATIONSANDFUNCTIONS** | | | | | **15** | | | |
| **PROOF TECHNIQUES**: Introduction – Methods of proving theorems – Direct Proofs, Proof byContraposition,Vacuousandtrivialproofs,Proofsbycontradiction–MistakesinProofs–Mathematical induction – Strong Mathematical induction – Strong mathematical induction and wellordering– Program Correctness.  **RELATIONS AND FUNCTIONS:** Definition and properties of binary relations– RepresentingRelations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions andCovering of sets – Partial Orderings – n-array Relations and their applications. Functions – Injective,Surjective,Bijectivefunctions, Composition, identityand inverse. | | | | | | | | | | |
| **UNITIII** | | **COMBINATORICS** | | | | | **15** | | | |
| Basics of Counting – The Pigeonhole principle – Permutations and Combinations with and withoutrepetition,Permutationswithindistinguishableelements–distributionsofobjects–Generatingpermutationsand combinations in lexicographic order. | | | | | | | | | | |

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| **UNITIV** | | **RECURRENCERELATIONS** | **15** |
| SomeRecurrenceRelationModels–Solutionoflinearhomogeneousrecurrencerelationswithconstantcoefficients–solutionoflinearnon-homogeneousrecurrencerelationsbythemethodof  characteristicroots –Divideandconquerrecurrencerelations. | | | |
| **UNITV** | | **LATTICES** | **15** |
| Latticesaspartiallyorderedset–PropertiesofLattices–Latticesas algebraicsystem–Sublattices –  DirectProductand Homomorphism–Somespeciallattices. | | | |
| **TotalLectureHours** | | | **75**  Hours |
| **TextBook(s)** | | | |
| **1** | KennethH.Rosen,“DiscreteMathematicsanditsapplications”,McGrawHill,2011. | | |
| **2** | JudithL.Gersting,“MathematicalStructures forComputerScience”,W.H>Freemanand  Company,2014 | | |
| **3** | TremblayJ.P.andManoharR.,“DiscreteandCombinatorialMathamatics–AnIntroduction”,  AddisonWesley,2009. | | |
| **ReferenceBooks** | | | |
| **1** | DoerrAlanandLevasseurK.,“AppliedDiscreteStructuresforComputerScience”,Galgotia  Publications,2002 | | |
| **2** | BenardKolman,Robert C.BusbyandSharanRoss,“DiscreteMathematicalStructures”,  PearsonEducation,2014 | | |
| **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | | | |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | |  |
| **CourseDesignedby :** | | | |

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|  | **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



ThirdSemester



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| **CourseCode** | | |  | **JavaProgramming** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:4** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | * Basic knowledge of ProgrammingConstructs. * Knowledge on Object OrientedProgrammingConcepts. | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * TointroducetheconceptsofObjectOrientedProgrammingParadigmand the programming   constructsofJAVA | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Recitethe historyofJAVA and its evolution | | | | | | | | **K1** | |
| 2 | Explainthevariousprogramminglanguageconstructs,objectorientedconceptslikeoverloading,inheritance,polymorphism,Interfaces,threads,exceptionhandlingand  packages | | | | | | | | **K2** | |
| 3 | IllustratetheconceptsofApplets,filesandtheconceptofstreamclasses. | | | | | | | | **K3** | |
| 4 | Outlinethebenefitsandapplicationsofobjectsorientedprogrammingconceptsand  defendhowJAVAdiffersfromotherprogramminglanguages | | | | | | | | **K3** | |
| 5 | Judgetheprosandconsofother objectoriented languagewiththeconceptsofJAVA | | | | | | | | **K4** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
|  | | | | | | | | | | |
| **UNITI** | |  | | | | | **18** | | | |
| Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm – Basic Concepts ofObject-Oriented Programming – Benefits of Object-Oriented Programming – Application of Object-Oriented Programming. Java Evolution: History – Features – How Java differs from C and C++ – JavaandInternet –Javaandwww –WebBrowsers.OverviewofJava:simpleJavaprogram–Structure –  JavaTokens – Statements – JavaVirtual Machine. | | | | | | | | | | |
| **UNITII** | |  | | | | | **18** | | | |
| Constants, Variables, Data Types - Operators and Expressions – Decision Making and Branching: if,if...else,nestedif,switch?:Operator-Decision MakingandLooping: while,do,for– JumpsinLoops  -Labeled Loops–Classes,ObjectsandMethods. | | | | | | | | | | |
| **UNITIII** | |  | | | | | **18** | | | |
| Arrays,StringsandVectors–Interfaces:MultipleInheritance–Packages:PuttingClassestogether–  MultithreadedProgramming. | | | | | | | | | | |
| **UNITIV** | |  | | | | | **18** | | | |
| ManagingErrorsandExceptions–AppletProgramming–GraphicsProgramming. | | | | | | | | | | |
| **UNITV** | |  | | | | | **18** | | | |
| ManagingInput/OutputFilesinJava:ConceptsofStreams-StreamClasses–ByteStreamclasses–  Characterstreamclasses–Usingstreams–I/OClasses–FileClass–I/Oexceptions–Creationoffiles–Reading/Writing characters,Byte-HandlingPrimitiveDataTypes–RandomAccessFiles. | | | | | | | | | | |

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| **TotalLectureHours** | | **90** |
| **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**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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

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



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| **CourseCode** | |  | **JAVAProgrammingLab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | **CoreLab:4** | **0** | **0** | **5** | | | **4** |
| **Pre- requisite** | | | * Basic knowledge of ProgrammingConstructs * Knowledge on Object OrientedProgrammingConcepts | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| * To introduce the concepts of Object Oriented Programming Paradigm and the programmingconstructsof JAVA | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | |
| 1 | ApplythevariousbasicprogrammingconstructsofJAVAlikedecisionmakingstatements.Loopingstatements,overloading,inheritance,polymorphism,constructors  anddestructors | | | | | | | **K3** | |
| 2 | Illustratetheconceptsofthreadingandmulti-threading | | | | | | | **K4** | |
| 3 | Designprogramsusingvariousfilestreamclasses;filetypes,andframes | | | | | | | **K4** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | |
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| **PROGRAM1** | | | | | | **3** | | | |
| WriteaJavaApplicationsto extractaportion ofacharacterstringandprinttheextractedstring. | | | | | | | | | |
| **PROGRAM2** | | | | | | **3** | | | |
| WriteaJavaProgramto implementtheconceptof multipleinheritanceusingInterfaces. | | | | | | | | | |
| **PROGRAM3** | | | | | | **3** | | | |
| WriteaJavaProgramtocreateanExceptioncalledpayout-of-bounds andthrowtheexception | | | | | | | | | |
| **PROGRAM4** | | | | | | **3** | | | |
| Write a Java Program to implement the concept of multithreading with the use of any threemultiplicationtables 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 | | | | | | | | | |

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| suchas mouseup, mousedown,etc., thecorrespondingmessagetobe displayed. | | |
| **PROGRAM11** | | **6** |
| WriteaJavaProgram todrawcircle,square, ellipseandrectangle at themouseclickpositions. | | |
| **PROGRAM12** | | **6** |
| WriteaJavaProgramwhich openanexistingfile and appendtextto thatfile. | | |
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| **TotalLectureHours** | | **60**  **Hours** |
| **TextBook(s)** | | |
| **1** | ProgrammingwithJava–APrimer-E. Balagurusamy,3rd Edition,TMH. | |
| **ReferenceBook(s)** | | |
| **1** | TheComplete Reference Java2-PatrickNaughton &Hebert Schildt, 3rd Edition, TMH | |
| **CourseDesignedby :** | | |

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

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



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| **CourseCode** | | |  | **DatabaseManagementSystems** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:5** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | None | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * The objective of the course is to present an introduction to database management systems, withan emphasis on how to organize, maintain and retrieve - efficiently, and effectively -information froma DBMS. | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Describethefundamentalelementsof relationaldatabasemanagementsystems | | | | | | | | **K2** | |
| 2 | Explainthebasicconceptsofrelationaldatamodel,entity-relationshipmodel,  relationaldatabasedesign,relationalalgebraand SQL. | | | | | | | | **K2** | |
| 3 | Explaintheconceptsoftransactionprocessing,basicdatabasestoragestructuresand  accesstechniques | | | | | | | | **K2** | |
| 3 | ConstructER-modelstorepresentsimpledatabaseapplicationscenarios | | | | | | | | **K3** | |
| 4 | Applythe normalizationtechniques toimprovise the databasedesign | | | | | | | | **K3** | |
| 5 | DevelopDDLandDMLcommandstoperform basicoperationson adatabase | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–apply K4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | INTRODUCTIONTODBMS | | | | | **18** | | | |
| File Systems Organization – Sequential, Pointer, Indexed, Direct – Purpose of Database System-Database System Terminologies-Database characteristics- Data models – Types of data models –ComponentsofDBMS-RelationalAlgebra.LOGICALDATABASEDESIGN:RelationalDBMS–  Codd‟s Rule – Entity- Relationship model – Extended ER Normalization – Functional Dependencies,Anomaly- 1NFto 5NF-Domain KeyNormal Form–Denormalization | | | | | | | | | | |
| **UNITII** | | SQL&QUERYOPTIMIZATION | | | | | **18** | | | |
| I SQL Standards – Data types – Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static VsDynamicSQL–QUERYOPTIMIZATION:QueryProcessingandOptimization–Heuristicsand  CostEstimates in QueryOptimization. | | | | | | | | | | |
| **UNITIII** | | TRANSACTIONPROCESSINGANDCONCURRENCYCONTROL | | | | | **18** | | | |
| Introduction-PropertiesofTransaction-Serializability-ConcurrencyControl–LockingMechanisms-  TwoPhaseCommitProtocol-Deadlock. | | | | | | | | | | |
| **UNITIV** | | TRENDSINDATABASETECHNOLOGY | | | | | **18** | | | |
| OverviewofPhysicalStorageMedia–MagneticDisks–RAID–Tertiarystorage–FileOrganization  – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – Btree Index Files – Static Hashing – Dynamic Hashing – Introduction to Distributed Databases- Clientservertechnology-MultidimensionalandParalleldatabases-Spatialandmultimediadatabases-Mobileand web databases-Data Warehouse-Mining-Data marts. | | | | | | | | | | |
| **UNITV** | | ADVANCEDTOPICS | | | | | **18** | | | |
| DATABASESECURITY:Data Classification-Threatsandrisks–DatabaseaccessControl–Typesof  Privileges–Cryptography-StatisticalDatabases.-DistributedDatabases-Architecture-Transaction | | | | | | | | | | |

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| Processing-DataWarehousingandMining-Classification-Associationrules-Clustering-Information  Retrieval-Relevanceranking-CrawlingandIndexingtheWeb-ObjectOrientedDatabases-XMLDatabases. | | |
| **TotalLectureHours** | | **90** |
| **TextBook(s)** | | |
| **1** | RamezElmasriandShamkantB.Navathe,“FundamentalsofDatabaseSystems”,FifthEdition,PearsonEducation, 2008. | |
| **ReferenceBook(s)** | | |
| **1** | AbrahamSilberschatz,HenryF.KorthandS.Sudharshan,“DatabaseSystemConcepts”,Sixth  Edition,TataMcGrawHill,2011. | |
| **2** | C.J.Date,A.KannanandS.Swamynathan,“AnIntroductiontoDatabaseSystems”,Eighth  Edition,Pearson Education,2006. | |
| **3** | AtulKahate,“IntroductiontoDatabaseManagementSystems”,PearsonEducation,NewDelhi,  2006. | |
| **4** | AlexisLeonandMathewsLeon,“DatabaseManagementSystems”,VikasPublishingHouse  PrivateLimited,NewDelhi,2003. | |
| **5** | RaghuRamakrishnan,“DatabaseManagementSystems”, Fourth Edition,TataMcGrawHill,  2010. | |
| **6** | G.K.Gupta,“DatabaseManagementSystems”,TataMcGrawHill,2011. | |
| **7** | RobCornell,“DatabaseSystemsDesignandImplementation”,CengageLearning,2011. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby:** | | |

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|  | **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



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| **CourseCode** | | |  | **DataCommunicationandNetworks** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Allied:3** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | None | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconceptsofdatacommunicationnetworks * Toexplainthevarioustypestopologies andtransmissionmedia | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Describethebasisand structureofcomputernetworks | | | | | | | | **K2** | |
| 2 | Understandtheconcept ofanalog/digitalsignals andtransmissions | | | | | | | | **K2** | |
| 3 | Describethelayers of the OSImodel | | | | | | | | **K2** | |
| 4 | Explaintheconceptof ISDNarchitectureandinterfaces | | | | | | | | **K2** | |
| 5 | Identifythedifferenttypesof networktopologies andprotocols. | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontocommunicationsandNetworking** | | | | | **16** | | | |
| IntroductiontocommunicationsandNetworking:Introduction–Fundamentalconcepts-Datacommunications – Protocols- standards - Standards organizations - Signal propagations- Analog andDigitalsignals-Bandwidthofasignalandamedium-Fourieranalysisandtheconceptofbandwidthofasignal-Thedatatransmissionrateandthebandwidth.Informationencoding:Introduction–  Representingdifferentsymbols-Minimizingerrors-Multimedia–Multimedia andData compression | | | | | | | | | | |
| **UNITII** | | **Analoganddigitaltransmissionmethods** | | | | | **17** | | | |
| Analoganddigitaltransmissionmethods:Introduction-Analogsignal,Analogtransmission-Digital  signal,Digitaltransmission-Digitalsignal,Analogtransmission-Baudrateandbitspersecond-Analogsignal, Digital (Storageand) transmission-Nyquist Theorem. | | | | | | | | | | |
| **UNITIII** | | **ModesofdatatransmissionandMultiplexing** | | | | | **20** | | | |
| Modes of data transmission and Multiplexing: Introduction – Parallel and Serial communication -Asynchronous, Synchronous and Isochronous communication - Simplex, Half-duplex and Full-duplexcommunication–Multiplexing-TypesofMultiplexing-FDMversusTDM.TransmissionErrors:  Detectionand correction: Introduction –Errorclassification–TypesofErrors –Errordetection. | | | | | | | | | | |
| **UNITIV** | | **Transmissionmedia** | | | | | **18** | | | |
| Transmission media: Introduction - Guided media - Un Guided media - Shannon capacity. Networktopologies, switching and routing algorithms: Introduction - Mesh topology - Star topology - Treetopology - Ring topology - Bus topology - Hybrid topology - Switching basics- Circuit switching –Packetswitching-Messageswitching-RouterandRouting–Factorsaffectingroutingalgorithms-  Routingalgorithm -Approachestorouting. | | | | | | | | | | |
| **UNITV** | | **NetworkingprotocolsandOSImodel** | | | | | **19** | | | |
| Networking protocols and OSI model: Introduction – Protocols in computer communications - TheOSI model - OSI layer functions.Integrated services digital networking (ISDN):Introduction–BackgroundofISDN-ISDNarchitecture–ISDNinterfaces-Functionalgrouping–Reference  points - ISDN protocol architecture - Broadband ISDN (B-ISDN). of ATM – Packet size – Virtualcircuitsin ATM – ATM cells– Switching–ATMlayers – Miscellaneous Topics. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90** | | | |

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|  | | **Hours** |
| **TextBook(s)** | | |
| **1** | DataCommunicationsandNetworks,Achyut.S.Godbole,TataMcGraw-HillPublishing  Company,2007. | |
| **ReferenceBook(s)** | | |
| **1** | B.A. Forouzan –“Data CommunicationsandNetworking(3rdEd.) “ –TMH | |
| **2** | A.S.Tanenbaum–“ComputerNetworks(4thEd.)”– PearsonEducation/PHI | |
| **3** | W.Stallings –“Dataand ComputerCommunications(5thEd.)”–PHI/PearsonEducation | |
| **CourseDesignedby :** | | |

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|  | **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** |

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| **CourseCode** | | |  | **DataVisualization** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **SkillBasedSubject:1** | **5** | **0** | **0** | | | **3** |
| **Pre- requisite** | | | | None | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * TointroducetheconceptofDataVisualization * Toexplainthe varioustechniquesin DataVisualization | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandthebasics of datavisualization | | | | | | | | **K2** | |
| 2 | Understandtheimportanceofdatavisualization andthe designanduseof manyvisual  components | | | | | | | | **K2** | |
| 3 | Explaintheprocess ofdatavisualization | | | | | | | | **K2** | |
| 4 | Explainthebasics ofinteractivedatavisualizationtechniquesvisualization-based  issues. | | | | | | | | **K2** | |
| 5 | Understandthe conceptofvarious typesofvisulaization | | | | | | | | **K2** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **Introduction** | | | | | **15** | | | |
| Introduction-contextofdatavisualization-definitionmethodology,visualizationdesignobjectives.Key factors-purpose, visualization function and tone, visualization design options- data  representation,datapresenation,sevenstagesof datavisualization,widgets,datavisualizationtools. | | | | | | | | | | |
| **UNITII** | | **visualizingdatamethods** | | | | | **15** | | | |
| visualizingdatamethods-mapping,timeseries-connectionsandcorrelations-scatterplotmaps-trees,  hierachiesandrecursion-networksnaadgraphs,infographics | | | | | | | | | | |
| **UNITIII** | | **Visualizingdataprocess** | | | | | **15** | | | |
| Visualizing data process- acquiring data, where to find data, tools of acquiring data from the internet,locating file for use with processing, loading text data, dealing withfiles and folders,lisiting files in afolder, asynchronous image downloads, advanced web techniques, using a database, dealing with largenumberoffiles,parsingdata,levelofeffort,toolsforgatheringclues,textisbest,textmarkup  languages, regular expressions(regexps),grammars and BNF notation, compressed data vectors andgeometry,binarydata formats, advances detect work | | | | | | | | | | |
| **UNITIV** | | **Interactivedatavisualization** | | | | | **15** | | | |
| Interactive data visualization-drawing with data,scales-axes-updates,transaction and mode-  interactivity-layouts-geomapping-exportingframework-T3lstabio | | | | | | | | | | |
| **UNITV** | | **Securitydatavisualization** | | | | | **15** | | | |
| Securitydatavisualization-portscanvisualization-vulnerabilityassessmentandexploitation-firewall  logvisualization-instructiondetectionlogvisualization-attackinganddefendingvisualizationsystems-creatingsecurityvisualization system | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | ScottMurray,”interactivedatavisualizationfortheweb“,O”Reillymedia,inc,2013. | | | | | | | | | |

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| **ReferenceBook(s)** | |
| **1** | Benfry,”visualizingdata”,O”Reillymedia,inc,2007 |
| **2** | Greg conti,”security data visualization:”,”graphical techniques for network analysis”,Nostarchpress inc,2007 |
| **CourseDesignedby :** | |

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|  | **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



FourthSemester



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| **CourseCode** | | |  | **PythonProgramming** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:6** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | * KnowledgeinBasicsofObjectOrientedProgramming | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducethe conceptsof thevarious programmingconstructsof 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** | | | | | | | | | | |
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| **UNITI** | | **BASICS** | | | | | **16** | | | |
| Python-Variables-ExecutingPythonfromtheCommandLine-EditingPythonFiles-PythonReservedWords-BasicSyntax-Comments-StandardDataTypes–RelationalOperators-Logical  Operators -BitWiseOperators -Simple Inputand Output. | | | | | | | | | | |
| **UNITII** | | **CONTROLSTATEMENTS,LISTS,TUPLES** | | | | | **17** | | | |
| **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:** | | | | | **20** | | | |
| Definition-PassingparameterstoaFunction-Built-infunctions-VariableNumberofArguments-Scope–Typeconversion-Typecoercion-PassingFunctionstoaFunction–MappingFunctionsina  Dictionary–Lambda -Modules-StandardModules –sys –math –time-dir–help Function. | | | | | | | | | | |
| **UNITIV** | | **ERRORHANDLING:** | | | | | **18** | | | |
| RunTimeErrors-ExceptionModel-ExceptionHierarchy-HandlingMultipleExceptions-DataStreams-AccessModesWriting-DatatoaFileReading-DataFromaFile-AdditionalFile  Methods-UsingPipesasDataStreams- HandlingIOExceptions -WorkingwithDirectories. | | | | | | | | | | |
| **UNITV** | | **OBJECTORIENTEDFEATURES**: | | | | | **19** | | | |
| 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-MatchingatBeginningorEnd-MatchObjects–Substituting-Splittinga  String-CompilingRegular Expressions. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | MarkSummerfield.―ProgramminginPython3:ACompleteintroductiontothePython | | | | | | | | | |

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|  | 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 :** | |

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|  | **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



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| **CourseCode** | | | |  | **DataWarehousingandDataMining** | **L** | **T** | **P** | | | | **C** |
| **Core/elective/Supportive** | | | | | **Core:7** | **6** | **0** | **0** | | | | **4** |
| **Pre- requisite** | | | | | None | **Syllabus**  **version** | | | **I** | | | |
| **CourseObjectives** | | | | | | | | | | | | |
| * Introduce the concepts of data ware house and data mining and explain the methodologiesusedforanalysis of data | | | | | | | | | | | |  |
| **ExpectedCourseOutcomes** | | | | | | | | | | | | |
| 1 | Understandthefunctionalityofthevariousdatamininganddatawarehousing | | | | | | | | | | **K2** | |
|  | component | | | | | | | |  |
| 2 |  | Describedifferent methodologiesused indataminingand datawarehousing. | | | | | | | |  | **K2** | |
| 3 |  | ExplaintheanalyzingtechniquesandOnlineAnalyticalProcessing | | | | | | | |  | **K2** | |
| 4 | Explainabouttheassociation ruleminingandclassification | | | | | | | | | | **K2** | |
| 5 | Comparedifferentapproachesofdatawarehousinganddataminingwithvarious  technologies | | | | | | | | | | **K4** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | | | |
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| **UNITI** | | | **DataWarehousing** | | | | | **18** | | | | |
| DatawarehousingComponents–BuildingaDatawarehouse–-MappingtheDataWarehousetoaMultiprocessorArchitecture–DBMSSchemasforDecisionSupport–DataExtraction,Cleanup,and  TransformationTools–Metadata. | | | | | | | | | | | | |
| **UNITII** | | | **BusinessAnalysis** | | | | | **18** | | | | |
| Reporting and Query tools and Applications – Tool Categories – The Need for Applications – CognosImpromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAPGuidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools andthe Internet. | | | | | | | | | | | | |
| **UNITIII** | | | **DataMining** | | | | | **17** | | | | |
| Introduction–Data–TypesofData–DataMiningFunctionalities–InterestingnessofPatterns–  ClassificationofDataMiningSystems–DataMiningTaskPrimitives–IntegrationofaDataMiningSystemwith aData Warehouse–Issues–DataPreprocessing | | | | | | | | | | | | |
| **UNITIV** | | | **AssociationRuleMiningandClassification** | | | | | **19** | | | | |
| MiningFrequentPatterns,AssociationsandCorrelations–MiningMethods–MiningvariousKindsof Association Rules – Correlation Analysis – Constraint Based Association Mining – Classificationand Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule BasedClassification–ClassificationbyBackpropagation–SupportVectorMachines–AssociativeClassification–LazyLearners –Other Classification Methods–Prediction. | | | | | | | | | | | | |
| **UNITV** | | | **ClusteringAnd TrendsIn DataMining** | | | | | **18** | | | | |
| ClusterAnalysis–TypesofData–CategorizationofMajorClusteringMethods–K-means–Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods –Model-BasedClusteringMethods–ClusteringHighDimensionalData–Constraint–BasedCluster  Analysis –Outlier Analysis –Data MiningApplications. | | | | | | | | | | | | |

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| **TotalLectureHours** | | **90**  **Hours** |
| **TextBook(s)** | | |
| **1** | AlexBersonandStephen J.Smith,“DataWarehousing,DataMiningand OLAP”,  TataMcGraw–HillEdition,ThirteenthReprint2008. | |
| **2** | JiaweiHanandMichelineKamber,“DataMiningConceptsandTechniques”,ThirdEdition,  Elsevier,2012. | |
| **ReferenceBook(s)** | | |
| **1** | Pang-NingTan,MichaelSteinbachandVipinKumar,“IntroductiontoDataMining”,Person  Education,2007. | |
| **2** | K.P.Soman,ShyamDiwakarand V.Aja,“InsightintoDataMiningTheoryandPractice”,  EasternEconomyEdition,PrenticeHallof India,2006. | |
| **3** | G.K.Gupta,“IntroductiontoDataMiningwithCaseStudies”,EasternEconomyEdition,  PrenticeHallofIndia,2006. | |
| **4** | DanielT.Larose,“DataMiningMethodsandModels”,Wiley-Interscience,2006. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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** | **M** | **L** | **L** | **L** | **L** | **L** | **L** | **L** |

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



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| **CourseCode** | | | |  | **PythonProgramming-Lab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | | **CoreLab :5** | **0** | **0** | **6** | | | **4** |
| **Pre- requisite** | | | | | * KnowledgeinbasicProgramming | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | | |
| * Tointroducetheconceptsofpythonprogrammingconstructsof C++ | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | | |
| 1 | ApplytheconceptofDecisionmakingstatements,loopingconstructs,functionsfor  solvingbasic programs | | | | | | | | | **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 findthelargestthreeintegersusingif-else and conditionaloperator. | | | | | | | | | | | |
| **PROGRAM -3** | |  | | | | | | **5** | | | |
| Write a python program that asks the user to enter a series of positive numbers (The user should enteranegativenumberto signalthe endoftheseries)and theprogram shoulddisplaythenumbers inorder  andtheirsum. | | | | | | | | | | | |
| **PROGRAM-4** | | |  | | | | | **5** | | | |
| Writeapython programto findtheproductoftwomatrices[A]mxp and[B]pxr | | | | | | | | | | | |
| **PROGRAM-5** | | |  | | | | | **5** | | | |
| Writerecursivefunctions forGCD oftwo integers. | | | | | | | | | | | |
| **PROGRAM-**  **6** | |  | | | | | | **10** | | | |
| Writerecursivefunctionsforthefactorialofpositiveinteger. | | | | | | | | | | | |
| **PROGRAM -7** | |  | | | | | | **10** | | | |
| WriterecursivefunctionsforFibonacciSequence uptogivennumber n. | | | | | | | | | | | |
| **PROGRAM-**  **8** | |  | | | | | | **10** | | | |
| Writerecursive functionsto displayprimenumber from 2to n. | | | | | | | | | | | |
| **PROGRAM -9** | |  | | | | | | **10** | | | |
| Writeapython programthat writesaseries ofrandom numberstoafilefrom1 ton anddisplay. | | | | | | | | | | | |
| **PROGRAM -10** | |  | | | | | | **10** | | | |

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| Writeapythonprogramtosortagivensequence:String, Listand Tuple. | | | |
| **PROGRAM-11** | |  | **10** |
| Writeapython programto makeasimplecalculator. | | | |
| **PROGRAM-12** | |  | **10** |
| Writeapythonprogramfor LinearSearchandBinarySearch. | | | |
| **TotalLectureHours** | | | **90**  **Hours** |
|  | | | |
| **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 :** | | | |

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



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| **CourseCode** | | |  | **DeepLearning** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Allied:4** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducestudents tothebasic conceptsandtechniques ofdeepLearning. | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandthebasicconceptsandtechniquesof Deep Learning. | | | | | | | | **K2** | |
| 2 | TounderstandandapplytheMachinelearningprinciples | | | | | | | | **K2** | |
| 3 | Tostudythe deeplearningarchitectures | | | | | | | | **K2** | |
| 4 | Exploreandcreatedeeplearningapplicationswith tensorflow | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3 –applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **Basicsof NeuralNetwork** | | | | | **18** | | | |
| TheNeuralNetwork–LimitsofTraditionalComputing–MachineLearning–Neuron–FFNeural  Networks–TypesofNeurons –Softmax outputlayers | | | | | | | | | | |
| **UNITII** | | **Variables&Operations** | | | | | **18** | | | |
| Tensorflow–Variables–Operations–Placeholders–Sessions–SharingVariables –Graphs–  Visualization | | | | | | | | | | |
| **UNITIII** | | **BasicsofCNN** | | | | | **19** | | | |
| ConvolutionNeuralNetwork –FeatureSelection–Max Pooling–Filters andFeatureMaps –  ConvolutionLayer–Applications | | | | | | | | | | |
| **UNITIV** | | **BasicsofRNN** | | | | | **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** | NikhilBuduma,Nicholas Locascio,“FundamentalsofDeep Learning:Designing  NextGenerationMachineIntelligenceAlgorithms”,O'ReillyMedia,2017. | | | | | | | | | |
| **ReferenceBook(s)** | | | | | | | | | | |
| **1** | IanGoodfellow,YoshuaBengio,AaronCourville,”Deep Learning(Adaptivecomputation  andMachineLearningseries”,MITPress,2017. | | | | | | | | | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | | | | | |  | | | |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | | | | | |  | | | |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | | | | | |  | | | |
| **CourseDesignedby :** | | | | | | | | | | |

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

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



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| **CourseCode** | |  | **CapstoneProjectWorkPhaseI** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportiv**  **e** | | | **SkillBasedSubject2** | **0** | **0** | **4** | | | **3** |
| **Pre- requisite** | | | * Students should have a goodunderstandingofsoftwareengineering * Studentshouldpossessstronganalyticalskills | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| Themain objectives ofthis courseareto:   * Tounderstandand selectthetask basedontheircoreskills. * Togettheknowledge aboutanalyticalskillforsolvingtheselected task. * Togetconfidencefor implementingthetaskandsolvingthe realtimeproblems. | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | |
| Onthesuccessful completionofthecourse,student willbe ableto: | | | | | | | | | |
| 1 | Illustrate arealworld problemand identifythelistofprojectrequirements | | | | | | | **K3** | |
| 2 | Compareexistingsystemwiththeproposedsystemandextracttheinnovative ideas | | | | | | | **K4** | |
| 3 | Judgethefeaturesoftheprojectincludingforms, databasesandreports | | | | | | | **K5** | |
| **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. Theproject work should be compulsorilydoneinthecollegeonlyunderthe supervision of thedepartmentstaff concerned.   **VivaVoce**   1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) andExternalExaminers,after dulyverifyingtheAnnexureReportavailable inthe College,foratotal of75marks at the last dayof thepractical session. 2. Outof75marks, 45 marksforproject reportand 30 MarksforVivaVoce. | | | | | | | | | |

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| **ProjectWork Format** |
| **PROJECTWORK**  **TITLEOFTHEDISSERTATION**  Bonafide Work Done bySTUDENTNAME |



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| REG.NO.  Dissertationsubmittedin partialfulfillmentofthe requirementsfor theawardof  <NameoftheDegree>  of Bharathiar University, Coimbatore-46.College Logo  Signatureof theGuide Signature of the HODSubmittedfortheViva-VoceExaminationheldon  InternalExaminer External ExaminerMonth– Year |
| **CONTENTS**  **AcknowledgementContents**  **Synopsis**   1. **Introduction**    1. OrganizationProfile    2. SystemSpecification       1. HardwareConfiguration       2. SoftwareSpecification 2. **SystemStudy**    1. ExistingSystem       1. Drawbacks    2. ProposedSystem       1. Features 3. **SystemDesign**    1. FormDesign    2. InputDesign    3. OutputDesign    4. DatabaseDesign   **ConclusionBibliographyAppendices**   1. DataFlow Diagram 2. TableStructure |
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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **S** | **S** | **M** | **L** | **L** | **L** | **L** | **L** | **L** |
| **CO2** | **S** | **S** | **S** | **M** | **L** | **L** | **L** | **L** | **L** | **L** |
| **CO3** | **S** | **S** | **S** | **M** | **M** | **L** | **L** | **L** | **L** | **L** |

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



Fifth Semester



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| **CourseCode** | | |  | **RProgramming** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:8** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **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** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoR** | | | | | **18** | | | |
| Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations –Recycling–CommonVector Operations–Using allandany–Vectorizedoperations – NAand  NULLvalues–Filtering–Victoriesedif-thenelse– VectorElementnames. | | | | | | | | | | |
| **UNITII** | | **Matricesandoperations** | | | | | **18** | | | |
| Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Addinganddeletingrowsandcolumns-Vector/MatrixDistinction – AvoidingDimensionReduction –Higher  Dimensional arrays – lists – Creating lists – General list operations – Accessing list components andvalues– applyingfunctions to lists– recursive lists. | | | | | | | | | | |
| **UNITIII** | | **DataFrames** | | | | | **18** | | | |
| Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functionsto Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors –Working with tables – Other factors and table related functions – Control statements – Arithmetic andBoolean operators and values – Default Values for arguments – Returning Boolean Values – Functionsareobjects–Environment andscopeissues – WritingUpstairs–Recursion–Replacement functions–  ToolsforComposingfunction code– Math and Simulation inR. | | | | | | | | | | |
| **UNITIV** | | **ClassesandObjects** | | | | | **18** | | | |
| S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor –readingandwritingfiles–accessingtheinternet–StringManipulation –Graphics –CreatingGraphs  –CustomizingGraphs –SavingGraphstofiles –CreatingThree-Dimensionalplots. | | | | | | | | | | |
| **UNITV** | | **ModellinginR** | | | | | **18** | | | |
| InterfacingRtootherlanguages –ParallelR– BasicStatistics–LinearModel–Generalized Linear  models–Non-linearModels –TimeSeriesandAuto-Correlation–Clustering. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |

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| **TextBook(s)** | | |
| **1** | NormanMatloff, “TheArtofRProgramming:ATourofStatisticalSoftwareDesign”,No  StarchPress,2011. | |
| **2** | JaredP. Lander,“RforEveryone:AdvancedAnalyticsand Graphics”,Addison-WesleyData  &AnalyticsSeries,2013. | |
| **ReferenceBook(s)** | | |
| **1** | MarkGardner,“BeginningR –TheStatisticalProgrammingLanguage”, Wiley,2013. | |
| **2** | RobertKnell,“IntroductoryR:ABeginner‟sGuidetoDataVisualisation,StatisticalAnalysisandprogramminginR”,AmazonDigitalSouthAsiaServicesInc,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**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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



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| **CourseCode** | |  | **RProgrammingLab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | **CoreLab:6** | **0** | **0** | **6** | | | **4** |
| **Pre- requisite** | | | **None** | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| * Toexposethestudent sotthefundamentalconcepts ofRProgramming | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | |
| 1 | Understandthebasicsin Rprogrammingin termsofconstructs, controlstatements,  stringfunctions | | | | | | | **K2** | |
| 2 | UnderstandtheuseofRforBigDataanalytics | | | | | | | **K2** | |
| 3 | ApplyR programmingfor Text processing | | | | | | | **K3** | |
| 4 | Appreciateandapplythe Rprogrammingfromastatistical perspective | | | | | | | **K3** | |
| **K1–RememberK2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | |
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| **ListofPrograms** | | | | | | | | | |
| 1. RExpressionsandDataStructures 2. Manipulationofvectorsandmatrix 3. OperatorsonFactorsinR 4. DataFramesinR 5. ListsandOperators 6. Workingwith loopingstatements. 7. GraphsinR 8. 3D plotsin R | | | | | | | | | |
| **TotalLectureHours** | | | | | | **90**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | |
| **1** | NormanMatloff,“TheArtofRProgramming:A TourofStatisticalSoftwareDesign”,No  StarchPress,2011. | | | | | | | | |
| **2** | JaredP. Lander,“RforEveryone:AdvancedAnalyticsand Graphics”,Addison-WesleyData  &AnalyticsSeries,2013. | | | | | | | | |
| **ReferenceBook(s)** | | | | | | | | | |
| **1** | MarkGardner,“BeginningR –TheStatisticalProgrammingLanguage”, Wiley,2013. | | | | | | | | |
| **2** | RobertKnell,“IntroductoryR:ABeginner‟sGuidetoDataVisualisation,StatisticalAnalysisandprogramminginR”,Amazon DigitalSouth AsiaServicesInc,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**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | | | | |  | | | |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | | | | |  | | | |
| **CourseDesignedby :** | | | | | | | | | |

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|  | **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



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| **CourseCode** | | |  | **BigDataAnalytics** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:9** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | None | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * TointroducetheconceptofBigdata analytics | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandthekeyissuesinbigdatamanagementanditsassociatedapplicationsin  intelligentbusinessandscientificcomputing. | | | | | | | | **K2** | |
| 2 | UnderstandtheconceptsofHadoopDistributedfilesystemandhadoopfilesystem  interfaces. | | | | | | | | **K2** | |
| 3 | Illustratetheconceptsof PIG andHIVE | | | | | | | | **K2** | |
| 4 | Identifythecharacteristicsofdatasetsandcomparethetrivialdataandbigdatafor  variousapplications. | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoData** | | | | | **17** | | | |
| Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, ApacheHadoop,AnalysingDatawithUnix tools,AnalysingDatawithHadoop,HadoopStreaming, HadoopEchoSystem,IBMBigDataStrategy,Introductionto InfosphereBigInsightsandBigSheets. | | | | | | | | | | |
| **UNITII** | | **IntroductiontoHDFS** | | | | | **19** | | | |
| HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command LineInterface,Hadoopfilesysteminterfaces,Dataflow,DataIngestwithFlumeandScoopandHadooparchives,HadoopI/O:Compression, Serialization,AvroandFile-BasedDatastructures. | | | | | | | | | | |
| **UNITIII** | | **Jobs & Tasks** | | | | | **17** | | | |
| MapReduceAnatomyof aMapReduceJobRun,Failures, JobScheduling,Shuffleand Sort,TaskExecution,Map ReduceTypesand Formats, MapReduceFeatures. | | | | | | | | | | |
| **UNITIV** | | **HadoopEcoSystemPig** | | | | | **18** | | | |
| Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig withDatabases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell,Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions. Hbase :HBasics, Concepts, Clients, Example, Hbase VersusRDBMS.BigSQL:Introduction | | | | | | | | | | |
| **UNITV** | | **DataAnalyticswithR MachineLearning** | | | | | **19** | | | |
| DataAnalyticswithRMachineLearning:Introduction,Supervised Learning,Unsupervised  Learning,CollaborativeFiltering.BigDataAnalyticswithBigR. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90** | | | |

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|  | | **Hours** |
| **TextBook(s)** | | |
| **1** | TomWhite“Hadoop:TheDefinitiveGuide”ThirdEditon,O‟reilyMedia,2012. | |
| **2** | SeemaAcharya,SubhasiniChellappan,"BigData Analytics"Wiley2015.References. | |
| **3** | MichaelBerthold,DavidJ.Hand,"IntelligentDataAnalysis”,Springer,2007. | |
| **4** | JayLiebowitz,“BigData andBusinessAnalytics”AuerbachPublications,CRCpress(2013) | |
| **5** | TomPlunkett,MarkHornick,“UsingRtoUnlocktheValueofBigData:BigDataAnalytics  with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media(2013),Oracle press. | |
| **6** | AnandRajaramanandJefreyDavidUlman, “MiningofMassiveDatasets”,Cambridge  UniversityPress, 2012. | |
| **ReferenceBook(s)** | | |
| **1** | BillFranks,“TamingtheBigDataTidalWave:FindingOpportunitiesinHugeDataStreams  withAdvancedAnalytics”,JohnWiley&sons,2012. | |
| **2** | GlenJ.Myat, “MakingSense ofData”, JohnWiley& Sons,2007 | |
| **3** | PeteWarden,“BigDataGlossary”,O‟Reily,2011. | |
| **4** | MichaelMineli,MicheleChambers,AmbigaDhiraj,"BigData,BigAnalytics:Emerging  Business IntelligenceandAnalyticTrendsforToday's Businesses",WileyPublications,2013. | |
| **5** | ArvindSathi,“BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame”,MC  Press,2012 | |
| **6** | PaulZikopoulos,DirkDeRoos,KrishnanParasuraman,ThomasDeutsch,JamesGiles,DavidCorigan,"HarnessthePowerofBigDataTheIBMBigDataPlatform",TataMcGraw  Hill Publications,2012 | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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



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| **CourseCode** | |  | **CapstoneProjectWorkPhaseII** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | **SkillBasedSubject3** | **0** | **0** | **6** | | | **3** |
| **Pre- requisite** | | | * StudentsshouldhavecompletedCapstoneProjectWork Phase –I * Strong coding skills in any oneprogrammingpaper | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| Themain objectives ofthis courseareto:   * Tounderstandand selectthetask basedontheircoreskills. * Togettheknowledge aboutanalyticalskillforsolvingtheselectedtask. * Togetconfidenceforimplementingthetaskandsolvingtherealtimeproblems. | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | |
| Onthesuccessful completionofthecourse,student willbe ableto: | | | | | | | | | |
| 1 | Selectappropriateinput,output,formandtabledesign | | | | | | | **K3** | |
| 2 | Designcodetomeettheinputrequirementsandtoachievetherequiredoutput | | | | | | | **K6** | |
| 3 | Composeaprojectreport incorporatingthe featuresoftheproject | | | | | | | **K6** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | |
|  | | | | | | | | | |
| **Aimoftheprojectwork** | | | | | | | | | |
| 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 of75 marks at the lastdayof thepractical session. 2. Outof75marks, 45 marksforproject reportand 30 MarksforVivaVoce. | | | | | | | | | |



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| **ProjectWork Format** |
| **PROJECTWORK**  **TITLEOFTHEDISSERTATION**  Bonafide Work Done bySTUDENT NAMEREG.NO.  Dissertationsubmitted inpartialfulfillment oftherequirementsfor theaward of  <NameoftheDegree>  ofBharathiar University,Coimbatore-46.  CollegeLogo  Signatureof theGuide Signature of the HODSubmittedfortheViva-VoceExaminationheldon  InternalExaminer External ExaminerMonth– Year |
| **CONTENTS**  **AcknowledgementContents**  **Synopsis**   1. **Introduction**    1. OrganizationProfile    2. SystemSpecification       1. HardwareConfiguration       2. SoftwareSpecification 2. **SystemStudy**    1. ExistingSystem       1. Drawbacks    2. ProposedSystem       1. Features 3. **SystemDesign andDevelopment**    1. FileDesign    2. InputDesign    3. OutputDesign    4. DatabaseDesign    5. SystemDevelopment       1. DescriptionofModules(Detailedexplanation abouttheprojectwork)   **4SoftwareTestingandImplementationConclusion**  **BibliographyAppendices**   1. DataFlow Diagram 2. TableStructure |

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| 1. SampleCoding 2. Sample Input 3. SampleOutput |
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|  | **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



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| **CourseCode** | | |  | **BusinessDataAnalytics** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:I** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducethefundamentalconcepts ofBusinessdataanalytics and associatedmethodologies | | | | | | | | | | |
|  | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandandcriticallyapplytheconceptsand methods ofbusiness analytics | | | | | | | | **K2** | |
| 2 | Demonstrationthevariousmethodologiesofdescriptivestatistics | | | | | | | | **K2** | |
| 3 | Understandingof modelinguncertaintyand statisticalinference | | | | | | | | **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 MAPREDUCEFRAMEWOR**K | | | | | **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,Groupingand Aggregation– Extensions to MapReduce. | | | | | | | | | | |
| **UNITV** | | **OTHERDATAANALYTICALFRAMEWORKS** | | | | | **17** | | | |
| OverviewofApplicationdevelopmentLanguagesforHadoop–PigLatin–Hive–HiveQueryLanguage(HQL)–IntroductiontoPentaho,JAQL– IntroductiontoApache:Sqoop,DrillandSpark,  ClouderaImpala–IntroductiontoNoSQLDatabases–Hbase andMongoDB. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | VigneshPrajapati,“BigDataAnalytics withRandHadoop”,PacktPublishing,2013. | | | | | | | | | |

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| **2** | UmeshRHodeghatta,UmeshaNayak,“BusinessAnalyticsUsingR–APracticalApproach”,  Apress,2017. | |
| **ReferenceBook(s)** | | |
| **1** | AnandRajaraman,JeffreyDavidUllman,“MiningofMassiveDatasets”, Cambridge  UniversityPress, 2012. | |
| **2** | JeffreyD. Camm,James J.Cochran, MichaelJ. Fry,JeffreyW.Ohlmann, DavidR. Anderson,  “EssentialsofBusiness Analytics”,CengageLearning,secondEdition,2016 | |
| **3** | U.DineshKumar, “BusinessAnalytics:TheScienceofData-DrivenDecisionMaking”,  Wiley,2017. | |
| **4** | A.Ohri,“RforBusiness Analytics”,Springer,20127.RuiMiguelForte,“Mastering  PredictiveAnalyticswithR”,PacktPublication,2015. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesigned by :** | | |

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|  | **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



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| **CourseCode** | | |  | **SocialNetworkAnalysis** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:I** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Toexplainthemethodologiesusedinsocialnetworkanalysis | | | | | | | | | | |
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| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandabroad rangeof network conceptsand theories. | | | | | | | | **K2** | |
| 2 | Appreciatehow network analysiscan contribute toincreasingknowledgeaboutdiverse  aspectsofsociety. | | | | | | | | **K2** | |
| 3 | Usearelationalapproachtoanswerquestionsofinteresttothem(i.e.beabletoapply  'networkthinking'). | | | | | | | | **K3** | |
| 4 | Analysesocial network datausingvarious softwarepackages. | | | | | | | | **K3** | |
| 5 | Presentresultsfromsocialnetworkanalysis,bothorallyandinwriting. | | | | | | | | **K5** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **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** | | | |
| Data Mining Essentials –Data Mining Algorithms - Web Content Mining –Latent semantic Indexing –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 | | | | | | | | | | |
| **UNITIV** | | **HUMANBEHAVIORANALYSIS AND PRIVACYISSUES** | | | | | **19** | | | |
| Understanding and Predicting Human Behavior for Social Communities – Use Data Management,InferenceandDistribution–EnablingNewHumanExperiences–RealityMining–ContextAwareness–PrivacyinOnlineSocialNetworks–TrustinOnlineEnvironment–TrustModelsBased  on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust andReputation–TrustDerivationBasedonTrustComparisons–AttackSpectrumandCountermeasures. | | | | | | | | | | |

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| **UNITV** | | **VISUALIZATIONANDAPPLICATIONSOFSOCIALNETWORKS** | **19** |
| Graph Theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – VisualizingOnline Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node-Link Diagrams – Hybrid Representations – Applications – Covert Networks – Community Welfare –Collaboration Networks – Co-Citation Networks – Recommendation in Social Media: Challenges –ClassicalRecommendationAlgorithms–RecommendationUsingSocialContext–EvaluatingRecommendations | | | |
| **TotalLectureHours** | | | **90**  **Hours** |
| **TextBook(s)** | | | |
| **1** | 1.PeterMika,“SocialnetworksandtheSemanticWeb”,Springer,2007. | | |
| **2** | 2.BorkoFurht,“HandbookofSocialNetworkTechnologies andApplications”,Springer,  2010. | | |
| **ReferenceBook(s)** | | | |
| **1** | Bing Liu, “WebDataMining:ExploringHyperlinks,Contents,andUsageData(DataCentric  SystemsandApplications)”,Springer;SecondEdition,2011. | | |
| **2** | RezaZafarani,MohammadAliAbbasi,HuanLiu,”SocialMediaMining”,Cambridge  UniversityPress,2014. | | |
| **3** | GuandongXu,Yanchun Zhangand Lin Li,“Web MiningandSocialNetworkingTechniques  andapplications”,Springer,2011 | | |
| **4** | DionGohandSchubertFoo,“Socialinformationretrievalsystems:emergingtechnologiesand  ApplicationsforsearchingtheWebeffectively”,IdeaGroup,2007. | | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | |  |
| **CourseDesignedby :** | | | |

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|  | **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



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| **CourseCode** | | |  | **ArtificialNeuralNetworkandFuzzySystems** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:I** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconcepts ofartificial neuralnetworks andfuzzysystems * To explain thebasic mathematical elements ofthetheoryof fuzzysets. | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Explaintheconceptsof neuralnetworksand ,fuzzylogic | | | | | | | | **K2** | |
| 2 | Understandingof the basic 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** | | | | | | | | | | |
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| **UNITI** | | **BasicConcepts** | | | | | **17** | | | |
| Basicconcepts-singlelayerperceptron-Multilayerperceptron-Adaline-Madaline-Learningrules-  Supervisedlearning-Backpropagationnetworks-Trainingalgorithm,Advancedalgorithms-Adaptivenetwork-Radial basis network modular network-Applications | | | | | | | | | | |
| **UNITII** | | **UnsupervisedLearning** | | | | | **19** | | | |
| Introduction-unsupervisedlearning–Competitivelearningnetworks-Kohonenselfuantizatinetworks-Learning vectoruantization – Hebbian learning – Hopfield network-Content addressablenature,BinaryHopfieldnetwork,ContinuousHopfieldnetworkTravellingSalespersonproblem–  Adaptiveresonancetheory–BidirectionalAssociativeMemory-PrinciplecomponentAnalysis | | | | | | | | | | |
| **UNITIII** | | **FuzzyLogic** | | | | | **18** | | | |
| Introduction–crispsetsanoverview–thenotionoffuzzysets–Basicconceptsoffuzzysets–classicallogicanoverview–Fuzzylogic.Operationsonfuzzysets-fuzzycomplement–fuzzyunion  –fuzzyintersection –combinationsofoperations–generalaggregationoperations | | | | | | | | | | |
| **UNITIV** | | **FuzzyLogicContd..** | | | | | **17** | | | |
| Crispandfuzzyrelations –binaryrelations–binaryrelationsonasingleset–equivalenceandsimilarityrelations–Compatibilityortolerancerelations–orderings–Membershipfunctions–  methodsofgeneration–defuzzificationmethods | | | | | | | | | | |
| **UNITV** | | **NeuroFuzzySystems** | | | | | **19** | | | |
| 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: FeedbackControlSystems,ExpertControl,InverseLearning,SpecializedLearning,Backpropagationthrough  Real–TimeRecurrentLearning. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |
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| **TextBook(s)** | | |
| **1** | “NeuroFuzzyandSoftcomputing”,JangJ.S.R.,SunC.TandMizutaniE–Pearson education,  2004 | |
| **2** | ”FundamentalsofNeuralNetworks”, LaureneFauseett,PrenticeHall India,NewDelhi,1994. | |
| **ReferenceBook(s)** | | |
| **1** | ”FuzzyLogicEngineeringApplications”,TimothyJ.Ross,McGrawHill,NewYork,1997. | |
| **2** | “Neuralnetworks, Fuzzylogics,and Geneticalgorithms”,S.Rajasekaranand  G.A.VijayalakshmiPaiPrenticeHallofIndia,2003 | |
| **3** | ”FuzzySetsandFuzzyLogic”,GeorgeJ.KlirandBoYuan,PrenticeHall Inc.,New  Jersey,1995 | |
| **4** | “PrinciplesofSoftComputing”S.N.Sivanandam, S.N.DeepaWileyIndiaPvt Ltd. | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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



SixthSemester



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| **CourseCode** | | |  | **LinuxandShellProgramming** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Core:10** | **6** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **BasicknowledgeaboutOperatingSystems** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * TointroducetheconceptsofLinuxoperatingsystem * ToexplainthevariousconstructsassociatedwithLinux | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | IllustratethevariousdirectoryandfiecommandsinLINUX | | | | | | | | **K2** | |
| 2 | ExplainthemethodsofsecuringfilesinLinux | | | | | | | | **K2** | |
| 3 | ExplainthevariouskernelcomponentsofLinux | | | | | | | | **K2** | |
| 4 | Applythevariouscommandsof Linuxtoperformseveraloperations | | | | | | | | **K3** | |
| 5 | SolvevariousnetworkadministrativeissuesbywritingLinuxshellscripts | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoLinux** | | | | | **15** | | | |
| IntroductiontoLINUXOperatingSystem:Introduction-TheLINUXOperatingSystem-Basic  commandsin Linux | | | | | | | | | | |
| **UNITII** | | **ManagingFiles&Directories** | | | | | **18** | | | |
| ManagingFilesandDirectories:Introduction–Directory CommandsinLINUX–FileCommandsinLINUX.Creatingfilesusingthevieditor:Texteditors–Thevieditor.ManagingDocuments:  Locatingfilesin LINUX–Standardfiles–Redirection–Filters–Pipes. | | | | | | | | | | |
| **UNITIII** | | **Shellscript** | | | | | **20** | | | |
| SecuringfilesinLINUX:Fileaccesspermissions–viewingFileaccesspermissions–ChangingFileaccesspermissions.AutomatingTasksusingShellScripts:Introduction–Variables-Localand  GlobalShellvariables–CommandSubstitution. | | | | | | | | | | |
| **UNITIV** | | **Conditional&LoopingStatements** | | | | | **19** | | | |
| Using Conditional Execution in Shell Scripts: Conditional Execution – The case…esac Construct.Managing repetitive tasks using Shell Scripts: Using Iteration in Shell Scripts – The while construct –untilconstruct–forconstruct–breakandcontinuecommands–SimpleProgramsusingShell  Scripts. | | | | | | | | | | |
| **UNITV** | | **Kernel&SystemRecovery** | | | | | **18** | | | |
| LinuxKernel-KernelComponents-compilingakernel-Customizingakernel–systemstartup-  Customizingthebootprocess-SystemRecovery | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | OperatingSystemLINUX,NIIT,PHI,2006,EasternEconomyEdition. | | | | | | | | | |
| **ReferenceBook(S)** | | | | | | | | | | |
| **1** | RichardPetersen,Linux:TheComplete Reference,SixthEdition,TataMcGraw-Hill  PublishingCompanyLimited, NewDelhi, Edition2008. | | | | | | | | | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | | | | | |  | | | |

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| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
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|  | **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



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| **CourseCode** | | |  | **LinuxandShellProgrammingLab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **CoreLab:7** | **0** | **0** | **5** | | | **4** |
| **Pre- requisite** | | | | * Basicknowledge Linux commands | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| Tointroduceheconceptsof Linux operatingsystemcommandsexecutionandvariousprogramming  constructionin Linux shellscript. | | | | | | | | | | |
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| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Tocreatethedirectory,howtochange andremovethedirectory. | | | | | | | | **K1** | |
| 2 | ToevaluatetheconceptofshellscriptingprogramsbyusinganAWKandSED  commands | | | | | | | | **K2** | |
| 3 | TodemonstratethebasicknowledgeofLinuxcommandsandfilehandlingutilitiesby  usingLinuxshellenvironment. | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **EXERCISE1** | |  | | | | | **6** | | | |
| WriteaShell scriptthat displayslist ofall thefiles inthecurrentdirectorytowhich theuserhasread,  writeand executepermissions. | | | | | | | | | | |
| **EXERCISE2** | |  | | | | | **6** | | | |
| Writeanawk scriptto findthe numberofcharacters,words andlines inafile? | | | | | | | | | | |
| **EXERCISE3** | |  | | | | | **9** | | | |
| WriteaShellscriptthataccepts a filename,startingandendinglinenumbersasargumentsand  displaysallthelinesbetween the givenlinenumbers? | | | | | | | | | | |
| **EXERCISE4** | |  | | | | | **9** | | | |
| Writeashellscript to sortnumber inascendingorder. | | | | | | | | | | |
| **EXERCISE5** | |  | | | | | **12** | | | |
| Writeashellscript(smallcalculator)thatadds, subtracts,multipliesanddividesthetwogiven  numbers. | | | | | | | | | | |
| **EXERCISE6** | |  | | | | | **9** | | | |
| Writeashellscript to determinewhether a givennumberisa primenumberor not. | | | | | | | | | | |
| **EXERCISE7** | |  | | | | | **12** | | | |
| Writeashell scriptto printthe firstn Fibonaccinumbers. | | | | | | | | | | |
| **EXERCISE8** | |  | | | | | **9** | | | |
| Writeashellscript tofind theGCD oftwogivennumbers. | | | | | | | | | | |
| **EXERCISE9** | |  | | | | | **9** | | | |
| Writeashellscript tocheck whether given stringis palindromeor not. | | | | | | | | | | |
| **EXERCISE**  **10** | |  | | | | | **9** | | | |
| Writeashell scriptto findthefactorialofgiveninteger. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **90**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |

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| **1** | OperatingSystemLINUX,NIIT,PHI,2006,EasternEconomyEdition. |
|  | |
| **ReferenceBook(S)** | |
| **1** | RichardPetersen,Linux:TheCompleteReference,SixthEdition,TataMcGraw-Hill  PublishingCompanyLimited, NewDelhi, Edition2008. |
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| **CourseDesignedby :** | |

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

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| **CourseCode** | |  | **ProjectWorkLab** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | **Core-11** | **0** | **0** | **3** | | | **6** |
| **Pre- requisite** | | | Studentsshouldhavethestrongknowledgeinanyone of theprogramminglanguagesin this  course. | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | |
| Themain objectives ofthis courseareto:   * Tounderstandand selectthetask basedontheircoreskills. * Togettheknowledge aboutanalyticalskillforsolvingtheselectedtask. * Togetconfidenceforimplementingthe taskand solvingthereal timeproblems. * Expresstechnicalandbehavioralideasandthoughtinoralsettings. * Prepareandconductoralpresentations | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | |
| Onthesuccessfulcompletion ofthe course, studentwill beable to: | | | | | | | | | |
| 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 theproject | | | | | | | **K1-K4** | |
| 5 | Generatealternativesolutions,comparethemandselecttheoptimumone | | | | | | | **K6** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | |
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| **Aimoftheprojectwork** | | | | | | | | | |
| 1. The aim of the project work is to acquire practical knowledge on the implementation of theprogrammingconcepts 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 ideafocusingon 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 of200marks at the last dayofthe practical session. 2. Outof200 marks,160marksforproject reportand 40marksfor VivaVoce. | | | | | | | | | |



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| **ProjectWork Format** |
| **PROJECTWORK**  **TITLEOFTHEDISSERTATION**  Bonafide Work Done bySTUDENT NAMEREG.NO.  Dissertationsubmitted inpartial fulfillmentoftherequirementsfor theaward of  <NameoftheDegree>  ofBharathiar University,Coimbatore-46.  CollegeLogo  Signatureof theGuide Signature of the HODSubmittedfortheViva-VoceExaminationheldon  InternalExaminer External ExaminerMonth– Year |
| **CONTENTS**  **Acknowledgement** |



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| **ContentsSynopsis**   1. **Introduction**    1. OrganizationProfile    2. SystemSpecification       1. HardwareConfiguration       2. SoftwareSpecification 2. **SystemStudy**    1. ExistingSystem       1. Drawbacks    2. ProposedSystem       1. Features 3. **SystemDesign andDevelopment**    1. FileDesign    2. InputDesign    3. OutputDesign    4. DatabaseDesign    5. SystemDevelopment       1. DescriptionofModules(Detailedexplanation abouttheprojectwork) 4. **TestingandImplementation** 5. **ConclusionBibliographyAppendices** |

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| 1. DataFlow Diagram 2. TableStructure 3. SampleCoding 4. Sample Input 5. SampleOutput |
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|  | **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



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| **CourseCode** | | |  | **MachineLearning** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Skillbasedsubject:4** | **4** | **0** | **0** | | | **3** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Toexplain aboutthebasics ofmachine learning | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandingofthefundamentalissuesandchallengesofmachinelearning:data,  modelselection,modelcomplexity,etc. | | | | | | | | **K2** | |
| 2 | Understandingofthestrengthsandweaknessesofmanypopularmachinelearning  approaches. | | | | | | | | **K2** | |
| 3 | Explainabouttheconceptsofcomputationallearningtheoryanddimensionality  reduction | | | | | | | | **K2** | |
| 4 | AppreciatetheunderlyingmathematicalrelationshipswithinandacrossMachine  Learningalgorithmsandtheparadigmsofsupervised andun-supervisedlearning. | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoLearning** | | | | | **12** | | | |
| Algorithmicmodelsoflearning,Learningclassifiers,functions,relations,grammars,probabilisticmodels,valuefunctions,behaviorsandprogramsforexperience.Bayesian,maximumsomeposterior,  andminimumdescriptionlengthframeworks. | | | | | | | | | | |
| **UNITII** | | **LearningModels** | | | | | **12** | | | |
| 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,locallyweightedregression,ensembleclassifiers. | | | | | | | | | | |
| **UNITIII** | | **ComputationalLearning** | | | | | **12** | | | |
| 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** | | | | | **12** | | | |
| UnsupervisedLearning:Clustering,mixturemodels,k-meansclustering,hierarchicalclustering,distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data andknowledge. | | | | | | | | | | |

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| **UNITV** | | **LearningApplications** | **12** |
| Selectedapplicationsindatamining,automatedknowledgeacquisition,patternrecognition,programsynthesis,textandlanguageprocessing,internet-basedinformationsystems,humancomputer  interaction,semanticweb,andbioinformaticsand computationalbiology. | | | |
| **TotalLectureHours** | | | **60**  **Hours** |
| **TextBook(s)** | | | |
| **1** | Bishop,C.(2006).PatternRecognitionandMachineLearning. Berlin:Springer-Verlag. | | |
|  | **ReferenceBook(s)** | |  |
| **1** | Russel,S.AndNorving,P.(2003).ArtificialIntelligence:AModern Approach.2ndEdition,  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**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) | |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) | |  |
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|  | **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



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| **CourseCode** | | |  | **WebApplicationSecurity** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:II** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconcepts of securityinwebapplications * 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** | | **Introductiontowebapplications** | | | | | **14** | | | |
| DatawithURL-HTML-DHTML:CascadingStyleSheets,CommonGatewayInterface:ProgrammingCG!Scripts-HTMLForms-:-CustomDatabaseQueryScripts-ServerSideIncludes-  Server\_securityissues. | | | | | | | | | | |
| **UNITII** | | **IntroductiontoScriptingLanguages** | | | | | **14** | | | |
| XHTML:Introduction,CSS-Scriptinglanguages-JavaScript:Controlstatements,Functions,Arrays,  Objects-DOM- Aiaxenablerichinternetapplications. | | | | | | | | | | |
| **UNITIII** | | **ServerSideProgramming** | | | | | **15** | | | |
| ServersideProgramming-Activeserverpages-Javaserverpages-JavaServlets:Servletcontainer-  Exceptions-SessionsandSessionTracking\_-UsingServletcontext-DynamicContentGeneration-ServletChainingand Communications. | | | | | | | | | | |
| **UNITIV** | | **HTML5 &CSS3** | | | | | **15** | | | |
| HTML review,Featuredetection,TheHTML5newElements,Canvas,Videoandaudio,Webstorage, Geo location, Offline Web pages , Micro data, HTML5 APLS, Migrating from HTML4 toHTML5,CSS3 . | | | | | | | | | | |
| **UNITV** | | **Web2.0** | | | | | **17** | | | |
| WEB2.0-HISTORY,characteristics,technologies,concepts,usage,web2.0ineducation,philanthropy,socialwork.Web3.0-Theory-andhistoryunderstanding.basicwebartifactsandapplications,implementation.MSsharepoint-Sharepoint2013overview,share(Putsocialtowork  ,Share your stuff, Take share point on the go), Discover (find experts, discover answers, find what youarelookingfor), Manage(cost, risk, time) | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | Deitel,DeitelandNeita,-InternetandWorldWide\_Web-Howtoprogramll,PearsonEducation | | | | | | | | | |

Asia,

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|  | 4th Edition, 2009. | |
| **2** | ElliotteRustyHerold,-JavaNetworkProgramming II,O'ReillyPublications, 3rdEdition,  2004. | |
| **ReferenceBook(s)** | | |
| **1** | JeffyDwight,MichaelErwinand RobertNikes-USINGCGIII,PH.IPublications,1997 | |
| **2** | JasonHunter,WilliamCrawford -JavaServlet ProgrammingO'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**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
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|  | **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



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| **CourseCode** | | |  | **SoftwareAgents** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:II** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Toexplainthefundamentalsofagentsandagentprogrammingparadigms. * Toexplainabout agentsandsecurity | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandingthe fundamentalsof agents and agent programmingparadigms. | | | | | | | | **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** | | | | | | | | | | |
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| **UNITI** | | **AGENTS–OVERVIEW** | | | | | **15** | | | |
| **UNITI**AgentDefinition–AgentProgrammingParadigms–AgentVsObject–Aglet–Mobile  Agents–AgentFrameworks–AgentReasoning | | | | | | | | | | |
| **UNITII** | | **JAVAAGENTS** | | | | | **15** | | | |
| **UNITII**Processes–Threads–Daemons–Components–JavaBeans–ActiveX–Sockets–RPCs–DistributedComputing–AgletsProgramming–JiniArchitecture–ActorsandAgents–Typedand  ProactiveMessages | | | | | | | | | | |
| **UNITIII** | | **MULTIAGENTSYSTEMS** | | | | | **15** | | | |
| InteractionbetweenAgents–ReactiveAgents–CognitiveAgents–InteractionProtocols–AgentCoordination–Agentnegotiation–AgentCooperation–AgentOrganization–Self-InterestedAgents  inElectronicCommerce Applications | | | | | | | | | | |
| **UNITIV** | | **INTELLIGENTSOFTWAREAGENTS** | | | | | **15** | | | |
| InterfaceAgents–AgentCommunicationLanguages–AgentKnowledgeRepresentation–Agent  Adaptability–Belief DesireIntension–MobileAgentApplications | | | | | | | | | | |
| **UNITV** | | **AGENTSANDSECURITY** | | | | | **15** | | | |
| AgentSecurityIssues–MobileAgentsSecurity–ProtectingAgentsagainstMaliciousHosts–  UntrustedAgent– BlackBoxSecurity–AuthenticationforAgents–SecurityIssues forAglets | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | Bigus &Bigus,“ConstructingIntelligentagentswithJava”,Wiley,2010. | | | | | | | | | |
| **2** | Bradshaw,“SoftwareAgents”,MITPress,2012. | | | | | | | | | |
| **ReferenceBook(s)** | | | | | | | | | | |
| **1** | Russel&Norvig,“ArtificialIntelligenceamodernapproach”,PrenticeHall,1994. | | | | | | | | | |
| **2** | RichardMurchandTonyJohnson,“IntelligentSoftwareAgents”,Prentice Hall,2000. | | | | | | | | | |
| **3** | MichaelWooldridge, “An IntroductiontoMultiAgentSystems”,JohnWiley,2002. | | | | | | | | | |

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|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
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|  | **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



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| **CourseCode** | | |  | **EmbeddedSystems** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:II** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconceptsofembeddedsystemsanditsarchitecture | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Understandhardwareandsoftwaredesignrequirementsofembeddedsystems. | | | | | | | | **K2** | |
| 2 | Explainaboutthearchitectureofmicroprocessorandoperatingsystemsinembedded  systems | | | | | | | | **K2** | |
| 3 | Analyzetheembeddedsystems‟specificationanddevelopsoftwareprograms. | | | | | | | | **K4** | |
| 4 | EvaluatetherequirementsofprogrammingEmbeddedSystems,relatedsoftware  architecturesandtoolchainforEmbeddedSystems. | | | | | | | | **K5** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **IntroductiontoEmbeddedSystems** | | | | | **15** | | | |
| ExamplesofEmbeddedSystems–TypicalHardware–Memory–Microprocessors–Busses–DirectMemoryAccess– Introductionto8051Microcontroller –Architecture-Instructionset –Programming. | | | | | | | | | | |
| **UNITII** | | **Microprocessors** | | | | | **16** | | | |
| Microprocessor Architecture–InterruptBasics– The Shared-Data problem–InterruptLatency-Round–Robin Architecture - Round–Robin with Interrupts Architecture - Function-QueueSchedulingArchitecture– Real-TimeOperatingSystemsArchitecture– SelectionofArchitecture. | | | | | | | | | | |
| **UNITIII** | | **Tasks&Semaphores** | | | | | **14** | | | |
| TasksandTaskStates–TasksandData–SemaphoresandSharedData–SemaphoreProblems–  Semaphorevariants. | | | | | | | | | | |
| **UNITIV** | | **MessageQueues& RTOS** | | | | | **15** | | | |
| MessageQueues–Mailboxes–Pipes–TimerFunctions–Events–MemoryManagement–InterruptRoutinesinRTOSEnvironment.RTOSdesign–Principles–EncapsulationSemaphoresandQueues  –Hard Real-Time SchedulingConsiderations–SavingMemorySpace– SavingPower. | | | | | | | | | | |
| **UNITV** | | **Host&Target Machines** | | | | | **15** | | | |
| HostandTargetMachines–Linker/LocatorforEmbeddedSoftware-GettingEmbeddedSoftwareintotheTargetSystem.Testingonyour HostMachine –InstructionSetSimulators–LaboratoryTools  usedforDebugging. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | The8051Microcontroller Architecture,Programming&Applications,KennethJ.Ayala,PenramInternational. | | | | | | | | | |
| **2** | AnEmbeddedSoftwarePrimer,DavidE.Simon,PearsonEducation,2005. | | | | | | | | | |

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| **ReferenceBook(s)** | | |
| **1** | EmbeddedSystems:Architecture,ProgrammingandDesign,RajKamal,TataMcGraw-Hill  Education,2008 | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
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|  | **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



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| **CourseCode** | | |  | **ClientServerComputing** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:III** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tointroducetheconcepts ofclient andserver * Todescribethevariouscomponents ofclientservercomputing | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Explainaboutthe variouscomponentsof clientservercomputing | | | | | | | | **K2** | |
| 2 | Understandthe rolesof client andserverin anetwork | | | | | | | | **K2** | |
| 3 | AnalyzethecomponentsofClientServercomputingintermsofconnectivity,  hardware/softwareandserviceandsupport | | | | | | | | **K3** | |
| 4 | Analyzethevarioustypesofwormsandviruses | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **Introduction** | | | | | **14** | | | |
| Client/ ServerComputing–Advantages ofClient /ServerComputing–TechnologyRevolution–  Connectivity–Ways toimprovePerformance–How toreducenetworkTraffic. | | | | | | | | | | |
| **UNITII** | | **ComponentsofClient/ServerApplications** | | | | | **16** | | | |
| Components of Client / Server Applications–The Client: Role of a Client–Client Services– Requestfor Service. Components of Client / Server Applications – The Server: The Role of a Server – ServerFunctionalityinDetail–TheNetworkOperatingSystem–WhataretheAvailablePlatforms–The  ServerOperatingsystem. | | | | | | | | | | |
| **UNITIII** | | **Connectivity&IPC** | | | | | **15** | | | |
| Components of Client / Server Applications–Connectivity: Open System Interconnect –  CommunicationsInterfaceTechnology– Inter-processcommunication–WANTechnologies. | | | | | | | | | | |
| **UNITIV** | | **ComponentsofC/Sapplication H/W&S/W** | | | | | **14** | | | |
| ComponentsofClient/ServerApplications–Software.ComponentsofClient/ServerApplications–  Hardware. | | | | | | | | | | |
| **UNITV** | | **Service&Support** | | | | | **16** | | | |
| ComponentsofClient/Serverapplications–ServiceandSupport:SystemAdministration.TheFutureofClient /Server Computing: EnablingTechnologies– TransformationalSystems. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | Client/ServerComputing,PatrickSmith,SteveGuenferich,2ndedition,PHI.*(Chapters1-8&*  *10)* | | | | | | | | | |
|  | **ReferenceBook(s)** | | | | | |  | | | |
| **1** | RobertOrfali,DanHarkey, JeriEdwards:TheEssentialClient/ServerSurvivalGuide,2nd  edition,GalgotiaPublications. | | | | | | | | | |
| **2** | DewireandDawanaTravis,Client/ServerComputing,TMH | | | | | | | | | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** | | | | | |  | | | |

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| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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



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| **CourseCode** | | |  | **OpenSourceSoftware** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:III** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabusversion** | | | **I** | | |
| **CourseObjectives** | | | |  | | | | | | |
| * Toexplain theneed andimportanceofopen sourcesoftware * Tointroducethevariousopensourcesoftwareslike Linux,MySql,PHPandPython | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Explainaboutthe needand importanceofopen sourcesoftware | | | | | | | | **K2** | |
| 2 | Demonstratethe conceptsofopensourcesoftwares | | | | | | | | **K2** | |
| 3 | Applytheprogrammingconstructsof MYSql,PHP,PythonandPERLtocreate  programs | | | | | | | | **K3** | |
| 4 | Developsmallprogramsusingopensourcesoftwares | | | | | | | | **K3** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **Introductiontoopensources** | | | | | **14** | | | |
| 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** | | | | | **16** | | | |
| 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** | | | | | **14** | | | |
| Syntaxandstyle–pythonobjects–numbers–sequences–strings–listsandtuples–dictionaries–conditionalloops–files–inputandoutput–errorsandexceptions–functions–modules–classesand  OOP–executionenvironment | | | | | | | | | | |
| **UNITV** | | **Pearl** | | | | | **15** | | | |
| Pearloverview–pearlparsingrules–variablesanddata–statementsandcontrolstructures–subroutines  -,packagesandmodules–workingwithfiles–datamanipulation. | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |
| **TextBook(s)** | | | | | | | | | | |
| **1** | TheLinuxKernelBook,RemyCard,EricandFrank Mevel,WileyPublications2003 | | | | | | | | | |

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| **2** | MySQLBible, SteveSuchring, JohnWiley2002. | |
|  | **ReferenceBook(s)** |  |
| **1** | ProgrammingPHP,RasmusLerdorfand LevinTatroe,O‗Reilly,2002 | |
| **2** | CorePythonProgramming,WesleyJ.Chun, PrenticeHall,2001 | |
| **3** | Perl:TheComplete Reference,2ndEdn,MartinC. Brown,TMH, 2009 | |
| **4** | MySQL:TheComplete Reference,2ndEdn,VikramVaswani,TMH,2009 | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
| **1** | [**https://onlinecourses.swayam2.ac.in/aic20\_sp06/preview**](https://onlinecourses.swayam2.ac.in/aic20_sp06/preview) |  |
| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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



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| **CourseCode** | | |  | **PrinciplesofSecureCoding** | **L** | **T** | **P** | | | **C** |
| **Core/elective/Supportive** | | | | **Elective:III** | **5** | **0** | **0** | | | **4** |
| **Pre- requisite** | | | | **None** | **Syllabus**  **version** | | | **I** | | |
| **CourseObjectives** | | | | | | | | | | |
| * Tounderstandthesecure softwaredevelopmentlifecycle * Toexplain about thesecurecodingtechniques | | | | | | | | | | |
| **ExpectedCourseOutcomes** | | | | | | | | | | |
| 1 | Explainaboutthesecure softwaredevelopmentlifecycle | | | | | | | | **K2** | |
| 2 | Understandthesecurecodingtechniques | | | | | | | | **K2** | |
| 3 | Demonstratethethreatmodelingprocessand benefits | | | | | | | | **K2** | |
| 4 | Explainaboutthe databaseandweb specificissues | | | | | | | | **K2** | |
| **K1–Remember K2 –Understand K3–applyK4-AnalyzeK5–evaluateK6-Create** | | | | | | | | | | |
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| **UNITI** | | **Needforsecuresystems** | | | | | **14** | | | |
| 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** | | | |
| Threatmodellingprocessanditsbenefits:IdentifyingtheThreatsbyUsingAttackTreesandratingthreatsusingDREAD,RiskMitigationTechniquesandSecurityBestPractices.Securitytechniques,  authentication,authorization.DefenseinDepthandPrincipleof LeastPrivilege. | | | | | | | | | | |
| **UNITIII** | | **SecureCodingTechniques** | | | | | **17** | | | |
| 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 Pro police. 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 oftheSecurityTester,Building theSecurityTest Plan. TestingHTTP-Based Applications, TestingFile-  Based Applications,TestingClientswithRogue **Servers** | | | | | | | | | | |
| **TotalLectureHours** | | | | | | | **75**  **Hours** | | | |

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| **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,2ndEdn,MartinC. Brown,TMH, 2009 | |
| **4** | MySQL:TheComplete Reference,2ndEdn,VikramVaswani,TMH,2009 | |
|  | **RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)** |  |
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| **2** | [**https://onlinecourses.swayam2.ac.in/arp19\_ap79/preview**](https://onlinecourses.swayam2.ac.in/arp19_ap79/preview) |  |
| **CourseDesignedby :** | | |

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|  | **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

Annexure

**B.Sc.ComputerSciencewithData Analytics**

**Syllabus**

(Witheffect from2020-21)

**ProgramCode:**



**DEPARTMENTOFCOMPUTERSCIENCE**

**BharathiarUniversity**

**(AStateUniversityAccreditedwith“a”byNAAACand13th Rank among Indian Universities by MHRD-NIRF)Coimbatore641046,INDIA**

**MISSION**

* TodevelopITprofessionalswithethicalandhumanvalues.
* To organize, connect, create and communicate mathematical ideas effectively, throughindustry4.0.
* Toprovide alearningenvironment to enhanceinnovations, problem solvingabilities,leadershippotentials, team-spirit and moral tasks.
* Tonurturetheresearch valuesin thedevelopingareas ofComputerScienceandinterdisciplinaryfields.
* Promote inter-disciplinary research among the faculty and the students to create state ofartresearch facilities.
* Topromotequalityand ethicsamongthe students.
* Motivatethestudentstoacquireentrepreneurialskillstobecomegloballeaders.