**M.Sc. COMPUTERSCIENCE**

Syllabus

SCHOOL OF DISTANCE EDUCATION

 **2023– 2024onwards**

**OPEN AND DISTANCE LEARNING**

**BHARATHIARUNIVERSITY**

**AStateUniversity,Accreditedwith“A++”Gradeby NAACRanked21stamongIndianUniversitiesby MHRD-NIRF**

**Coimbatore-641 046, TamilNadu,India**



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| **ProgramEducationalObjectives(PEOs)** |
| The**M.Sc. CS**programdescribeaccomplishmentsthatgraduatesareexpected toattainwithinfivetosevenyearsafter graduation |
| Toenrichthestudentswiththeclearpictureofthecourseobjectivesandtomaptheirrequirements. |
| Toenablethestudents,tounderstandthecoreconcepts,visualizeandtoapplythemin thereal timescenarios. |
| Toimparttheneedforconsistentlearning,importanceofresearch&developmentforthe welfareof thesocietyand to thenationat large. |



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| **Program SpecificOutcomes(PSOs)** |
| Afterthesuccessfulcompletionof**M.Sc.CS**program,thestudentsareexpectedto |
| Abletoanalyze,designanddevelopproblemsolvingskillsinthedisciplineofcomputerscience. |
| Acquireevaluationofpotentialbenefitsofalternativesolutionindesigningsoftware and/or hardware systems in broad range of open source programminglanguagesto withstand technological changes. |
| AbletopursuecareersinITindustry/consultancy/researchanddevelopment,teachingandallied areasrelatedto computer science. |
| Adapttothecontinuoustechnologicalchangeincomputationalscienceandupdatethemselves to meet theindustryrequirements and standards. |
| Applythepracticesandstrategiesofcomputerscienceforsoftwareprojectdevelopmenttodeliveraqualitysoftwareproductandcontributetoresearchinthechosen fieldand perform effectively. |



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| **ProgramOutcomes(POs)** |
| Onsuccessfulcompletionofthe**M.Sc.CS**program |
| Developcreativityandproblemsolvingskillswiththeknowledgeofcomputingandmathematics. |
| Abilitytodevelopandcarryoutexperiments,interpretandinferdata. |
| Designalgorithmsanddevelopsoftwaretoaidsolutionstoindustryandgovernments. |
| Reviewthelatesttechnologyandtoolhandling mechanism. |
| Analyzetheoutcometosolveglobalenvironmentrelatedissues. |
| Applytheknowledgeinlifelong learningjourney toequip themselves. |
| Identifytheperspectiveofbusiness practices,risksandlimitations. |
| Workwithprofessionalandethicalvalues. |
| Formulatethe responsibilitiesofhumanrightsandentrepreneurialspirit. |
| Understandthemethodstocommunicateeffectivelyandworkcollectively. |

**SCHOOL OF DISTANCE EDUCATION**

**BHARATHIARUNIVERSITY::COIMBATORE641046**

OPEN AND DISTANCE LEARNING PROGRAMME (ODL)

**M.Sc.ComputerScience Curriculum**

***(For the students admitted during the academic year 2023-24 onwards)***

## SCHEMEOFEXAMINATIONS

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| **Titleof theCourse** | **Credits** | **MaximumMarks** |
| **CIA** | **ESE** | **Total** |
| **FIRSTSEMESTER** |
| Paper I : Analysis &DesignofAlgorithms | 4 | 25 | 75 | 100 |
| Paper II : Object OrientedAnalysis and Design &C++ | 4 | 25 | 75 | 100 |
| Paper III:Python Programming | 4 | 25 | 75 | 100 |
| Paper IV : AdvancedSoftwareEngineering | 4 | 25 | 75 | 100 |
| PracticalI:AlgorithmandOOPSLab | 4 | 40 | 60 | 100 |
| PracticalII:PythonProgrammingLab | 4 | 40 | 60 | 100 |
| **SECONDSEMESTER** |
| PaperV:DataMiningandWarehousing | 4 | 25 | 75 | 100 |
| PaperVIAdvancedOperatingSystems | 4 | 25 | 75 | 100 |
| PaperVIIAdvancedJavaProgramming | 4 | 25 | 75 | 100 |
| Paper VIII : ArtificialIntelligence&MachineLearning | 4 | 25 | 75 | 100 |
| Elective–I :Multimedia and its Applications | 4 | 25 | 75 | 100 |
| Practical III: Data MiningLabusing R | 4 | 40 | 60 | 100 |
| PracticalIV:AdvancedJavaProgrammingLab | 4 | 40 | 60 | 100 |
| **THIRDSEMESTER** |
| PaperIX:DigitalImageProcessing | 4 | 25 | 75 | 100 |
| PaperX:CloudComputing | 4 | 25 | 75 | 100 |
| Paper XI: NetworkSecurityandCryptography | 4 | 25 | 75 | 100 |
| PaperXII: DataScience&Analytics | 4 | 25 | 75 | 100 |
| Elective–II | 4 | 25 | 75 | 100 |
| PracticalV:DigitalImageProcessing Lab usingMATLAB | 4 | 40 | 60 | 100 |
| PracticalVI:CloudComputingLab | 4 | 40 | 60 | 100 |
| Practical VII : WebApplicationdevelopment&hosting | 2 | 20 | 30 | 50 |
| **FOURTHSEMESTER** |
| ProjectworkandViva-voce(200marks) | 8 |  |  | 200\* |
| **Grand Total** | 90 |  |  | 2250 |

**\*** Project Report – 160 marks & Viva Voce – 40 marks#DuringIIorIIISemester (Optional)

## ELECTIVE – I

1.1.Multimediaand itsApplications

1.2.EmbeddedSystems

1.3.InternetofThings

1.4. Critical Thinking, Design Thinking and Problem Solving.

## 2. ELECTIVE – II

2.1. Mobile Computing

2.2.Block Chain Technology

2.3.WebServices

2.4. RoboticProcessAutomation forBusiness



FirstSemester



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| **Coursecode** | **ANALYSIS & DESIGN OFALGORITHMS** | **Core** |
| **Pre-requisite** | BasicDataStructures &Algorithms |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. EnablethestudentstolearntheElementaryDataStructures andalgorithms.
2. Presentsanintroductiontothealgorithms,theiranalysisanddesign
3. DiscussvariousmethodslikeBasicTraversalAndSearchTechniques,divideandconquermethod,Dynamicprogramming, backtracking
4. Understoodthevariousdesignand analysisofthe algorithms.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Getknowledgeaboutalgorithmsanddeterminestheirtimecomplexity.Demonstratespecificsearchandsortalgorithmsusingdivideandconquertechnique. |
| GaingoodunderstandingofGreedymethod anditsalgorithm. |
| Abletodescribeaboutgraphsusing dynamicprogrammingtechnique. |
| Demonstratethe conceptofbacktracking&branchandboundtechnique. |
|  Explorethetraversaland searchingtechniqueandapplyitfortreesandgraphs. |
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| **Unit:1** | **INTRODUCTION** |
| Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - BinarySearchTree-Heap – Heapsort-Graph. |
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| **Unit:2** | **TRAVERSALANDSEARCHTECHNIQUES** |
| BasicTraversalAndSearchTechniques:TechniquesforBinaryTrees-TechniquesforGraphs-Divideand Conquer: -GeneralMethod– BinarySearch– MergeSort– Quick Sort. |
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| **Unit:3** | **GREEDYMETHOD** |
| The Greedy Method: - General Method – Knapsack Problem – Minimum Cost Spanning Tree –SingleSourceShortest Path. |
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| **Unit:4** | **DYNAMICPROGRAMMING** |
| Dynamic Programming - General Method – Multistage Graphs – All Pair Shortest Path – OptimalBinarySearchTrees –0/1Knapsacks –TravelingSalesmanProblem–Flow ShopScheduling. |
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| **Unit:5** | **BACKTRACKING** |
| Backtracking:-GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring–HamiltonianCycles – BranchAnd Bound:-The Method–Traveling Salesperson. |
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| **TextBooks** |
| 1 | EllisHorowitz,“ComputerAlgorithms”,GalgotiaPublications. |
| 2 | AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman, "DataStructures andAlgorithms". |
| **ReferenceBooks** |
| 1 | Goodrich,“DataStructures&AlgorithmsinJava”,Wiley3rdedition. |
| 2 | Skiena,”TheAlgorithmDesignManual”,SecondEdition,Springer,2008 |
| 3 | AnanyLevith,”IntroductiontotheDesignandAnalysisofalgorithm”,PearsonEducationAsia, 2003. |
| 4 | RobertSedgewick,PhillipeFlajolet,”AnIntroductiontotheAnalysisofAlgorithms”,Addison-WesleyPublishing Company,1996. |
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| **Coursecode** | **OBJECT ORIENTED ANALYSIS ANDDESIGN& C++** | **Core** |
| **Pre-requisite** | BasicsofC++andObject OrientedConcepts |
| **CourseObjectives:** |
| Themain objectivesof this courseareto:1. Presenttheobjectmodel,classesandobjects,objectorientation,machineviewandmodelmanagementview.
2. Enablesthestudentstolearnthebasic functions,principlesandconceptsofobject orientedanalysisand design.
3. EnablethestudentstounderstandC++language withrespecttoOOAD
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| UnderstandtheconceptofObject-Orienteddevelopmentandmodelingtechniques |
| Gainknowledgeaboutthevariousstepsperformedduringobjectdesign |
| Abstractobject-basedviewsfor genericsoftwaresystems |
| LinkOOADwithC++language |
| ApplythebasicconceptofOOPsand familiarize towriteC++program |
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| **Unit:1** | **OBJECTMODEL** |
| The Object Model: The Evolution of the Object Model– Elements of the Object Model–Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship amongObjects**.** |
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| **Unit:2** | **CLASSESANDOBJECTS** |
| ClassesandObject:NatureofClass–RelationshipAmongclasses–TheInterplayofclassesandObjects.Classification:TheimportanceofProperClassification–identifyingclassesandobjects–KeyAbstractionsandMechanism. |
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| **Unit:3** | **C++INTRODUCTION** |
| IntroductiontoC++-InputandoutputstatementsinC++-Declarations-controlstructures–Functionsin C++. |
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| **Unit:4** | **INHERITANCEAND OVERLOADING** |
| ClassesandObjects–ConstructorsandDestructors–operatorsoverloading–TypeConversion-Inheritance– Pointers and Arrays. |

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| **Unit:5** | **POLYMORPHISMANDFILES** |
| MemoryManagementOperators-Polymorphism–Virtualfunctions–Files–ExceptionHandling– String Handling-Templates. |
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| **TextBooks** |
| 1 | “ObjectOrientedAnalysisandDesignwithApplications”,GradyBooch,SecondEdition,PearsonEducation. |
| 2 | “Object-OrientedProgrammingwithANSI&TurboC++”,AshokN.Kamthane,FirstIndianPrint -2003, Pearson Education. |
| **ReferenceBooks** |
| 1 | Balagurusamy“ObjectOrientedProgrammingwithC++”,TMH,SecondEdition,2003. |
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|  **Coursecode** | **PYTHONPROGRAMMING** | **Core** |
| **Pre-requisite** | Basicsofany OOProgramming Language |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. PresentsanintroductiontoPython,creationofwebapplications,networkapplicationsandworkingin the clouds
2. Usefunctions forstructuring Python programs
3. UnderstanddifferentData StructuresofPython
4. RepresentcompounddatausingPythonlists,tuplesanddictionaries
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthebasicconcepts ofPythonProgramming |
| Understand Fileoperations,ClassesandObjects |
| AcquireObject Oriented Skills inPython |
|  DevelopwebapplicationsusingPython |
| DevelopClientServerNetworkingapplications |
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| **Unit:1** | **INTRODUCTION** |
| **Python:**Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets–Comparison. |
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| **Unit:2** |  **CODESTRUCTURES** |
| **Code Structures:** if, elseif, and else – Repeat with while – Iterate with for – Comprehensions –Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try andexcept– User Exceptions. |
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| **Unit:3** |  **MODULES,PACKAGESANDCLASSES** |
| **Modules,Packages,andPrograms:**StandalonePrograms–Command-LineArguments–Modules and the import Statement – The Python Standard Library. **Objects and Classes:** Definea Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parentwith super – In self Defense – Get and Set Attribute Values with Properties – Name Mangling forPrivacy– Method Types–Duck Typing – SpecialMethods–Composition. |
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| **Unit:4** |  **DATATYPESAND WEB** |
| **DataTypes:**TextStrings–BinaryData.**StoringandRetrievingData:**FileInput/Output–StructuredTextFiles–StructuredBinaryFiles -RelationalDatabases–NoSQLDataStores.**Web:**WebClients – WebServers–Web ServicesandAutomation |
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| **Unit:5** |  **SYSTEMSANDNETWORKS** |
| **Systems:**Files–Directories–ProgramsandProcesses–CalendarsandClocks.**Concurrency:**Queues–Processes–Threads–GreenThreadsandgevent–twisted–Redis.**Networks:** Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –InternetServices – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce –Working intheClouds. |
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| **TextBooks** |
| 1 | BillLubanovic,“IntroducingPython”,O’Reilly,FirstEdition-SecondRelease,2014. |
| 2 | MarkLutz,“Learning Python”,O’Reilly, FifthEdition,2013. |
| **ReferenceBooks** |
| 1 | David M. Beazley,“Python Essential Reference”, Developer’s Library, FourthEdition,2009. |
| 2 | SheetalTaneja,Naveen Kumar, “Python Programming-A ModularApproach”,PearsonPublications. |
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| **Coursecode** | **ADVANCEDSOFTWAREENGINEERING** | **Core** |
| **Pre-requisite** | BasicsofSoftwareEngineering&SPM |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. IntroducetoSoftwareEngineering,Design,TestingandMaintenance.
2. Enablethestudents to learn theconcepts of SoftwareEngineering.
3. LearnaboutSoftwareProjectManagement,SoftwareDesign&Testing.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandabout SoftwareEngineering process |
| Understand about Software project management skills,design and qualitymanagement |
| AnalyzeonSoftwareRequirementsandSpecification |
| Analyzeon SoftwareTesting, Maintenanceand SoftwareRe-Engineering |
| Designandconduct varioustypes andlevels ofsoftwarequalityforasoftwareproject |
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| **Unit:1** | **INTRODUCTION** |
| Introduction: The Problem Domain – Software Engineering Challenges - Software EngineeringApproach – Software Processes: Software Process – Characteristics of a Software Process –SoftwareDevelopment Process Models– Other softwareprocesses. |
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| **Unit:2** | **SOFTWAREREQUIREMENTS** |
| SoftwareRequirementsAnalysisandSpecification:Requirementengineering–TypeofRequirements–FeasibilityStudies–RequirementsElicitation–RequirementAnalysis–Requirement Documentation – Requirement Validation – Requirement Management – SRS -Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study:Student Result management system. Software Quality Management – Software Quality, SoftwareQualityManagement System, ISO 9000, SEICMM. |
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| **Unit:3** | **PROJECTMANAGEMENT** |
| SoftwareProjectManagement:Responsibilitiesofasoftwareprojectmanager–Projectplanning* MetricsforProjectsizeestimation–ProjectEstimationTechniques–EmpiricalEstimationTechniques–COCOMO–Halstead‟ssoftwarescience–Staffinglevelestimation–Scheduling
* OrganizationandTeamStructures–Staffing–Riskmanagement–SoftwareConfigurationManagement– Miscellaneous Plan.
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| **Unit:4** | **SOFTWAREDESIGN** |



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| Software Design: Outcome of a Design process – Characteristics of a good software design –Cohesionand coupling- Strategy of Design–Function OrientedDesign– ObjectOrientedDesign-Detailed Design- IEEERecommendedPractice forSoftwareDesignDescriptions. |
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| **Unit:5** | **SOFTWARETESTING** |
| SoftwareTesting:AStrategicapproachtosoftwaretesting–Terminologies–Functionaltesting–Structuraltesting–Levelsoftesting–Validationtesting-Regressiontesting–ArtofDebugging – Testing tools - Metrics-Reliability Estimation. Software Maintenance - MaintenanceProcess-ReverseEngineering–SoftwareRe-engineering-ConfigurationManagementActivities. |
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| **TextBooks** |
| 1 | AnIntegratedApproachtoSoftwareEngineering–PankajJalote,NarosaPublishingHouse,Delhi, 3rdEdition. |
| 2 | FundamentalsofSoftwareEngineering–RajibMall,PHIPublication,3rdEdition. |
| **ReferenceBooks** |
| 1 | SoftwareEngineering–K.K.AggarwalandYogeshSingh,NewAgeInternationalPublishers,3 rd edition. |
| 2 | APractitionersApproach-SoftwareEngineering,- R.S.Pressman,McGrawHill. |
| 3 | Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D.Manodrioli,PHIPublication. |
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| **Coursecode** | **PRACTICALI:ALGORITHMANDOOPS LAB** | **Core** |
| **Pre-requisite** | BasicProgrammingof C++language |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Thiscoursecoversthe basicdatastructureslike Stack,Queue,Tree,List.
2. Thiscourseenables thestudentsto learntheapplicationsofthedatastructuresusingvarioustechniques
3. ItalsoenablethestudentstounderstandC++languagewithrespecttoOOADconcepts
4. ApplicationofOOPSconcepts.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthe concepts ofobjectoriented withrespecttoC++ |
| Abletounderstand andimplement OOPSconcepts |
| ImplementationofdatastructureslikeStack, Queue,Tree,ListusingC++ |
| ApplicationofthedatastructuresforSorting,Searchingusingdifferenttechniques. |
| **K1**-Remember; **K2**-Understand; **K3**-Apply;**K4**-Analyze;**K5** -Evaluate; **K6** -Create |
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| **LISTOFPROGRAMS** |
| 1. Writeaprogram tosolve the towerofHanoi usingrecursion.
2. Writeaprogramto traversethroughbinarysearchtreeusingtraversals.
3. Writeaprogram toperform variousoperationson stackusing linkedlist.
4. Writeaprogram toperform variousoperationin circularqueue.
5. Writeaprogramto sortan arrayof anelements usingquick sort.
6. Writeaprogram to solve numberof elements in ascendingorder using heap sort.
7. Writeaprogramtosolve the knapsackproblemusinggreedymethod
8. Writeaprogramto search foran element ina tree using divide&conquerstrategy.
9. Writeaprogramto place the8 queenson an8X8matrixso thatno twoqueens Attack.
10. WriteaC++program toperformVirtualFunction
11. WriteaC++programtoperformParameterizedconstructor
12. WriteaC++programtoperform Friend Function
13. WriteaC++programtoperform FunctionOverloading
14. WriteaC++programtoperformSingleInheritance
15. WriteaC++programto perform EmployeeDetails using files.
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| Expertlectures,onlineseminars –webinars |
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| **TextBooks** |
| 1 | Goodrich,“DataStructures&AlgorithmsinJava”,Wiley3rdedition. |
| 2 | Skiena,”TheAlgorithmDesignManual”,SecondEdition,Springer,2008 |
| **ReferenceBooks** |
| 1 | AnanyLevith,”IntroductiontotheDesignandAnalysisofalgorithm”,PearsonEducationAsia, 2003. |
| 2 | RobertSedgewick,PhillipeFlajolet,”AnIntroductiontotheAnalysisofAlgorithms”,Addison-WesleyPublishing Company,1996. |
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| **Coursecode** | **PRACTICAL II : PYTHONPROGRAMMINGLAB** | **Core** |
| **Pre-requisite** | Basicsofany OOProgramming Language |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Thiscoursepresentsanoverviewofelementarydata items,lists,dictionaries,setsandtuples
2. TounderstandandwritesimplePythonprograms
3. ToUnderstandthe OOPSconceptsofPython
4. TodevelopwebapplicationsusingPython
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| AbletowriteprogramsinPythonusingOOPS concepts |
| Tounderstandthe conceptsof FileoperationsandModules inPython |
| Implementationoflists,dictionaries,sets andtuplesasprograms |
| TodevelopwebapplicationsusingPython |
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| **LISTOFPROGRAMS** |
| Implementthe followinginPython:1. Programsusingelementarydataitems,lists,dictionariesandtuples
2. Programsusingconditionalbranches,
3. Programsusingloops.
4. Programsusingfunctions
5. Programsusingexceptionhandling
6. Programsusinginheritance
7. Programsusingpolymorphism
8. Programstoimplementfileoperations.
9. Programsusingmodules.
10. Programsforcreatingdynamicandinteractivewebpagesusingforms.
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| **TextBooks** |
| 1 | BillLubanovic,“Introducing Python”,O’Reilly,FirstEdition-SecondRelease,2014. |
| 2 | MarkLutz,“Learning Python”,O’Reilly, FifthEdition,2013. |
| **ReferenceBooks** |

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| 1 | David M. Beazley,“Python Essential Reference”, Developer’s Library, FourthEdition,2009. |
| 2 | SheetalTaneja,Naveen Kumar, ”Python Programming-A ModularApproach”,PearsonPublications. |
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SecondSemester



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| **Coursecode** |  | **DATAMININGAND WAREHOUSING** | **Core** |
| **Pre-requisite** | BasicsofRDBMS&Algorithms |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. EnablethestudentstolearntheconceptsofMiningtasks,classification,clusteringandDataWarehousing.
2. Developskillsofusing recent dataminingsoftwareforsolving practicalproblems.
3. Developand applycriticalthinking,problem-solving,anddecision-makingskills.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion ofthecourse, studentwill beable to: |
| Understandthebasicdataminingtechniquesandalgorithms |
| Understand the Associationrules, Clustering techniques andDatawarehousingcontents |
| Compareandevaluatedifferentdataminingtechniqueslikeclassification,prediction,Clustering and association rule mining |
| DesigndatawarehousewithdimensionalmodelingandapplyOLAPoperations |
| Identifyappropriatedata miningalgorithmstosolverealworldproblems |
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| **Unit:1** | **BASICSAND TECHNIQUES** |
| Basic data mining tasks – data mining versus knowledge discovery in databases – data miningissues – data mining metrics – social implications of data mining – data mining from a databaseperspective.Data miningtechniques:Introduction–a statisticalperspective ondata mining–similaritymeasures– decision trees– neuralnetworks– geneticalgorithms. |
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| **Unit:2** | **ALGORITHMS** |
| Classification: Introduction–Statistical–based algorithms- distance –basedalgorithms- decisiontree-basedalgorithms-neuralnetwork–basedalgorithms–rule-basedalgorithms–combiningtechniques. |
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| **Unit:3** | **CLUSTERING ANDASSOCIATION** |
| Clustering:Introduction–SimilarityandDistanceMeasures–Outliers–HierarchicalAlgorithms-PartitionalAlgorithms.Association rules: Introduction - large item sets - basic algorithms – parallel &distributedalgorithms – comparing approaches- incremental rules – advanced association rules techniques –measuringthe quality ofrules. |
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| **Unit:4** | **DATAWAREHOUSINGANDMODELING** |
| Datawarehousing:introduction-characteristicsofadatawarehouse–datamarts–otheraspects |



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| ofdatamart.Online analyticalprocessing:introduction-OLTP&OLAPsystemsDatamodeling–starschemaformultidimensionalview–datamodeling–multifactstarschemaorsnowflakeschema–OLAP TOOLS–Stateof themarket – OLAP TOOLSand the internet. |
| **Unit:5** | **APPLICATIONSOFDATAWAREHOUSE** |
| Developing a data WAREHOUSE: why and how to build a data warehouse –data warehousearchitectural strategies and organization issues - design consideration – data content – metadatadistribution of data – tools for data warehousing – performance considerations – crucial decisionsindesigning adata warehouse.Applications of data warehousing and data mining in government: Introduction - national datawarehouses– otherareas fordata warehousingand data mining. |
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| **TextBooks** |
| 1 | MargaretH.Dunham,“DataMining:IntroductoryandAdvancedTopics”,Pearsoneducation,2003. |
| 2 | C.S.R.Prabhu,“DataWarehousingConcepts,Techniques,ProductsandApplications”,PHI,SecondEdition. |
| **ReferenceBooks** |
| 1 | ArunK.Pujari,“DataMiningTechniques”,UniversitiesPress(India)Pvt. Ltd.,2003. |
| 2 | AlexBerson,StephenJ.Smith,“DataWarehousing,DataMiningandOLAP”,TMCH,2001. |
| 3 | JiaweiHan&MichelineKamber,“DataMiningConcepts&Techniques”,2001,Academicpress. |
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| **Coursecode** |  | **ADVANCEDOPERATING SYSTEMS** | **Core** |
| **Pre-requisite** | BasicsofOS&its functioning |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Enablethestudentsto learnthedifferenttypes ofoperating systemsand theirfunctioning.
2. GainknowledgeonDistributedOperatingSystems
3. Gaininsightintothecomponentsandmanagementaspectsofrealtimeandmobileoperatingsystems.
4. LearncasestudiesinLinuxOperatingSystems
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthedesignissuesassociatedwithoperatingsystems |
| Mastervariousprocessmanagementconceptsincludingscheduling,deadlocksanddistributed filesystems |
| PrepareRealTimeTask Scheduling |
|  AnalyzeOperatingSystems forHandheld Systems |
| AnalyzeOperatingSystemslikeLINUXandiOS |
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| **Unit:1** | **BASICSOFOPERATINGSYSTEMS** |
| Basics of Operating Systems: What is an Operating System? – Main frame Systems –DesktopSystems–MultiprocessorSystems–DistributedSystems–ClusteredSystems–Real-TimeSystems–HandheldSystems–FeatureMigration–ComputingEnvironments-ProcessScheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention –Avoidance– Detection–Recovery. |
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| **Unit:2** | **DISTRIBUTEDOPERATINGSYSTEMS** |
| DistributedOperatingSystems:Issues–CommunicationPrimitives–Lamport‟sLogicalClocks–Deadlockhandlingstrategies–Issuesindeadlockdetectionandresolution-distributedfilesystems–design issues – Casestudies – TheSun Network FileSystem-Coda. |
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| **Unit:3** | **REALTIMEOPERATINGSYSTEM** |
| Realtime Operating Systems :Introduction–Applications of RealTime Systems– BasicModelofRealTimeSystem–Characteristics–SafetyandReliability-RealTimeTaskScheduling |
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| **Unit:4** | **HANDHELDSYSTEM** |
| OperatingSystemsforHandheldSystems:Requirements–TechnologyOverview–HandheldOperatingSystems–PalmOS-SymbianOperatingSystem-Android–Architectureofandroid– |



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| Securinghandheldsystems |
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| **Unit:5** | **CASESTUDIES** |
| Case Studies : Linux System: Introduction– Memory Management – Process Scheduling –Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDKFramework-Media Layer -Services Layer-CoreOS Layer-FileSystem. |
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| **TextBooks** |
| 1 | AbrahamSilberschatz;PeterBaerGalvin;GregGagne,“OperatingSystemConcepts”,SeventhEdition, John Wiley & Sons, 2004. |
| 2 | MukeshSinghalandNiranjanG.Shivaratri,“AdvancedConceptsinOperatingSystems–Distributed,Database, andMultiprocessorOperatingSystems”,TataMcGraw-Hill,2001. |
| **ReferenceBooks** |
| 1 | RajibMall,“Real-TimeSystems:TheoryandPractice”,PearsonEducationIndia,2006. |
| 2 | PramodChandraP.Bhatt,Anintroductiontooperatingsystems,conceptandpractice,PHI,Third edition,2010. |
| 3 | Daniel.P.Bovet&Marco Cesati,“UnderstandingtheLinuxkernel”,3rdedition,O‟Reilly,2005 |
| 4 | NeilSmyth,“iPhoneiOS4DevelopmentEssentials–Xcode”,FourthEdition,Payloadmedia,2011. |
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| **Coursecode** |  | **ADVANCEDJAVAPROGRAMMING** | **Core** |
| **Pre-requisite** | BasicsofJava& its Usage |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Enablethestudentstolearnthebasicfunctions,principlesandconceptsofadvancedjavaprogramming.
2. Provideknowledgeon conceptsneeded fordistributed ApplicationArchitecture.
3. LearnJDBC,Servletpackages, JQuery,JavaServer PagesandJAR fileformat
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthe advancedconceptsofJavaProgramming |
| UnderstandJDBCandRMIconcepts |
| ApplyandanalyzeJavainDatabase |
|  Handledifferenteventinjavausingthedelegationeventmodel,eventlistenerandclass |
| Designinteractive applicationsusingJavaServlet, JSPandJDBC |
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| **Unit:1** | **BASICSOF JAVA** |
| JavaBasicsReview:Componentsandeventhandling–Threadingconcepts–Networkingfeatures– Media techniques |
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| **Unit:2** | **REMOTEMETHODINVOCATION** |
| Remote MethodInvocation-Distributed Application Architecture-Creating stubsand skeletons-DefiningRemoteobjects-RemoteObject Activation-Object Serialization-JavaSpaces |
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| **Unit:3** | **DATABASE** |
| JavainDatabases-JDBCprinciples–databaseaccess-Interacting-databasesearch–Creatingmultimediadatabases –Databasesupport in webapplications |
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| **Unit:4** | **SERVLETS** |
| Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a javaServlet-Readingdatafromaclient-Readinghttprequestheader-sendingdatatoaclientandwritingthehttp responseheader-working with cookiesJava Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions-Scriptlets-Directives-Declarations-Acompleteexample |
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| **Unit:5** | **ADVANCEDTECHNIQUES** |
| JARfileformatcreation–Internationalization–SwingProgramming–Advancedjava |

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| techniques |
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| **TextBooks** |
| 1 | JamieJaworski,“JavaUnleashed”,SAMSTechmediaPublications,1999. |
| 2 | Campione,Walrath andHuml,“TheJavaTutorial”,AddisonWesley,1999. |
| **ReferenceBooks** |
| 1 | JimKeogh,”TheCompleteReferenceJ2EE”,TataMcGrawHillPublishingCompanyLtd,2010. |
| 2 | DavidSawyerMcFarland,“JavaScriptAndJQuery-TheMissingManual”,OreillyPublications,3rd Edition,2011. |
| 3 | DeitelandDeitel, “JavaHowtoProgram”,ThirdEdition,PHI/PearsonEducationAsia. |
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| **Coursecode** |  | **ARTIFICIAL INTELLIGENCE &MACHINELEARNING** | **Core** |
| **Pre-requisite** | BasicsofAI& anIntroductionabout ML |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Enablethestudentsto learn thebasic functionsof AI, HeuristicSearch Techniques.
2. Provideknowledgeonconcepts ofRepresentations andMappings andPredicate Logic.
3. IntroduceMachineLearning withrespectDataMining,BigData andCloud.
4. StudyaboutApplications& ImpactofML.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| DemonstrateAIproblemsandtechniques |
| Understandmachinelearningconcepts |
| Applybasicprinciples of AIinsolutions thatrequireproblemsolving,inference,perception,knowledgerepresentation,and learning |
| Analyzethe impactof machinelearning onapplications |
| Analyzeanddesignarealworldproblemforimplementationandunderstandthedynamicbehavior ofasystem |
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| **Unit:1** | **INTRODUCTION** |
| Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces,Search: State space search - Production Systems - Problem Characteristics - Issues in design ofSearch. |
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| **Unit:2** | **SEARCHTECHNIQUES** |
| Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction,Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representationsand mappings -Approaches to Knowledge representations -Issues in Knowledge representations -FrameProblem. |
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| **Unit:3** | **PREDICATELOGIC** |
| UsingPredicatelogic:Representingsimplefactsinlogic-RepresentingInstanceandIsarelationships-Computablefunctionsandpredicates-Resolution-Naturaldeduction.Representingknowledgeusingrules:ProceduralVsDeclarative knowledge- Logic programming-ForwardVsBackwardreasoning-Matching-Controlknowledge. |
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| **Unit:4** | **MACHINELEARNING** |



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| Understanding Machine Learning:What Is Machine Learning?-Defining Big Data-Big Data inContext with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Power ofMachine Learning-The Roles of Statistics and Data Mining with Machine Learning-PuttingMachineLearning in Context-Approaches to Machine Learning. |
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| **Unit:5** | **APPLICATIONSOFMACHINE LEARNING** |
| LookingInsideMachineLearning:TheImpactofMachineLearningonApplications-DataPreparation-TheMachineLearning Cycle. |
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| **TextBooks** |
| 1 | ElaineRichandKevinKnight,"ArtificialIntelligence",TataMcGrawHillPublisherscompanyPvt Ltd, Second Edition, 1991. |
| 2 | GeorgeFLuger,"ArtificialIntelligence",4thEdition,PearsonEducationPubl,2002. |
| **ReferenceBooks** |
| 1 | MachineLearningForDummies®,IBMLimitedEdition byJudith Hurwitz, DanielKirsch. |
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| **Coursecode** |  | **PRACTICALIII:DATAMININGUSING R** | **Core** |
| **Pre-requisite** | Basics of DM Algorithms & RProgramming |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. ToenablethestudentstolearntheconceptsofDataMiningalgorithmsnamelyclassification,clustering,regression….
2. Tounderstand &writeprogramsusing theDM algorithms
3. Toapplystatisticalinterpretationsforthesolutions
4. Ableto usevisualizationstechniques forinterpretations
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Ableto writeprograms using RforAssociationrules, Clustering techniques |
| Toimplement datamining techniqueslikeclassification,prediction |
| Abletousedifferent visualizations techniquesusing R |
| Toapplydifferentdataminingalgorithmstosolvereal worldapplications |
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| **LISTOFPROGRAMS** |
| 1. ImplementApriorialgorithmtoextractassociationruleof datamining.
2. Implementk-meansclusteringtechnique.
3. Implement anyoneHierarchalClustering.
4. ImplementClassificationalgorithm.
5. ImplementDecisionTree.
6. LinearRegression.
7. DataVisualization.
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| **TextBooks** |
| 1 | MargaretH.Dunham,“DataMining:IntroductoryandAdvancedTopics”,Pearsoneducation,2003. |
| 2 | C.S.R.Prabhu,“DataWarehousingConcepts,Techniques,ProductsandApplications”,PHI,SecondEdition |
| **ReferenceBooks** |
| 1 | ArunK.Pujari,“DataMiningTechniques”,UniversitiesPress(India)Pvt.Ltd.,2003. |
| 2 | AlexBerson,StephenJ.Smith,“DataWarehousing,DataMiningandOLAP”,TMCH,2001. |
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| **Coursecode** |  | **PRACTICALIV:ADVANCEDJAVALAB** | **Core** |
| **Pre-requisite** | Basicsin JavaProgramming |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1.ToenablethestudentstoimplementthesimpleprogramsusingJSP,JAR2.Toprovide knowledge on using Servlets, Applets3.TointroduceJDBCandnavigationofrecords4.Tounderstand RMI& its implementation5.TointroducetoSocketprogramming |
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understand tothe implement concepts of Java using HTML forms, JSP &JAR |
| Mustbecapable ofimplementingJDBCand RMIconcepts |
| Ableto writeAppletswith Event handling mechanism |
| ToCreateinteractiveweb basedapplicationsusingservletsandjsp |
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| **LISTOFPROGRAMS** |
| 1. DisplayawelcomemessageusingServlet.
2. DesignaPurchaseOrder formusingHtmlformandServlet.
3. Developaprogramfor calculatingthepercentageofmarksofastudentusingJSP.
4. DesignaPurchaseOrder formusingHtmlformandJSP.
5. PrepareaEmployeepayslipusingJSP.
6. WriteaprogramusingJDBCforcreating atable,Inserting,Deletingrecordsandlistouttherecords.
7. Writeaprogram usingJavaservlet tohandle formdata.
8. Write a simple Servlet program to create a table of all the headers it receives along withtheirassociatedvalues.
9. Writeaprogram inJSPby usingsessionobject.
10. WriteaprogramtobuildasimpleClientServerapplication usingRMI.
11. Createan appletfora calculatorapplication.
12. Programtosendatextmessagetoanothersystemandreceivethetextmessagefromthesystem(usesocket programming).
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| Expertlectures,onlineseminars –webinars |
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| **TextBooks** |
| 1 | JamieJaworski,“JavaUnleashed”,SAMSTechmediaPublications,1999. |
| 2 | Campione,Walrath andHuml,“TheJavaTutorial”,AddisonWesley,1999. |
| **ReferenceBooks** |
| 1 | JimKeogh,”TheCompleteReferenceJ2EE”,TataMcGrawHillPublishingCompanyLtd,2010. |
| 2 | DavidSawyerMcFarland,“JavaScriptAndJQuery-TheMissingManual”,OreillyPublications,3rd Edition,2011. |
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ThirdSemester



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| **Coursecode** |  | **DIGITALIMAGEPROCESSING** | **Core** |
| **Pre-requisite** | Basicsof ImageProcessing |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Learnbasicimageprocessingtechniques forsolving realproblems.
2. Gainknowledgein imagetransformationandImage enhancementtechniques.
3. LearnImagecompressionandSegmentationprocedures.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthe fundamentalsofDigitalImageProcessing |
| Understandthemathematicalfoundationsfordigitalimagerepresentation,imageacquisition, imagetransformation,and imageenhancement |
| Apply,DesignandImplementandgetsolutionsfordigitalimageprocessingproblems |
| Applytheconceptsoffilteringand segmentationfordigitalimageretrieval |
| ExploretheconceptsofMulti-resolutionprocessandrecognizetheobjectsinanefficient manner |
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| **Unit:1** | **INTRODUCTION** |
| Introduction: What is Digital image processing – the origin of DIP – Examples of fields that useDIP – Fundamentals steps in DIP – Components of an image processing system. Digital ImageFundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Imagesensing and acquisition – Image sampling and Quantization – Some Basic relationship betweenPixels– Linear & Nonlinear operations. |
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| **Unit:2** | **IMAGEENHANCEMENT** |
| ImageEnhancementinthespatialdomain:-Background–somebasicGraylevelTransformations – Histogram Processing – Enhancement using Arithmetic / Logic operations –Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combiningspatial enhancementmethods. |
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| **Unit:3** | **IMAGERESTORATION** |
| Image Restoration: A model of the Image Degradation / Restoration Process – Noise models –Restorationistheprocessofnoiseonly–SpatialFiltering–PeriodicNoisereductionbyfrequencydomainfiltering–Linear,Portion–InvariantDegradations–Estimatingthedegradation function – Inverse filtering – Minimum mean square Error Filtering – Constrainedleastsquares filtering –Geometric mean filter–Geometric Transformations. |
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| **Unit:4** |  **IMAGECOMPRESSION** |
| ImageCompression:Fundamentals–Imagecompressionmodels–ElementsofInformationTheory– ErrorFreecompression–Lossy compression –Imagecompression standards. |
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| **Unit:5** |  **IMAGESEGMENTATION** |
| Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction –Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – Theuseof motion in segmentation. |
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| **TextBooks** |
| 1 | RafaelC.Gonzalez,RichardE.Woods,“DigitalImageProcessing”,SecondEdition,PHI/PearsonEducation. |
| 2 | B.Chanda,D.DuttaMajumder,“DigitalImageProcessingandAnalysis”,PHI,2003. |
| **ReferenceBooks** |
| 1 | NickEfford,“DigitalImageProcessingapracticalintroducingusingJava”,PearsonEducation,2004. |
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| **Coursecode** |  | **CLOUDCOMPUTING** | **Core** |
| **Pre-requisite** | BasicsofCloud&itsApplications |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Gainknowledgeon cloudcomputing,cloudservices,architecturesandapplications.
2. Enablethestudentsto learnthebasics ofcloud computingwith realtimeusage
3. Howto storeand share, inand from cloud?
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion of thecourse, studentwill beable to: |
| Understandthe conceptsofCloudanditsservices |
| CollaborateCloudforEvent&ProjectManagement |
| Analyzeon cloudin –WordProcessing,SpreadSheets,Mail,Calendar,Database |
| Analyzecloudinsocialnetworks |
| Explorecloud storageand sharing |
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| **Unit:1** | **INTRODUCTION** |
| INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working ofcloud computing, pros and cons, benefits, developing cloud computing services, Cloud servicedevelopment,discovering cloud services. |
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| **Unit:2** | **CLOUDCOMPUTING** |
| CLOUDCOMPUTINGFOREVERYONECentralizingemailcommunications,cloudcomputingforcommunity,collaboratingonschedules,collaboratingongroupprojectsandevents, cloud computing for corporation, mapping, schedules, managing projects, presenting onroad. |
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| **Unit:3** | **CLOUDSERVICES** |
| USINGCLOUDSERVICESCollaboratingoncalendars,Schedulesandtaskmanagement,exploring on line scheduling and planning, collaborating on event management, collaborating oncontact management, collaborating on project management, collaborating on word processing,spreadsheets,and databases. |
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| **Unit:4** | **OUTSIDETHECLOUD** |
| OUTSIDETHECLOUDEvaluatingwebmailservices,Evaluatinginstantmessaging,Evaluatingwebconferencetools,creatinggroupsonsocialnetworks,Evaluatingonline |

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| groupware,collaboratingvia blogsandwikis. |
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| **Unit:5** | **STORINGANDSHARING** |
| STORINGANDSHARINGUnderstandingcloudstorage,evaluatingonlinefilestorage,exploring on line book marking services, exploring on line photo editing applications, exploringphotosharing communities,controlling it with webbased desktops. |
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| **TextBooks** |
| 1 | MichaelMiller,“Cloud Computing”,PearsonEducation,NewDelhi,2009. |
| **ReferenceBooks** |
| 1 | AnthonyT.Velte,“CloudComputing:APracticalApproach”,1stEdition,TataMcGrawHill Education Private Limited, 2009. |
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| **Coursecode** |  | **NETWORKSECURITYANDCRYPTOGRAPHY** | **Core** |
| **Pre-requisite** | BasicsofNetworks& itsSecurity |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies inCryptography.
2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic andnumbertheory.
3. To explore the working principles and utilities of various cryptographic algorithms includingsecretkey cryptography,hashes and messagedigests, and publickey algorithms.
4. To explore the design issues and working principles of various authentication Applicationsand various secure communication standards including Kerberos, IPsec, and SSL/TLS andemail.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandtheprocess ofthecryptographicalgorithms |
| Compareandapplydifferentencryptionanddecryptiontechniquestosolveproblemsrelated to confidentiality and authentication |
| Applyandanalyzeappropriatesecuritytechniquestosolvenetworksecurityproblem |
| Explore suitablecryptographicalgorithms |
| Analyzedifferentdigitalsignaturealgorithmstoachieveauthenticationanddesignsecure applications |
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| **Unit:1** | **INTRODUCTION** |
| Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- StreamcipherandBlockcipher-SymmetricandAsymmetric-keyCryptosystemSymmetricKeyAlgorithms:Introduction–DES– TripleDES– AES – IDEA–Blowfish – RC5. |
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| **Unit:2** | **CRYPTOSYSTEM** |
| Public-keyCryptosystem:IntroductiontoNumberTheory-RSAAlgorithm–KeyManagement-Diffie-HellmanKeyexchange–EllipticCurveCryptographyMessageAuthenticationandHashfunctions– HashandMacAlgorithm–DigitalSignatures andAuthenticationProtocol. |
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| **Unit:3** | **NETWORKSECURITY** |
| NetworkSecurityPractice:AuthenticationApplications–Kerberos–X.509AuthenticationservicesandEncryptionTechniques.E-mail Security – PGP– S/MIME –IP Security. |
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| **Unit:4** |  **WEBSECURITY** |
| Web Security - Secure Socket Layer – Secure Electronic Transaction. System Security - IntrudersandViruses –Firewalls– Password Security. |
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| **Unit:5** |  **CASESTUDY** |
| CaseStudy:ImplementationofCryptographicAlgorithms–RSA–DSA–ECC(C/JAVAProgramming).NetworkForensic–SecurityAudit-OtherSecurityMechanism:Introductionto:Stenography–QuantumCryptography– WaterMarking -DNACryptography |
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| **TextBooks** |
| 1 | WilliamStallings,“CryptographyandNetworkSecurity”,PHI/PearsonEducation. |
| 2 | BruceSchneir,“AppliedCryptography”,CRCPress. |
| **ReferenceBooks** |
| 1 | A.Menezes,PVanOorschotandS.Vanstone,“HandBookofAppliedCryptography”,CRCPress,1997 |
| 2 | AnkitFadia,”NetworkSecurity”,MacMillan. |
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| **Coursecode** |  | **DATASCIENCE&ANALYTICS** | **Core** |
| **Pre-requisite** | BasicsofDataScience&itsApplications |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Introducethestudentstodatascience,bigdata &its ecosystem.
2. Learndataanalytics &its lifecycle.
3. Toexploretheprogramming languageR,with respectto the datamining algorithms.
4. Relatetherelationshipbetweenartificialintelligence,machinelearning anddatascience.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandtheconcept ofdatascienceand itstechniques |
| Reviewdataanalytics |
| Apply and determine appropriate Data Mining techniques using R to real timeapplications |
| Analyzeonclusteringalgorithms |
| Analyzeon regressionmethods in AI |
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| **Unit:1** | **INTRODUCTION** |
| IntroductionofDataScience:datascienceandbigdata–facetsofdata-datascienceprocess-Ecosystem-TheData Scienceprocess– six steps-Machine Learning. |
|  |
| **Unit:2** | **BASICSOFDATA ANALYTICS** |
| DataAnalyticslifecycle-reviewofdataanalytics-AdvanceddataAnalytics-technologyandtools. |
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| **Unit:3** | **DATAANALYTICSUSING R** |
| Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – AttributeandDataTypes–DescriptiveStatistics–ExploratoryDataAnalysis–VisualizationBeforeAnalysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – DataExplorationVersus Presentation. |
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| **Unit:4** | **CLUSTERING** |
| Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-meansAnalysisusingR–Classification–DecisionTrees–OverviewofaDecisionTree–DecisionTree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem – NaïveBayesClassifier– Smoothing– Naïve Bayes in R. |

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| **Unit:5** |  **ARTIFICIALINTELLIGENCE** |
| Artificialintelligence:MachineLearninganddeeplearningindatascience-Clustering,associationrules. Linear regression-logisticregression-Additional regressionmethods. |
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| **TextBooks** |
| 1 | Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016.Pdf |
| 2 | Datasciencein bigdata analytics-Wiley 2015JohnWiley &Sons |
| **ReferenceBooks** |
| 1 | Asimpleintroduction to DataScience -Lars Nielson 2015 |
| 2 | IntroducingDataScienceDavyCielen,ArnoD.B.Meysman,MohamedAli2016ManningPublication |
| 3 | RProgrammingforData Science-RogerD.Peng2015LeanPublication |
| 4 | DataScience& BigDataAnalytics:Discovering,Analyzing,VisualizingandPresentingData |
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| **Coursecode** |  | **PRACTICAL V : DIGITAL IMAGEPROCESSINGUsingMATLAB** | **Core** |
| **Pre-requisite** | BasicProgrammingofImageProcessing&anintro to MATLAB |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. TounderstandthebasicsofDigitalImageProcessingfundamentals,imageenhancementandimagerestoration techniques
2. Toenablethestudentsto learnthefundamentalsof imagecompression andsegmentation
3. Tounderstand ImageRestoration&FilteringTechniques
4. Implementationofthe aboveusingMATLAB
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Towriteprograms in MATLABforimageprocessing usingthe techniques |
| ToabletoimplementImageEnhancements&Restorationtechniques |
| CapableofusingCompressiontechniquesinan Image |
| Must beable to manipulatethe imageand Segment it |
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| **LISTOFPROGRAMS** |
| 1. ImplementImageenhancementTechnique.
2. HistogramEqualization
3. ImageRestoration.
4. ImplementImageFiltering.
5. EdgedetectionusingOperators(Roberts,PrewittsandSobelsoperators)
6. Implementimagecompression.
7. ImageSubtraction
8. BoundaryExtractionusing morphology.
9. ImageSegmentation
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| **TextBooks** |
| 1 | RafaelC.Gonzalez,RichardE.Woods, “Digital ImageProcessing”, SecondEdition, |

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|  | PHI/PearsonEducation. |
| 2 | B.Chanda,D.DuttaMajumder,“DigitalImageProcessingandAnalysis”,PHI,2003. |
| **ReferenceBooks** |
| 1 | NickEfford,“DigitalImageProcessingapracticalintroducingusingJava”,PearsonEducation,2004. |
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| **Coursecode** |  | **PRACTICAL VI : CLOUDCOMPUTINGLAB** | **Core** |
| **Pre-requisite** | BasicProgrammingusingCloud |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Thiscoursecoversthe basicdatastructureslike Stack,Queue,Tree,List.
2. Thiscourseenablesthestudentsto learntheapplicationsof thedata structuresusingvarioustechniques
3. ItalsoenablethestudentstounderstandC++languagewithrespecttoOOADconcepts
4. ApplicationofOOPSconcepts
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion ofthe course,studentwill beable to: |
| Understandthe concepts ofobjectorientedwithrespecttoC++ |
| Abletounderstand andimplement OOPSconcepts |
| ImplementationofdatastructureslikeStack, Queue,Tree,ListusingC++ |
| Application of the data structures for Sorting, Searching usingdifferenttechniques. |
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| **LISTOFPROGRAMS** |
| 1. WorkingwithGoogleDrivetomakespreadsheetandnotes.
2. LaunchaLinux VirtualMachine.
3. Tohosta staticwebsite
4. ExploringGooglecloudforthefollowinga)Storageb)Sharingofdatac)manageyourcalendar,to-do lists, d) a document editing tool
5. Workingand installationof GoogleApp Engine
6. Workingandinstallation ofMicrosoftAzure
7. ToConnectAmazonRedshiftwithS3bucket
8. To[CreateandQuerya NoSQLTable](https://aws.amazon.com/getting-started/tutorials/create-nosql-table/?trk=gs_card&e=gs&p=gsrc)
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| Expertlectures,onlineseminars–webinars |
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| **TextBooks** |
| 1 | MichaelMiller,“Cloud Computing”,PearsonEducation,NewDelhi,2009. |
| **ReferenceBooks** |

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| 1 | AnthonyT.Velte,“CloudComputing:APracticalApproach”,1stEdition,TataMcGrawHill Education Private Limited, 2009. |
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| **Coursecode** |  | **PRACTICAL VII : WEBAPPLICATIONDEVELOPMENTANDHOSTING** | **Core** |
| **Pre-requisite** | BasicProgrammingusing HTMLtags |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Ableto designa web pageusing HTML tags
2. To enable thestudentstouse Framesets,hyperlinksanddifferentformattingfeaturesof HTMLtags
3. EnablethestudentstouseForms&other controlsinawebpage4.Tocreate interactiveapplications using PHP
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion ofthecourse, student willbe able to: |
| Understand&implementthebasic HTMLtagstocreatestaticwebpages |
| Capableofusing hyperlinks,frames ,images, tables, inaweb page |
| Abletowritedynamicweb applicationsusingHTML forms |
| Mustbeable towritedynamicwebapplicationsin PHP&HTML tagsusingXAMPP. |
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| **LISTOFPROGRAMS** |  |
| 1. Developa websitefor yourcollegeusing advanced tags ofHTML.
2. Write namesof severalcountriesina paragraphandstore itasanHTMLdocument,world.html. Each country name must be a hot text. When you click India (for example), it mustopenindia.html and it should provide abrief introductionabout India.
3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) todisplaythe Table FormatData
4. Develop a Complete Web Page using Frames and Framesets which gives the Informationabouta Hospital using HTML.
5. WriteaHTML documenttoprint yourBio-Datain aneatformat usingseveralcomponents.
6. DevelopaHTML documentto displayaRegistrationFormfor aninter-collegiatefunction.
7. Using HTML form accept Customer details like Name, City, Pin code, Phone number andEmailaddress and validatethedata and display appropriatemessages forviolationsusing PHP

(Eg.Name isMandatory field; Pincodemust be6 digits,etc.).1. Writeaprogramtoaccepttwonumbersn1andn2usingHTMLformanddisplaythePrime
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| numbersbetweenn1 andn2 usingPHP. |
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| **TextBooks** |
| 1 | Ivan Bayross, “Web Enabled Commercial Applications Development Using HTML,JavaScript,DHTML andPHP”, BPBPublications,4th RevisedEdition,2010. |
| **ReferenceBooks** |
| 2 | A.K.SainiandSumintTuli,“MasteringXML”, FirstEdition,NewDelhi,2002. |
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ElectiveCourses



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| **Coursecode** |  | **MULTIMEDIA AND ITSAPPLICATIONS** | **Elective** |
| **Pre-requisite** | BasicsofMultimedia |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Tointroducethe studentstheconcepts ofMultimedia,Images &Animation.
2. TointroduceMultimediaauthoringtools
3. TounderstandtheroleofMultimediainInternet
4. ToknowaboutHighDefinitionTelevisionandDesktopComputing–KnowledgebasedMultimedia systems
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| UnderstandthebasicconceptsofMultimedia |
| DemonstrateMultimedia authoringtools |
|  Analyzethe conceptsofSound, Images, Video&Animation |
| ApplyandAnalyzethe roleofMultimediainInternet andrealtimeapplications |
| AnalyzemultimediaapplicationsusingHDTV |
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| **Unit:1** | **INTRODUCTION** |
| WhatisMultimedia?–IntroductiontomakingMultimedia–MacintoshandWindowsProductionplatforms – Basic Softwaretools. |
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| **Unit:2** | **MULTIMEDIATOOLS** |
| Making Instant Multimedia – Multimedia authoring tools – Multimedia building blocks – Text –Sound. |
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| **Unit:3** | **ANIMATION** |
| Images–Animation –Video. |
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| **Unit:4** | **INTERNET** |
| MultimediaandtheInternet–TheInternetandhowitworks–ToolsforWorldWideWeb–Designingfor theWorld Wide Web. |
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| **Unit:5** | **MULTIMEDIASYSTEMS** |
| HighDefinitionTelevisionandDesktopComputing–KnowledgebasedMultimediasystems. |

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| **TextBooks** |
| 1 | TayVaughan, “Multimediamakingitwork”,FifthEdition,TataMcGrawHill. |
| 2 | JohnF.KoegelBufford,“MultimediaSystems”,PearsonEducation. |
| **ReferenceBooks** |
| 1 | JudithJeffloate,“MultimediainPractice(TechnologyandApplications)”,PHI,2003. |
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| **Coursecode** |  | **EMBEDDEDSYSTEMS** | **Elective** |
| **Pre-requisite** | BasicsofMicroController |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Presenttheintroductionto8051MicrocontrollerInstructionSet,conceptsonRTOS&Softwaretools.
2. Gaintheknowledge about theembeddedsoftwaredevelopment.
3. Learn aboutMicrocontrollerandsoftwaretoolsintheembeddedsystems.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthe conceptof8051microcontroller |
| Understandthe InstructionSetandProgramming |
| Analyzethe conceptsofRTOS |
| AnalyzeanddesignvariousrealtimeembeddedsystemsusingRTOS |
| Debugthemalfunctioningsystem usingvariousdebuggingtechniques |
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| **Unit:1** | **8051MICROCONTROLLER** |
| 8051 Microcontroller:Introduction-8051Architecture-Input/Output Pins, Ports andCircuits -ExternalMemory-Counters/ Timers-Serial DataInput/ Output–Interrupts |
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| **Unit:2** | **PROGRAMMINGBASICS** |
| InstructionSetandProgrammingMovingData-AddressingModes-Logicaloperations-ArithmeticOperation-JumpandCallInstructions-SimpleProgram.Applications:KeyboardInterface-Display Interface-PulseMeasurements-DIAandAIDConversions-MultipleInterrupts. |
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| **Unit:3** | **CONCEPTS ON RTOS** |
| CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasksand data- Semaphores and shared data. MORE operating systems services: Interrupt Processcommunication - Message Queues, Mailboxes and pipes- Timer Functions-Events - MemoryManagement-InterruptRoutines in an RTOS Environment. |
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| **Unit:4** | **DESIGNUSING RTOS** |
| BasicDesignusingaRTOS:Principles-EncapsulatingsemaphoresandQueues-Hardrealtimeschedulingconsiderations-Savingmemory space and power-introductions toRTL &QNX. |
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| **Unit:5** | **SOFTWARETOOLS** |
| SOFTWARETOOLS:EmbeddedsoftwareDevelopmentTools:HostsandTargetMachines- |

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| Linker/Locators for Embedded software-getting Embedded software into the Target systems.Debugging Techniques: Testing on your Host machine -Instruction set simulators- The assertmacro-using laboratory tools. |
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| **TextBooks** |
| 1 | DavidE.Simon,“AnEmbeddedSoftwareprimer”PearsonEducationAsia,2003. |
| 2 | KennethJAyala,“The8051MicrocontrollerandArchitectureprogrammingandapplication”,Second Edition, Penram International. |
| **ReferenceBooks** |
| 1 | Raj Kamal, “Embedded Systems – Architecture, programming and design”, Tata McGraw –Hill, 2003. |
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| **Coursecode** |  | **INTERNETOFTHINGS** | **Elective** |
| **Pre-requisite** | BasicsofSensors& its Applications |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. AboutInternetofThingswherevariouscommunicatingentitiesarecontrolledandmanagedfordecision making in theapplication domain.
2. EnablestudentstolearntheArchitectureof IoTandIoTTechnologies
3. DevelopingIoTapplicationsandSecurityinIoT,BasicElectronicsforIoT,ArduinoIDE,Sensorsand ActuatorsProgrammingNODEMCUusing Arduino IDE.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion of thecourse, student willbe able to: |
| Understandabout IoT,itsArchitectureanditsApplications |
| UnderstandbasicelectronicsusedinIoT&itsrole |
|  DevelopapplicationswithCusingArduinoIDE |
| Analyzeaboutsensorsandactuators |
| DesignIoTinrealtimeapplicationsusingtoday’sinternet&wirelesstechnologies |
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| **Unit:1** | **INTRODUCTION** |
| IntroductiontoIoT:EvolutionofIoT–Definition&CharacteristicsofIoT-ArchitectureofIoT–TechnologiesforIoT–DevelopingIoTApplications–ApplicationsofIoT–IndustrialIoT–Securityin IoT |
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| **Unit:2** | **BASICELECTRONICSFOR IoT** |
| BasicElectronicsforIoT:ElectricCharge,Resistance,CurrentandVoltage–BinaryCalculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals –A/Dand D/A Conversion – Pulse Width Modulation. |
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| **Unit:3** | **PROGRAMMINGUSINGARDUINO** |
| Programming Fundamentals with C using Arduino IDE: Installing and Setting up the ArduinoIDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements andLoops – Using Arduino C Library Functions for Serial, delay and other invoking Functions –Stringsand Mathematics Library Functions. |
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| **Unit:4** | **SENSORSANDACTUATORS** |
| SensorsandActuators:AnalogandDigitalSensors–Interfacingtemperaturesensor,ultrasound |



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| sensorandinfrared(IR)sensorwithArduino– Interfacing LEDandBuzzerwithArduino. |
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| **Unit:5** |  **SENSORDATAININTERNET** |
| SendingSensorDataOverInternet:IntroductiontoESP8266NODEMCUWiFiModule–Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit datafromtemperaturesensortoOpen SourceIoTcloud platform (ThingSpeak). |
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| **TextBooks** |
| 1 | ArshdeepBahga,VijayMadisetti,“InternetofThings:AHands-OnApproach”,2014.ISBN:978-0996025515 |
| 2 | BorisAdryan,DominikObermaier,PaulFremantle,“TheTechnicalFoundationsofIoT”,ArtechHouser Publishers, 2017. |
| **ReferenceBooks** |
| 1 | MichaelMargolis,“ArduinoCookbook”,O‟Reilly,2011 |
| 2 | MarcoSchwartz,“InternetofThingswithESP8266”,PacktPublishing,2016. |
| 3 | DhivyaBala,“ESP8266:StepbyStepTutorialforESP8266IoT,ArduinoNODEMCUDev.Kit”, 2018. |
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| **Coursecode** |  | **CRITICAL THINKING, DESIGNTHINKINGANDPROBLEMSOLVING** | **Elective** |
| **Pre-requisite** | BasicsofLogical& Reasoning Skills |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Learncriticalthinkinganditsrelatedconcepts
2. Learndesignthinkinganditsrelated concepts
3. DevelopThinkingpatterns,Problemsolving&Reasoning
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| **Expected CourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandthe conceptsofCriticalthinkinganditsrelatedtechnology |
| Focusontheexplicitdevelopmentofcriticalthinkingandproblemsolvingskills |
| Applydesignthinking inproblems |
| Makeadecision andtakeactions basedonanalysis |
| AnalyzetheconceptsofThinkingpatterns,Problemsolving&Reasoninginrealtimeapplications |
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| **Unit:1** | **CRITICALTHINKING** |
| CriticalThinking:Definition,ConclusionsandDecisions,BeliefsandClaims,Evidence–finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram.Appliedcriticalthinking:Inference,Explanation,Evidence,Credibility,TwoCaseStudies,criticalthinking and science, critical evaluation,self assessment. |
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| **Unit:2** | **DESIGNTHINKING** |
| Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinkingprocess,TraditionalProblemSolvingversusDesignThinking,phasesofDesignThinking,problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea toimplementation. |
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| **Unit:3** | **CASESTUDY** |
| Thinkingtoconfidence,fearmanagement,dutyVspassion,Teammanagement,ToolsforThinking, prototype design, Relevance of Design and Design Thinking in engineering, humancentereddesign, casestudy: apply design thinkingin problem. |
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| **Unit:4** | **PROBLEMSOLVING** |
| Problemsolving:problemdefinition,problemsolvingmethods,selectingandusinginformation,dataprocessing,solutionmethods,solvingproblemsbysearching,recognizingpatterns,spatial |



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| reasoning,necessityandsufficiency,choosingandusingmodels,makingchoicesanddecisions. |
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| **Unit:5** |  **REASONING** |
| Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating,implementing,andevaluatingsolutions,interpersonalproblemsolving.Advancedproblemsolving: Combining skills – using imagination, developing models, Carrying out investigations,Data analysis and inference. Graphical methods of solution, Probability, tree diagramsanddecisiontrees |
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| **TextBooks** |
| 1 | JohnButterworthandGeoffThwaites,Thinkingskills:CriticalThinkingandProblemSolving,CambridgeUniversity Press, 2013. |
| 2 | H.S.FoglerandS.E.LeBlanc,StrategiesforCreativeProblemSolving,2ndedition,Pearson,Upper Saddle River, NJ, 2008. |
| **ReferenceBooks** |
| 1 | A.WhimbeyandJ.Lochhead,ProblemSolving&Comprehension,6thedition,LawrenceErlbaum,Mahwah,NJ, 1999. |
| 2 | M.Levine,EffectiveProblemSolving,2ndedition,PrenticeHall,UpperSaddleRiver,NJ,1994. |
| 3 | MichaelBaker, TheBasicofCriticalThinking, TheCriticalThinkingCopress,2015. |
| 4 | DavidKelleyandTomKelley,CreativeConfidence,2013. |
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| **Coursecode** |  | **MOBILECOMPUTING** | **Elective** |
| **Pre-requisite** | BasicsofMobileCommunication |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. PresenttheoverviewofMobilecomputing,ApplicationsandArchitectures.
2. Describethefuturisticcomputingchallenges.
3. Enablethestudents to learn theconcept of mobilecomputing.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Understandtheneedandrequirementsofmobile communication |
| Focusonmobilecomputingapplicationsandtechniques |
| Demonstratesatellitecommunicationinmobilecomputing |
| Analyzeaboutwirelesslocallooparchitecture |
| Analyzevariousmobilecommunicationtechnologies |
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| **Unit:1** | **INTRODUCTION** |
| Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobilecommunication: Need for Mobile Communication – Requirements of Mobile Communication –Historyof Mobile Communication. |
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| **Unit:2** | **MOBILECOMMUNICATION** |
| IntroductiontoCellularMobileCommunication–MobileCommunicationStandards–MobilityManagement–Frequency Management – Cordless MobileCommunicationSystems. |
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| **Unit:3** | **MOBILECOMPUTING** |
| Mobile Computing: History of data networks – Classification of Mobile data networks - CDPDSystem–SatellitesinMobileCommunication:Satelliteclassification–GlobalSatelliteCommunication – Changeover from one satellite to other – Global Mobile Communication –Interferencesin Cellular Mobile Communication. |
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| **Unit:4** | **MOBILECOMMUNICATIONSYSTEM** |
| Important Parameters of Mobile Communication System– Mobile Internet: Working of MobileIP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL –Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service –WirelessApplication Protocol. |
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| **Unit:5** | **COMMUNICATIONTECHNOLOGY** |

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| WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc NetworkandBluetoothtechnology–IntelligentMobileCommunicationsystem–FourthGenerationMobileCommunication systems. |
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| **TextBooks** |
| 1 | T.G.Palanivelu,R.Nakkeeran,“WirelessandMobileCommunication”,PHILimited,2009. |
| 2 | JochenSchiller,“Mobile Communications”,SecondEdition,PearsonEducation, 2007. |
| **ReferenceBooks** |
| 1 | AsokeK Talukder, HasanAhmed, RoopaYavagal,“[Mobile Computing](http://mheducation.co.in/html/9780070144576.html)”,TMH, 2010. |
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| **Coursecode** | **BLOCKCHAINTECHNOLOGY** | **Elective** |
| **Pre-requisite** | BasicsofBlockChain &CryptoCurrency |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. Understandthe fundamentalsofblockchainand cryptocurrency.
2. Understandthe influence and roleofblockchainin variousotherfields.
3. Learnsecurityfeaturesanditssignificance.
4. Identifyproblems&challenges posedby BlockChain.
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| Demonstrateblockchain technologyandcrypto currency |
| Understandtheminingmechanisminblockchain |
| Applyandidentifysecuritymeasures,andvarioustypesofservicesthatallowpeopleto tradeand transact with bitcoins |
| Applyand analyzeBlockchain inhealth careindustry |
| Analyzesecurity,privacy,andefficiencyof agivenBlockchain system |
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| **Unit:1** | **INTRODUCTION** |
| Introduction to Blockchain - The big picture of the industry – size, growth, structure, players.Bitcoin versus Cryptocurrencies versus Blockchain- Distributed Ledger Technology (DLT).Strategic analysis of the space – Blockchain platforms, regulators, application providers. Themajorapplication: currency, identity, chain of custody. |
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| **Unit:2** | **NETWORKANDSECURITY** |
| Advantage over conventional distributed database, Blockchain Network, Mining Mechanism,Distributed Consensus, Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features.Privacy,Security issues in Blockchain. |
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| **Unit:3** | **CRYPTOCURRENCY** |
| Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography -Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trustmodel:Peer-to-Peer,Leviathan,andIntermediary.ApplicationofCryptographytoBlockchain |
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| **Unit:4** | **CRYPTOCURRENCYREGULATION** |
| CryptocurrencyRegulation-Stakeholders,RootsofBitcoin,Legalviews-exchangeofcryptocurrency-BlackMarket-GlobalEconomy.Cyrptoeconomics–assets,supplyand |



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| demand,inflationanddeflation –Regulation. |
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| **Unit:5** | **CHALLENGESINBLOCKCHAIN** |
| OpportunitiesandchallengesinBlockChain–Applicationofblockchain:Industry4.0–machine to machine communication – Data management in industry 4.0 – future prospects. Blockchain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - HealthcareValue-Challenges forusing blockchain forhealthcaredata |
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| **TextBooks** |
| 1 | Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,“BitcoinandCryptocurrencyTechnologies:AComprehensiveIntroduction”,PrincetonUniversityPress (July 19, 2016). |
| 2 | Antonopoulos,“MasteringBitcoin:UnlockingDigitalCryptocurrencies” |
| **ReferenceBooks** |
| 1 | SatoshiNakamoto,“Bitcoin:APeer-to-PeerElectronicCashSystem” |
| 2 | RodrigodaRosaRighi,AntonioMarcosAlberti,MadhusudanSingh,“BlockchainTechnologyforIndustry4.0” Springer 2020. |
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| **Coursecode** | **WEBSERVICES** | **Elective** |
| **Pre-requisite** | BasicsofDistributedComputing |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. PresenttheWebServices,BuildingrealworldEnterpriseapplicationsusingWebServiceswithTechnologies XML, SOAP , WSDL, UDDI
2. Getoverview ofDistributedComputing,XML,anditstechnologies
3. UpdatewithQoSanditsfeatures
4. DevelopStandards andfutureofWebServices
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| **ExpectedCourseOutcomes:** |
| Onthesuccessfulcompletion ofthe course,studentwill beable to: |
| Understandwebservices anditsrelatedtechnologies |
| UnderstandXML concepts |
| Analyzeon SOAPand UDDImodel |
| Demonstratetheroadmap forthe standardsand futureofweb services |
| AnalyzeQoSenabledapplicationsinwebservices |
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| **Unit:1** | INTRODUCTION |
| Introduction to web services – Overview of Distributed Computing- Evolution and importance ofwebservices-Industrystandards,Technologiesandconceptsunderlyingwebservices-Webservicesandenterprises-web servicesstandardsorganization-web servicesplatforms. |
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| **Unit:2** | **XMLFUNDAMENTALS** |
| XMLFundamentals – XMLdocuments-XML Namespaces-XML Schema–Processing XML. |
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| **Unit:3** | **SOAPMODEL** |
| SOAP:TheSOAPmodel-SOAPmessages-SOAPencoding-WSDL:WSDLstructure-interfacedefinitions-bindings-services-UsingSOAPandWSDL-UDDI:AboutUDDI-UDDIregistrySpecification-Coredata structures-Accessing UDDI |
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| **Unit:4** | **TECHNOLOGIESANDSTANDARDS** |
| Advancedwebservicestechnologiesandstandards:Conversationsoverview-webservicesconversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-datastorage-errors-Webservices security issues. |
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| **Unit:5** | **QUALITYOFSERVICE** |
| Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoSenabledwebservices-QoSenabledapplications.Webservicesmanagement-webservicesstandardsand futuretrends. |
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| **TextBooks** |
| 1 | SandeepChatterjee,JamesWebber,“DevelopingEnterpriseWebServices:AnArchitectsGuide”,PrenticeHall, Nov 2003. |
| 2 | KeithBallinger,“NETWebservices:ArchitectureandImplementationwith.Net”,PearsonEducation,First Edition,Feb 2003. |
| **ReferenceBooks** |
| 1 | RameshNagappan,“DevelopingJavaWebServices:ArchitectinganddevelopingsecureWebServicesUsingJava”, JohnWileyand Sons,firstEdition Feb2003. |
| 2 | EricAMarksandMarkJWerrell,“ExecutiveGuidetoWebservices”,JohnWileyandsons,March 2003. |
| 3 | AnneThomasManes,“Web Services:AmanagersGuide”, AddisonWesley,June2003. |
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| **Coursecode** | **ROBOTIC PROCESS AUTOMATIONFOR BUSINESS** | **Elective** |
| **Pre-requisite** | BasicsofRobots&itsApplications |
| **CourseObjectives:** |
| Themain objectives ofthis courseareto:1. LearntheconceptsofRPA, itsbenefits,typesandmodels.
2. GaintheknowledgeinapplicationofRPAinBusinessScenarios.
3. IdentifymeasuresandskillsrequiredforRPA
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| **ExpectedCourseOutcomes:** |
| Onthesuccessful completionofthecourse,student willbe ableto: |
| DemonstratethebenefitsandethicsofRPA |
| UnderstandtheAutomationcycle anditstechniques |
| DrawinferencesandinformationprocessingofRPA |
| Implement&ApplyRPAinBusinessScenarios |
| AnalyzeonRobots &leveragingautomation |
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| **Unit:1** | **INTRODUCTION** |
| Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries& domains fit for RPA - Identification of process for automation - Types of Robots - Ethics ofRPA&BestPractices-AutomationandRPAConcepts-DifferentbusinessmodelsforimplementingRPA-Centreof Excellence–Typesandtheirapplications - Building anRPAteam-ApproachforimplementingRPAinitiatives. |
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| **Unit:2** | **AUTOMATION** |
| Role of a Business Manager in Automation initiatives - Skills required by a Business Manager forsuccessfulautomation-TheimportanceofaBusinessManagerinautomation-Analyzingdifferent business processes - Process Mapping frameworks - Role of a Business Manager insuccessful implementation – Part 1 - Understanding the Automation cycle – First 3 automationstagesand activities performed by different people. |
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| **Unit:3** | **AUTOMATIONIMPLEMENTATION** |
| Evaluating the Automation Implementation Detailed description of last 3 stages and activitiesperformed by different people - Role of a Business Manager in successful completion – Part 2 -Activities to be performed post-implementation - Guidelines for tracking the implementationsuccess - Metrics/Parameters to be considered for gauging success - Choosing the right licensingoption-Sending emails-Publishing and RunningWorkflows. |
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| **Unit:4** | **ROBOT** |



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| Ability to process information through scopes/systems- Understand the skill of informationprocessing and its use in business - Leveraging automation - Creating a Robot - New Processes.Establishcausalitybyvariablebehavior-Understandtheskillofdrawinginferenceorestablishing causality by tracking the behavior of a variable as it varies across time/referencedvariable-Leveraging automationforthis skill-Robot & new processcreation. |
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| **Unit:5** | **ROBOTSKILL** |
| Inference from snapshots of curated terms– Omni-source data curation - Multisource trendtracking - Understand the skill of drawing inference from the behavior of curated terms by takingsnapshots across systems in reference to time/variable(s) - Leveraging automation for this skill –Robotcreation and newprocess creation for this skill. |
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| **TextBooks** |
| 1 | AlokManiTripathi”LearningRoboticProcessAutomation:CreateSoftwarerobotsandautomatebusinessprocesses withtheleading RPAtool” PacktPublishing LimitedMarch2018. |
| 2 | TomTaulli“TheRoboticProcess AutomationHandbook”Apress,February2020. |
| **ReferenceBooks** |
| 1 | SteveKaelble”RoboticProcess Automation”JohnWiley& Sons,Ltd.,2018 |
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