**SYLLABUS**

**PG** **(INFORMATION TECHNOLOGY)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SEMESTER** | **PAPER** | **PAPER**  **CODE** | **FULL**  **MARKS** | **CREDITS** | **REMARKS** |
| FIRST | ADVANCED  COMPUTER ARCHITECTURE | MIT-1.1.1 | 100 | 6 | COMPULSORY |
| COMPUTER  GRAPHICS | MIT-1.1.2 | 100 | 6 | COMPULSORY |
| MOBILE  COMMUNICATIONS | MIT-1.1.3 | 100 | 6 | COMPULSORY |
| PROBABILITY AND STOCHASTIC  PROCESS | MIT-1.1.4 | 100 | 6 | COMPULSORY |
| GREENIT | MIT-1.1.5 | 100 | 6 | COMPULSORY |
| SECOND | ARTIFICIAL  INTELLIGENCE | MIT-1.2.1 | 100 | 6 | COMPULSORY |
| DATA MINING AND  DATA WAREHOUSING | MIT-1.2.2 | 100 | 6 | COMPULSORY |
| DESIGN ANDANALYSIS OF  ALGORITHMS | MIT-1.2.3 | 100 | 6 | COMPULSORY |
| WIRELESS SENSOR  NETWORKS | MIT-1.2.4 | 100 | 6 | COMPULSORY |
| ADVANCE DATA  STRUCTURE ANDALGORITHM | MIT-1.2.5 | 100 | 6 | COMPULSORY |
| THIRD | SOFTWARE  EVOLUTION | MIT-2.3.1 | 100 | 6 | COMPULSORY |
| CRYPTOGRAPHY  AND NETWORKSECURITY | MIT-2.3.2 | 100 | 6 | COMPULSORY |
| ITINFRA STRUCTURE  DESIGN | MIT-2.3.3 | 100 | 6 | COMPULSORY |
| INTERNETOF  THINGS | MIT-2.3.4 | 100 | 6 | COMPULSORY |
| ADVANCE  OPEARTING SYSTEM | MIT-2.3.5 | 100 | 6 | COMPULSORY |
| FOURTH | CLOUD COMPUTING | MIT-2.4.1A | 100 | 6 | CHOOSE ANYONE OF THETWO  COURSES |
| BIOINFORMATICS | MIT-2.4.1B | 6 |
| DIGITALI MAGE  PROCESSING | MIT-2.4.2A | 100 | 6 | CHOOSE ANYONE OF THETWO  COURSES |
| EMBEDDED  SYSTEMS | MIT-2.4.2B | 6 |

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| --- | --- | --- | --- | --- | --- |
|  | SOFTWARE PROJECT  MANAGEMENT | MIT-2.4.3 | 100 | 6 | COMPULSORY |
| PROJECT | MIT-2.4.4 | 300 | 6 | COMPULSORY |

# FIRSTSEMESTER

## Advanced Computer Architecture(MIT-1.1.1)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objectives**

To make students know about the Parallelism concepts in Programming

• To give the students an elaborate idea about the different memory systems and buses.

• To introduce the advanced processor architectures to the students.

• To make the students know about the importance of multiprocessor and multicomputers.

* To study about data flow computer architectures

**Course Outcomes (COs):**

* Demonstrate concepts of parallelism in hardware/software.
* Discuss memory organization and mapping techniques.
* Describe architectural features of advanced processors.
* Interpret performance of different pipelined processors.
* Explain data flow in arithmetic algorithms
* Development of software to solve computationally intensive problems

#### UNITI

DigitalElectronics:Booleanalgebra,Combinationalcircuits,Karnaughmap,Flip-flops,Sequentialcircuits.RISCprocessors,RISCvsCISC,ClassificationofInstructionsetArchitecture, Performance measurement, Basic parallel processing techniques: Instructionlevel,Thread levelandProcesslevel. Classificationof parallelarchitecture.

#### UNITII

Pipeline: Arithmetic pipeline, Instruction pipeline. Hazards in a pipeline: Structural, data andcontrol hazard, Overview of hazard resolution techniques. Dynamic instruction scheduling,Branchpredictiontechniques,Instruction-levelparallelismusingsoftwareapproaches,Superscalartechniques.

#### UNITIII

Basic concept of hierarchical memory organization, Main memories, Cache memory designand implementation, Cache coherence problem and synchronization mechanisms, Virtualmemorydesign andimplementation,Secondarymemorytechnology, RAID.

#### UNITIV

Busstructuresandstandards,Synchronousandasynchronousbuses,Typesandusesofstorage devices, Interfacing I/O to the rest of the system, Reliability and availability, I/Osystemdesign, Platformarchitecture.

#### UNITV

Centralizedvs.distributedsharedmemory,Interconnectiontopologies,Multiprocessorarchitecture,Symmetricmultiprocessors,Cachecoherenceproblem,Synchronization,Memoryconsistency,Multicorearchitecture.Distributedcomputers,Clusters,Grid,Mainframecomputers.

TextBook:-

1. ComputerOrganisationandDesign:TheHardware/SoftwareInterfacebyDavidA.Pattersonand JohnL. Hennessy.5th Edition, MorganKaufmann, 2013.
2. ComputerSystemArchitecturebyM.Mano,3rdEdition,PearsonEducation,2007.
3. ComputerArchitecture:AQuantitativeApproachbyJ.HennesseyandD.Patterson,5thEdition,Morgan Kaufman.
4. AdvancedComputerArchitecture:AdesignSpaceApproachbyD.Sima,Addison-Wesley, 1987.

## Computer Graphics(MIT-1.1.2)

### Full marks – 100 (Mid Semester: 20; End Semester:50(Theory)+30(Practical))

**Course Objectives:**

This course is intended to understand the principles of computer graphics including two-dimensional transformation, three-dimensional transformation, clipping algorithms, polygon filling, line drawing algorithms, rendering, projection of objects and demonstrates its application in various fields of computer science.

**Learning Outcomes:**

**The student will be able to**

* Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
* Use of geometric transformations on graphics objects and their application in composite form.
* Extract scene with different clipping methods and its transformation to graphics display device.
* Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
* Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

#### UNITI

**A survey of computer graphics:**Computer Aided Design, Presentation Graphics, ComputerArt, Entertainment, Education Training, Visualization, Image Processing, Graphical UserInterface. **Overview of graphics system:** Video Display Devices, Raster Scan Systems,RandomScanSystems,InputDevices,Hard-copyDevices,GraphicsSoftware.**Outputprimitives:** Points and lines, DDA and Bresenham’s Line Drawing Algorithm, Midpointcircle algorithm, Filled area primitives. **Attributes of output primitives:** Line attributes,Curveattributes,Colourandgrayscalelevels,Area-fillattributes,Characterattributes,Bundledattributes.

#### UNITII

**Two dimensional geometric transformations:** Basic Transformation (Translation, Rotation,Scaling), Matrix representation and homogenous coordination, Composite Transformation,Reflection, Shear. **Two dimensional viewing:** The viewing Pipe-line, Viewing CoordinateReference frame, Window-to-viewport coordinate transformation. **Clipping:** Line Clipping(CohenSutherlandAlgorithm),Polygonclipping(Sutherland-HodgemenAlgorithm)

#### UNITIII

**Three dimensional object representation:** Polygon Surfaces, Quadratic surfaces, SplineRepresentations,BeizerCurvesandsurfaces, B-SplineCurves and surfaces

#### UNITIV

**Threedimensionalgeometricandmodelingtransformations:**Translation,Rotation,Scaling,Reflections,Shears,CompositeTransformation.**Threedimensionalviewing:**Viewingpipeline,Viewing coordinates,Projections(ParallelandPerspective).

#### UNITV

**Visible-surface detection methods: Classification of** visible-surface detection algorithms,back-facedetection,Depth-Buffermethod,A-Buffermethod,Scan-linemethod, Depth-sortingmethod.**IlluminationModels:**Basicilluminationmodels,Displayinglightintensities,HalftonePatternsandDitheringTechnique,PolygonRenderingMethods,(Gouraudandphong shading)

TextBook:-

1. Computer Graphics C Version, by D. Heam and M. P. Baker, 2nd Edition, PearsonEducation,2002.

### Practical

Background concept of enabling graphics mode in C and usage of various graphic functionsavailable in graphics.h, Simple animation programs using graphics library, Implementation ofDDA and Bresenham’s line drawing, Mid point circle algorithms in C, Writing program in Ctoimplementationtranslation,rotation,scaling, lineclipping,polygonclipping.

## MobileCommunications(MIT-1.1.3)

### Fullmarks–100(MidSemester:20;EndSemester:80)

COURSE OBJECTIVES:

To expose the students to understand the fundamentals of mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.

COURSE OUTCOMES:

After successful completion of the course, the students are able to:

* Identify concept of wireless networks , applications & challenges. Various types of multiplexing techniques , modulation techniques, spread spectrum concepts .
* Students will identify motivation behind specialized MAC in wireless communications, various MAC protocols and their benefits.
* Students will understand details about GSM network like architecture ,handover, protocols, IP packet delivery, tunneling and encapsulation .
* Students will understand basic concepts of Wireless LAN like IEEE 802.11, system architecture ,medium access control, MAC management schemes.
* Students will gain knowledge about 3G and 4G cellular systems their services classes and applications.

#### UNITI

IntroductiontoWirelessNetworks:EvolutionofWirelessNetworks,Applications,Challenges,Overviewofvarious Wireless Networks.

Wirelesstransmission:Frequenciesforradiotransmission,signals,antennas,Signalpropagation.

Multiplexing (Space Division Multiplexing, Frequency Division Multiplexing, Time DivisionMultiplexing, Code Division Multiplexing, Orthogonal Frequency Division Multiplexing),Modulation(Amplitudeshiftkeying,Frequencyshiftkeying,Phaseshiftkeying),spreadspectrum(DirectSequenceSpreadSpectrum,FrequencyHoppingSpreadSpectrum).

#### UNITII

Motivation for a specialized MAC: Hidden and exposed terminal, Near and far terminals.SDMA,FDMA,TDMA:FixedTDM,ClassicalAloha,SlottedAloha,Carriersensemultipleaccess,Demandassignedmultipleaccess,PRMApacketreservationmultipleaccess,ReservationTDMA,Multipleaccesswithcollisionavoidance,Polling,Inhibitsensemultipleaccess,CDMA: SpreadAloha multiple access

#### UNITIII

GSM: Mobile services, System architecture, Radio interface, Protocols, Localization andcalling,Handover, Security, Newdata services,

MobileIP:Goals,assumptionsandrequirements,Entitiesandterminology,IPpacketdelivery,Agentdiscovery,Registration,Tunnelingandencapsulation,Optimizations,Reversetunneling ,IPv6, IPmicro-mobility support

#### UNITIV

WirelessLAN:Infraredvsradiotransmission,Infrastructureandad-hocnetwork,

IEEE802.11:Systemarchitecture,Protocolarchitecture,Physicallayer(FHSS,DSSS),Mediumaccesscontrol layer (BasicDFWMAC-DCF usingCSMA/CA,DFWMAC-DCFwithRTS/CTSextension,DFWMAC-PCFwithpolling),MACframes,MACmanagement(Registration,Handoff,Power Management).

#### UNITV

ThirdGeneration(3G)CellularSystems:Introduction,3GSpectrumAllocation,ThirdGenerationService Classesand Applications,Third GenerationStandards.

FourthGeneration(4G):Introduction,DesignGoalsfor4GandBeyondandRelatedResearchIssues, 4GServices and Applications,Challenges.

TextBook:

1.MobileCommunications,byJochenSchiller,2ndEdition,AddisonWesley,2003

Reference:

1. WirelessNetworks,byP.Nicopolitidis,M.S.Obaidat,G.I.Papadimitriou,A.S.Pomportsis,John Wiley.
2. PrincipleofWirelessNetworks,byKavehPahlavanandPrashantKrishnamurthy.

## Probability and Stochastic Process(MIT-1.1.4)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objective:**

To familiar the students with the concepts which are much useful in research. To expose the students to the basics of probability theory and random processes essential for their subsequent study of different areas in computer science and allied topics.

**Course Outcomes:**

Students will be able to

* Know the basic principles of probability theory.
* Understand and think of random variables as an intrinsic need for the analysis of random phenomena.
* Characterize probability models and function of random variables based on single & multiples random variables.
* Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
* Understand the concept of random processes and determine covariance.
* Understand and use stochastic process and markov chain.
* Understand the use of queuing theory.

#### UNITI

Probability: Introduction to Probability, Sample Space and Events, The complement of anEvent,MutuallyExclusiveEvents,AdditionalRulesforProbability,IndependentandDependentEvents, Conditional Probabilities, ,Bayes Formula.

#### UNITII

Randomvariables-Whatisrandomvariable.Cumulativedistributionfunction,DiscreteRandom Variables: Definition of probability mass function, The Bernoulli Random Variable,The Binomial Random Variable, The Geometric Random Variable, The Poisson RandomVariable.

ContinuousRandomVariables:Definitionofprobabilitydensityfunction,TheUniformRandomVariables,ExponentialRandomVariables,GammaRandomVariables,NormalRandomVariables.

#### UNITIII

Expectation of Random Variables: The Discrete Case and the Continuous Case. ExpectationofaFunctionofaRandomVariables,JointlyDistributedRandomVariables:JointDistribution Function, Independent Random Variables. Covariance and Variance, MomentGeneratingFunctions.Markov’sand Chebyshey’sInequality,Central LimitTheorem.

#### UNITIV

Stochasticprocesses:Definitionwithexamples,Markovchains,ChapmanKolmogorovequations, Classification of states, Limiting Probabilities, some applications: The gambler’sRuinproblem.

TheExponentialDistribution:Definition,PropertiesoftheExponentialDistribution.

The Poisson Process: Counting Processes, Definition of Poisson Process, Inter-arrival andWaiting Time Distributions, Properties of Poisson Processes, Conditional Distribution of theArrivalTimes.

#### UNIT V

Continuous-time Markov Chains. Birth-and-death processes, Transition probability function,LimitingProbability.

QueuingTheory:Preliminaries,SteadyStateProbabilities,AsingleServerExponentialQueuingSystem(M/M/1),AsingleserverExponentialQueuingSystemHavingFiniteCapacity,Network of Queues.AQueuing System withBulkService.

TextBooks:

1. IntroductiontoProbabilityModelsbySheldonM.Ross,AcademicPressHarcourtIndiaPrivateLimited.
2. AnIntroductiontoProbabilityandStatisticsbyV.K.RohatgiandA.K.Md.EhasanesSaleh,Second edition, John Wileyand Sons.

## GREEN IT(MIT-1.1.5)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objectives:**

The course's main objective is: This course provides in-depth knowledge in the following points:

* The Importance of Green Information Technologies, The Governance and Regulatory Issues.
* Minimizing Power Usage, Cooling.
* Business Process Reengineering for Sustainability, Going Paperless, Recycling.
* Sustainable Hardware, Technology Company and University Case Studies.
* Data Centre Design and Redesign, Virtualization, Managing Your Green IT Transformation.

**Learning Outcomes**:

Upon completion of the course, student should possess the following skills:

* how you can save money by going green.
* governments and organizations around the world takes initiatives in place that will help reduce the impact of electronic waste.
* how you can lessen the amount of power consumption in Datacenters and IT departments.
* datacenters generate a lot of heat (largely from inefficient power supplies), we tend to crank up the air conditioning to cool things down, alternatives for cooling your datacenter.
* how you can transition your office into a paperless environment.
* how you can responsibly get rid of old computers and toner cartridges.
* There are steps you can take to ensure you use the best equipment and use the least amount of power.
* A huge trend in green computing is virtualizing your servers and storage. In other words, it is now possible to put multiple logical servers onto a handful of physical servers. This obviously saves money in hardware acquisition, as well as in the power used to run them.

#### UNITI

TheImportanceofGreenInformationTechnologies,TheGovernanceandRegulatoryIssues.

Velte:Chapter1,Chapter2.

Lamb:Chapter1,Chapter2(15-30),Chapter3,Chapter4.

#### UNITII

MinimizingPowerUsage,Cooling.

Velte:Chapter3,Chapter4(63-75)

Lamb:Chapter2(30-37),Chapter7(109-115),Chapter8.

#### UNITIII

Business Process Reengineering for Sustainability, Going Paperless, Recycling:Velte:Chapter 5, Chapter 6, Chapter7

Lamb:Chapter3

#### UNITIV

SustainableHardware,TechnologyCompanyandUniversityCaseStudies.

Velte:Chapter8,Chapter9,Chapter10

Lamb:Chapter10,Chapter11

#### UNITV

DataCentreDesignandRedesign,Virtualization,ManagingYourGreenITTransformation.

Velte:Chapter11,Chapter12,Chapter13

Lamb:Chapter6,Chapter7(115-121)

TextBooks:

1. GreenIT:ReduceYourInformationSystem’sEnvironmentalImpactWhileAddingtotheBottomLine. by T.Velte, A. Velteand R. Elsenpeter,McGrawHill.
2. TheGreeningofIT:HowCompaniesCanMakeDifferencefortheEnvironment.byJohnLamb– pearson.

# SECOND SEMESTER

## Artificial Intelligence(MIT-1.2.1)

### Fullmarks–100(Mid Semester:20;End Semester:80)

**Course Objective:**

* To provide a strong foundation of fundamental concepts in Artificial Intelligence
* To provide a basic exposition to the goals and methods of Artificial Intelligence
* To enable the student to apply these techniques in applications which involve perception,

reasoning and learning

**Course Outcome:**

On completion of the course students will be able to

* Understand the various searching techniques, constraint satisfaction problem and example

problems- game playing techniques.

* Apply these techniques in applications which involve perception, reasoning and learning.
* Explain the role of agents and how it is related to environment and the way of evaluating it

and how agents can act by establishing goals.

* Acquire the knowledge of real world Knowledge representation.
* Analyze and design a real world problem for implementation and understand the dynamic

behavior of a system.

* Use different machine learning techniques to design AI machine and enveloping applications

for real world problems.

#### UNITI

Introduction to AI, Application areas of AI, State-space search: production system design,productionsystemcharacteristics.

Searchtechniques

Blindsearch:depthfirstsearch,breadthfirstsearch

Heuristicsearchtechniques:Hillclimbing,bestfirstsearch.Branchandbound,A\*,AO\*

#### UNITII

Gameplaying:Min-Maxsearch,Alpha-Betacutoff

Knowledge Logic: Propositional logic, Predicate logic, Unification algorithm, ResolutionProlog:function, syntaxandpredicate, cut( bluecut, green cut,red cut)

#### UNITIII

Structured knowledge representation: semantic nets, frames, conceptual dependency, scripts.Expertsystem: expertsystem need&justification, rulebasesarchitecture.

Non-productionsystemarchitecture

#### UNITIV

Conceptoflearning,typesoflearning,geneticalgorithm,neuralnetworks.

Natural language processing: introduction syntactic processing, semantic analysis, discourseandpragmatic processing.

Knowledgeorganization&Management:Introduction,HAM

#### UNITV

LISP: syntax and numeric functions. Basic list manipulation function, functions, predicateand conditionals, input, output and local variables, iteration and recursion, property list andarray

TextBook:

1. Introduction to Artificial Intelligence and Expert Systems, by D. W. Paterson, PrenticeHall.
2. ArtificialIntelligence,E.Ritche,K.KnightandS.B.Nair,3rdEdition,McGrawHill,2009
3. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, PrenticeHall.

## Data Mining and Data Warehousing(MIT-1.2.2)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objectives:**

This course is intended to introduce the concepts of multidimensional schemas suitable for data warehousing, data warehouse architectures, data mining algorithms, functionalities to support critical thinking, business intelligence gathering, problem solving and to derive business rules for decision support system.

**Course Outcomes:**

* Design a data mart or data warehouse for any organization.
* Know about data mining tasks and issues.
* Extract knowledge using data mining techniques.
* Understand and implement classical models and algorithms for organization needs.
* Characterize the kinds of patterns that can be discovered by association rule mining, classification andclustering of large data sets.

#### UNITI

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification ofDataMiningsystems,DataMiningTaskPrimitives,IntegrationofaDataMiningSystemwithaDatabaseoraDataWarehouseSystem,MajorissuesinDataMining.DataPreprocessing:NeedforPreprocessingtheData,DataCleaning,DataIntegrationandTransformation,DataReduction,Discretization and Concept Hierarchy Generation.

#### UNIT-II

DataWarehouseandOLAPTechnologyforDataMining:DataWarehouse,MultidimensionalDataModel,DataWarehouseArchitecture,DataWarehouseImplementation, Further Development of Data Cube Technology, From Data Warehousing toData Mining Data Cube Computation and Data Generalization: Efficient Methods for DataCube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

#### UNIT-III

MiningFrequentPatterns,AssociationsandCorrelations:BasicConcepts,EfficientandScalable Frequent ItemsetMining Methods, Mining various kinds ofAssociation Rules,FromAssociationMiningtoCorrelationAnalysis,Constraint-BasedAssociationMining.

#### UNIT-IV

Classification and Prediction: Issues Regarding Classification and Prediction, ClassificationbyDecisionTreeInduction,BayesianClassification,Rule-BasedClassification,ClassificationbyBackpropagation,SupportVectorMachines,AssociativeClassification,LazyLearners,OtherClassificationMethods,Prediction,AccuracyandErrormeasures,Evaluatingthe accuracyof aClassifier or aPredictor, EnsembleMethods.

#### UNIT-V

Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of MajorClustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods,Grid- Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data,Constraint-BasedClusterAnalysis,OutlierAnalysis.

TextBook:-

1. DataMining–ConceptsandTechniques–J.HanandM.Kamber,MorganKaufmannPublishers,Elsevier,2ndEdition, 2006.
2. IntroductiontoDataMining–P.Tan,M.SteinbachandV.Kumar,PearsonEducation.

## Design and Analysis of Algorithms(MIT-1.2.3)

### Fullmarks–100(MidSemester:20;EndSemester:

**50(Theory)+30(Practical))**

**Course Objective:**

To know how to analyze the asymptotic performance of algorithms and demonstrate a familiarity with major algorithms and data structures. Top apply important algorithmic design paradigms and methods of analysis.

To synthesize efficient algorithms in common engineering design situations. To get idea regarding P, NP class.

**Course Outcome:**

* Argue the correctness of algorithms using inductive proofs and invariants.
* Analyze worst-case running times of algorithms using asymptotic analysis.
* Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
* Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
* Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
* Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.
* Analyze the future studies of algorithm by using N, NP class.

#### UNITI

Algorithm, Space and Time Complexity, Asymptotic notation, worst case, best case andaveragecase,Insertionsort,Substitutionmethod,Recursion-treemethod,mastermethod.

#### UNITII

Divide and conquer technique, Quick sort , Randomized quick sort, Priority Queue, HeapSort,Rabin-KarpStringMatching,Miller-RabinPrimalityTest,BinarySearch,FindingMinimumMaximum,Merge Sort.

#### UNITIII

Greedymethod,Activityselectionproblem,HuffmanCodes,FractionalKnapsack,Jobsequencewithdeadlines,MinimumCostSpanningTrees-Prim’sandKruskal’salgorithm.

#### UNITIV

Dynamicprogramming,Matrixchainmultiplication,LongestCommonSubsequence,Travelling Salesman Problem, Single Source Shortest Path: The Bellman Ford algorithm,Dijkstra’sAlgorithm,AllpairShortestpath:FloydWarshallalgorithm,Backtracking,EightqueensProblem, Subset Sum Problem.

#### UNITV

Complexity Class: P, NP, NP-Hard, NP Completeness and reducibility, P Space,NP Space,Clique, Vertex Cover, Hamiltonian Cycle, Approximation Algorithm: Vertex Cover problem,Approximationalgorithm fortravelling-salesman problem.

TextBooks:

1. FundamentalsofComputerAlgorithmsbyEllisHorowitz,SartajSahani,2ndEdition,UniversitiesPress.
2. IntroductiontoAlgorithmsbyThomasH.Cormen,3rdEdition,MITPress.

### Practical

Writinganefficientsortingalgorithm.(QuickSort,Mergesort,Heapsort),Designingefficient algorithm for inserting, deletingand searching in a binary tree, Minimum costspanningtree(PrimsandKruskal),Activityselectionproblem,LongestCommonSubsequence,Travellingsalesman problem.

## Wireless Sensor Networks(MIT-1.2.4)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**COURSE OBJECTIVE:-**

This course designed for MSC students, covers the challenges and the latest research results related to the design and management of wireless sensor networks (WSNs). WSNs have recently gained tremendous popularity due to the wide range of applications they can be used for such as disaster management, military, building and road monitoring, health care, etc. WSNs are infrastructures wireless networks that are significantly constrained in the amount of available resources such as energy, storage and computation. Such constraints make the design and operation of sensor networks considerably different from contemporary wireless networks, and necessitate the development of resource conscious protocols and management techniques.

**COURSE OUTCOME:-**

After completing this course the students should:

* Understand the basic concepts of wireless sensor network, applications , design challenges ,network deployment , connectivity ,coverage metrics concepts.
* Be able to know localization concept and various types of localizations along with approaches of data synchronization.
* Be able to know various wireless characteristics, link quality, medium access sleep scheduling & topology control for WSN.
* Be able to know various types of routing approaches , data centric storage retrieval developed for WSN.
* Understand security challenges, threats and attacks and various types of Operating systems used in WSN.

#### UNITI

Networkedwirelesssensordevices,Applications,Keydesignchallenges.

Networkdeployment:Structuredversusrandomizeddeployment,Networktopology,Connectivity,Connectivityusingpowercontrol,Coveragemetrics,Mobiledeployment.

#### UNITII

Localization:issues&approaches,Coarse-grained&Fine-grainednodelocalization,Network-widelocalization, Theoreticalanalysisoflocalization techniques.

**Synchronization:** Issues & Traditional approaches, Fine-grained clock synchronization, andCoarse-graineddata synchronization.

#### UNITIII

Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINRcapturemodel forinterference.

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MACprotocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-freeprotocols.

Sleep-basedtopologycontrol:Constructingtopologiesforconnectivity,constructingtopologiesfor coverage

#### UNITIV

Routing:Metric-basedapproaches,Routingwithdiversity,Multi-pathrouting,Lifetime-maximizingenergy-awareroutingtechniques,Geographicrouting,Routingtomobilesinks.

Data-centric networking: Data-centric routing, Data-gathering with compression, Querying,Data-centricstorageandretrieval,The databaseperspectiveon sensornetworks.

#### UNITV

Dependability issues: Security Challenges, Threat and attack models, Quality of Serviceprovisioning, Clock Synchronization, Supporting fault tolerant operations. Introduction toTinyOS, Nes C, Sensor Simulator.

TextBooks:

1. WirelessSensorNetworks:Technology,Protocols,andApplications:KazemSohraby,DanielMinoli, TaiebZnati , WileyInterScience.
2. WirelessSensorNetworks:ArchitecturesandProtocols:EdgarH.Callaway,Jr.AuerbachPublications,CRCPress.
3. WirelessSensorNetworks:EditedbyC.SRaghavendra,KrishnaM,Sivalingam,TaiebZnati, Springer.

### ADVANCE DATA STRUCTURE AND ALGORITHM(MIT-1.2.5)

**Fullmarks–100(MidSemester:20;EndSemester:80)**

**Course Objectives:**

This course is intended to focus on principles for good program design and analysis, to gain in depth knowledge about appropriate data structure and algorithm use to solve complex problems in various domains.

**Course Outcomes:**

**The student will be able to**

* Master a variety of advanced abstract data type (ADT) and data structures and their implementation.
* Have the knowledge about different algorithm design techniques (brute‐force, divide and conquer, greedy, etc.).
* Develop programs for implementing trees and their traversaloperations.

Apply mathematical foundations, algorithmic principles and computer science theory for modeling and design of computer-based systems.

#### UNITI

Heap Structure: Min-Max heap, Leftist heaps, Binomial heaps, Fibonacci heaps, Skew heaps,Lazybinomial heaps, Deap Data structure.

#### UNITII

Search and Multimedia Structure: Binary Search Tree, AVL Tree, 2-3 Tree, B-Tree, B+ Tree,Red-BlackTree, SegmentTree, k-dTree, PointQuad Trees,R-Tree, TV-Tree.

#### UNITIII

AsymptoticNotations,DynamicProgramming(LCS,Floyd-WarshallAlgorithm,MatrixChain Multiplication), Greedy Algorithm (Single Source Shortest Path, Knapsack problem,Minimum Cost Spanning Trees). Geometric Algorithm (Convex hulls, Segment Intersections,ClosestPair),InternetAlgorithm(Tries,Ukonnen’sAlgorithm,Textpatternmatching),NumericalAlgorithm(Integer,MatrixandPolynomialmultiplication,ExtendedEuclid’salgorithm)

#### UNITIV

Geometric Algorithm (Convex hulls, Segment Intersections, Closest Pair), Internet Algorithm(Tries, Ukonnen’s Algorithm, Text pattern matching), Numerical Algorithm (Integer, MatrixandPolynomial multiplication, ExtendedEuclid’s algorithm)

#### UNITV

PolynomialTime,Polynomial-TimeVerification,NPCompleteness&reducibility,NPCompletenessproofs, Cook’s theorem

TextBooks:

1. T.H.Cormen,C.E.Leiserson,andR.L.Rivest,“IntroductiontoAlgorithms”,PHI.
2. E.Horowitz,S.SahaniandDineshMehta,FundamentalsofDataStructuresinC++,2ndEd,University Press.
3. MarkAllenWeiss,“DataStructures&AlgorithmAnalysisinC/C++”,PearsonEdu.India.
4. AdamDrozdex,DataStructuresandalgorithmsinC++,Thomasonlearning.

# THIRD SEMESTER

## Software Evolution(MIT-2.3.1)

### Fullmarks–100(Mid Semester:20; End Semester:80)

**Course Objectives:**

To understand the design and implementation of an existing system and which parts need to be modified, to build software systems that are easier to maintain, and to design systems with reuse and evolution in mind from the very start.

**Learning outcomes:**

* To understand the laws of software engineering, evolution.
* To know the different maintenance models, reengineering techniques, legacy information systems, impact analysis, refactoring, program comprehension, and reuse.
* Explains two maintenance standards: IEEE/EIA 1219 and ISO/IEC14764 based on the IEEE SWEBOK (Software Engineering Body of Knowledge)
* To know the program comprehension, goal of code cognition and differentcongition models.
* Will be able to explain theories, models, tools and processes related to the maintenance and evolution of large software systems.
* Will be able to apply state-of-the-art techniques when maintaining and/or evolving large software systems.

#### UNITI

IntroductiontoEvolutionandMaintenance,ClassificationofSoftwareMaintenance:Intention-based, Activity-based, and Evidence-based. Categories of Maintenance Concepts:Product, Types, Organization Processes, Peopleware. Evolution of Software Systems: SPETaxonomy,LawsofS/WEvolution,EmpericalStudies,EvolutionofFOSSSystems,Maintenanceof COTS-based Systems.

Maintenance Models: Reuse-Oriented Model, Staged-Model for Closed SourceSoftware(CSS)andOpenSourceSoftware(OSS),andChangeMini-CycleModel,IEEE?EIAandISO/IECMaintenanceProcess,SoftwareConfigurationManagement.

#### UNITII

ReengineeringConcepts,AGeneralModelofSoftwareReengineering,ReengineeringProcess,CodeReverseEngineering,TechniquesusedforReverseEngineering,De-compilation Versus Reverse Engineering, Data Reverse Engineering, Reverse EngineeringTools.

Legacy Information Systems, Wrapping, Migration, Migration Planning, Migration Methods:Cold Turkey, Database First, Database Last, Composite Database, Chicken Little, Butterfly,Iterative.

#### UNITIII

ImpactAnalysis, ImpactAnalysis Process:Identifyingthe SIS,AnalysisofTraceabilityGraph,IdentifyingtheCandidateImpactSet,Dependency-BasedImpactAnalysis:CallGraph,ProgramDependencyGraph,RippleEffect,ComputingRippleEffect,ChangePropagation Model: Recall and Precision of Change Propagation Heuristics, Heuristics forChangePropagation, Empirical Studies.

#### UNITIV

Re-factoring, Activities in a Re-factoring Process, Formalisms for Re-factoring: Assertions,GraphTransformation, SoftwareMetrics, Examples ofRe-factorings,

InitialWorkonSoftwareRestructuring,FactorsInfluencingSoftwareStructure,Classificationof RestructuringApproaches, Restructuring Techniques.

Reuse: Benefits of Reuse, Reuse Models, Factors Influencing Reuse, Success Factors ofReuse. Reuse Capability, Economic Models of Software Reuse: Cost Model of Gaffney andDurek,CostModel ofGaffney andCruickshank,BusinessModelof Poulinand Caruso.

DomainEngineering,ApplicationEngineering,DomainEngineeringApproaches.

#### UnitV

ProgramComprehension,GoalofCodeCognition,Knowledge,MentalModel,UnderstandingCode,CognitionModelsforProgramUnderstanding:LetovskyModel,

ShneidermanandMayerModel,BrooksModel,Soloway,Adelson,andEhrlichModel,PenningtonModel,IntegratedMeta-model,ProtocolAnalysis,VisualizationforComprehension.

TextBook:

1..SoftwareEvolutionandMaintenance:APractitioner’sApproach,Priyadarshi(Piyu)Tripathy,and Kshirasagar (Sagar) Naik,Wiley,Hoboken, NJ, 2015.

ReferenceBook:

1.SoftwareMaintenanceConceptsandPractice,GrubbP.andTakangA,2e,WorldScientific,2003.

## Cryptography and Network Security(MIT-2.3.2)

### Fullmarks–100(Mid Semester:20;End Semester:80)

**Course Objectives:-**

* To understand basics of Cryptography and Network Security.
* To be able to secure a message over insecure channel by various means.
* To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

**Course Outcomes:-**

* Learn about how to maintain the Confidentiality, Integrity and Availability of a data.
* Analyze and design classical encryption techniques and block ciphers.
* Understand and analyze public-key cryptography, RSA and other public-key cryptosystems.
* Design message authentication and analyze and design hash and MAC algorithms.
* Understand security protocols for protecting data on networks and analyze and design digital signature.

#### UNITI

SecurityAttacks(Interruption,Interception,ModificationandFabrication),SecurityServices(Confidentiality,Authentication,Integrity, Non-repudiation, Access Controlandavailability)andmechanisms,OSISecurityArchitecture,Cryptography,Cryptanalysis,SymmetricCipherModel,SubstitutionTechnique:MonoalphabeticCiphers,PolyalphabeticCiphers(Playfair,Vigenere,Hill),TranspositionTechnique.

#### UNITII

Data Encryption Standard (DES), Block Cipher Principles, Stream Cipher, Block Cipher,StrengthandWeaknessofDES,AdvancedEncryptionStandard(AES).

#### UNITIII

ModularArithmetic,Euclid’sAlgorithm,FiniteFieldsoftheformGF(P),PrincipleofPublicKeyCryptosystems,ApplicationsforPublicKeyCryptosystems,TheRSAAlgorithm,DiffieHellmanKeyExchange.

#### UNITIV

AuthenticationRequirement,AuthenticationFunctions:MessageEncryption,MessageAuthenticationCode,HashFunction,MessageDigestAlgorithm:MD5.

#### UNITV

DigitalSignatures:DirectDigital Signature, Arbitrated DigitalSignature, AuthenticationProtocol:MutualAuthentication,SymmetricEncryptionApproach,PublicKeyEncryptionApproach,DigitalSignatureStandard,Kerberos(Version4).

TextBooks:

1. CryptographyandNetworkSecurityPrinciplesandPracticesbyWilliamStallings.
2. CryptographyandNetworkSecuritybyBehrouzA.Forouzan.

## IT Infrastructure Design(MIT-2.3.3)

COURSE OBJECTIVE:-

The objective of Network Analysis, Architecture, and Design defines a disciplined approach to network architecture and design. It addresses the critical elements required to successfully design and deploy networks in an increasingly complex environment. It helps to understand and define your network architecture and design. It examines the entire system, from users and their applications, to the devices and networks that support them. It is about making intelligent, informed network engineering decisions. This includes processes to develop and validate requirements for your project, and applying them in making architecture and design decisions. These processes have been adopted by corporations, universities, and government agencies around the world.

COURSE OUTCOME:-

After completing this course the students should:

* Understand the basic concepts of network analysis, architecture and design processes, models of network analysis, various performance characteristics ,architectural models.
* Be able to know Enterprise LAN design rules, working LAN devices, campus LAN design best practices.
* Be able to know various routing protocols and loop prevention techniques.
* Be able to know server centric IT architecture and storage centric IT architecture , intelligent disk subsystems.
* Understand enterprise WLAN architecture components, performance, troubleshooting.

#### UNITI

Overview of Analysis, Architecture, and Design Processes: Process Components , Tacticaland Strategic Significance, Hierarchy and Diversity, Importance of Network Analysis, ModelforNetworkAnalysis,Architecture,and Design

A Systems Methodology, System Description, Service Description, Service Characteristics:ServiceLevels,SystemComponentsandNetworkServices,ServiceRequestsandRequirements,ServiceOfferings, Service Metrics.

PerformanceCharacteristics:Capacity,Delay,RMA,PerformanceEnvelopes,NetworkSupportability

NetworkArchitecture:ComponentArchitecture–Routing,NetworkManagement,Performance,Security.

Architecturalmodels:topological,flowmodel,Functionalmodel.

#### UNITII

EnterpriseLANDesign:EthernetDesignRule.100MbpsFastEthernetDesignrules,gigabitEthernetDesign Rules,10 Gigabit EthernetDesign rules, 10GEMedia types

UnderstandingWorkingofRepeater,hub,Bridge,routers,Layer2/3Switch,

CampusLANDesignBestPractice,ServerFarmDesign,CampusLANQoSconsideration,MulticastTraffic Consideration

#### UNITIII

Routing Protocol Characteristics, Static Versus Dynamic Route Assignment,Interior VersusExterior Routing Protocols, Distance-Vector Routing Protocols, EIGRP, Link-State RoutingProtocols,Distance-VectorRoutingProtocolsVersusLink-StateProtocols,HierarchicalVersus Flat Routing Protocols, Classless Versus Classful Routing Protocols, AdministrativeDistance. Routing Protocol Metrics and Loop Prevention: Hop Count , Bandwidth, Cost,Load,Delay, Reliability,MaximumTransmissionUnit ,

Routing Loop-Prevention Schemes: Split Horizon, Poison Reverse, Counting to Infinity ,TriggeredUpdates

RIPv2:Authentication,MD5Authentication,RIPv2RoutingDatabase,RIPv2MessageFormat,RIPv2 Timers,RIPv2 Design, RIPv2

RIPng:RIPngTimers,Authentication,RIPngMessageFormat,RIPngDesign

OSPF: Metric, Adjacencies and Hello Timers, OSPF Areas,OSPF Router Types, OSPF DRs,LSATypes

EIGRP:Components,NeighborDiscoveryandRecovery,Timers,PacketTypes,Design

#### UNITIV

Server-CentricITarchitectureanditsLimitations,Storage-centricITArchitectureanditsAdvantages.

Intelligent Disk Subsystems: Architecture, Storage Virtualization using RAID, RAID levels,I/OTechniques:SCSI,FibreChannelProtocolstack,FibreChannelSAN,IPStorage.

#### UNITV

EnterpriseWirelessLANArchitecture:ComponentsofCentralizeArchitecture:understanding 802.11X standards. WLAN technologies (Narrow Band, Spread Spectrum,FHSS, DSS)and topologies,

Wireless Network Components: Access Point and NICs, Router etc; WLAN enterprisedesign, WLAN performance, WLAN monitoring and troubleshooting, WLAN security. Intraandinter controllerroaming.

TextBooks:

1. NetworkAnalysis,Architecture,andDesign,JamesD.McCabe,3rdEdition,MorganKaufman
2. CCDACiscoofficialGuide
3. StorageNetworksexplainedbyUlfTroppen,Wiley.
4. Storage Network Management and Retrieval by Dr. VaishaliKhairnar, NilimaDongre, Wiley,India

## Internet of Things(MIT-2.3.4)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objectives**

Students will be explored to:

* The interconnection and integration of the physical world and the internet world.
* The designing and developing IoT Systems and IoT Devices with their various interfaces.
* The protocols that govern an IoT System and the language that helps in program an IoT System.
* The handling of Big Data and the use of cloud storage.
* The security issues involved in an IoT Network.

**Course Outcomes**

After completion of the course, students will be able to:

* Understand the application areas of IoT and building blocks of IoT.
* Develop Python Programs for running an IoT System.
* Realize the revolution of Internet in Mobile Devices, Cloud and Sensor Networks.
* Design small IoT Networks for Home Automation, Communication through e-mails, etc.

#### UNIT-I

INTRODUCTION&CONCEPTS:IntroductiontoInternetofThings,DefinitionsandCharacteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Designof IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoTEnabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data Analytics,Communication Protocols, Enbeedded Systems, IoT levels and Development Templates, IoTLevel-1,IoTLevel-2,IoTLevel-3, IoTLevel-4,IoTLevel-5,IoTLevel-6.

Textbook1:1.1–1.5

#### UNIT-II

IoT and M2M, Introduction, M2M, Difference between IoT and M2M, SDN and NFV forIoT, Software Defined Networking, Network Function Virtualization, IoT Platform DesignMethodology,Introduction,IoTDesignMethodology,Step1:Purposeandrequirementspecification, Step2: Process Specification, Step 3: Domain Model Specification, Step 4:InformationModelSpecification,Step5:ServiceSpecification,Step6:IoTLevelSpecification, Step 7: Function View Specification, Step 8: Operational View Specification,Step 9: Device and Component Integration, Step 10: Application Development, IoT SystemLogocal Design Using Python, Introduction, Installing Python, Python Data Types and DataStructures,ControlFlow,Functions,Modules,Packages,FileHandling,DateTimeapplications,Classes, PythonPackages ofInterestforIoT.

Textbooks1:3.1-3.4,5.1-5.4,6.1-6.11

#### UNIT-III

IoT Physical Devices and End Points: What is and IoT Device, Exemplary Device RaspberryPi, About the Board, Linux on Raspberry Pi, Raspberry pi interfaces, programming raspberrypi with python, other IoT devices. IoT physical servers and cloud offerings: introduction tocloudstoragemodelsandcommunicationNetworks,wamp-autobahnforIoT,xivelycloudfor IoT, python web application frame work-django, designing a RESTful web API, amazonwebservices forIoT, SkyNetIoTmessaging platforms.

Textbook1:7.1-7.7,8.1-8.7

#### UNIT-IV

Data Analytics for IoT; Introduction AppacheHadoop, using HadoopMapReduce for BatchData Analysis, Apache oozie, Apache Spark, Apache Storm, using Apache Storm for Real-timeDataAnalysis.

Textbook1:10.1-10.8

#### UNIT-V

Ethics: Characterizing the IoT, Privacy, Control, Distributing Control and Crowd Sourcing,Environment, Physical Thing, Electronics, Internet Service, Solutions, Internet of Things asPartof Solution, CautiousOptimizing,The Open IoTdefinition.

Textbook2:Chapter11

TextBooks:

1. InternetOfThings-AHandsonApproach,byArshdeepBahgaandVijayMadisetti,

UniversityofPenn,<http://www.internet-of-things-book.com/>

1. Designing the Internetof Things, by Adrian McEwen and Hakim Cassimally**,** WileyPublication.

ReferenceBooks:

1.InternetofThings:ConvergingTechnologiesforSmartEnvironmentsandIntegratedEcosystems.ByOvidiuVermesanandPeterFriess,RiverPublishersSeriesinCommunication.

## ADVANCE OPERATING SYSTEM(MIT-2.3.5)

### Fullmarks–100(Mid Semester:20;End Semester:80)

**Advance Operating System (MIT-2.3.5)**

**Course Objectives:**

To understand the principles in the design of modern operating systems, distributed and multiprocessor operating systems.To give an understanding of practical engineering issues in real-time and concurrent systems; and suggest appropriate implementation techniques

**Learning Outcomes:**

* To get a comprehensive knowledge of the architecture of distributed systems and issues in distributed system.
* To give an understanding of practical engineering issues in real-time and concurrent systems; and suggest appropriate implementation techniques
* Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system To understand the deadlock and shared memory issues and their solutions in distributed environments. To know the termination detection and mutual exclusion algorithms.
* Discuss the various resource management techniques for distributed systems. To get knowledge of distributed file system, scheduling and fault tolerance and multiprocessor operating system.
* Identify the different features of real time operating system.

#### UNITI

System Architecture Types, Distributed Operating Systems, Issues in Distributed OperatingSystems, Lamport’s Logical Clocks, Vector Clocks, Causal Ordering of Messages, GlobalState,Chandy-Lamport'sGlobalState RecordingAlgorithm,

#### UNITII

Cuts of a Distributed Computation, Termination Detection, Mutual Exclusion Algorithms,PerformanceMeasures,Non-Token-BasedAlgorithms,Ricart-AgrawalaAlgorithm,Maekawa Algorithm, Token-Based Algorithms, Suzuki-Kasami Algorithm, Raymond TreebasedAlgorithm, Comparative Performance Analysis.

#### UNITIII

DeadlockHandlingStrategies,CentralizedDeadlock-DetectionAlgorithms,DistributedDeadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms, AgreementProtocols.

#### UNITIV

DistributedFileSystems,DistributedSharedMemory,DistributedScheduling,FaultTolerance,Multiprocessor Operating Systems.

#### UNITV

Introduction to Real Time Operating Systems (RTOS), RTOS Taxonomy and Architecture,Paradigms.

TextBooks:

1. M.SinghalandN.G.Sivaratri,“AdvancedconceptsinOperatingSystems”,TataMcGrawHill.
2. Coulouris,"DistributedSystems:ConceptsandDesign",PearsonEducation.
3. P.K.Sinha“DistributedOperatingSystemsConceptsandDesign”PHI.
4. JohnA.StankovicandR.Rajkumar,“Real-timeOperatingSystems,”*Real-TimeSystems*,Vol.28, Page:237-253, 2004.Kluwer Academic Publisher.(UNITV)

# FOURTH SEMESTER

## Cloud Computing(MIT-2.4.1A)

### Fullmarks–100(Mid Semester:20;End Semester:80)

COURSE OBJECTIVE:-

This course gives students an insight into the basics of cloud computing along with cloud services ,evolution of cloud, virtualization techniques. Cloud computing is one of the fastest growing domain from a while now. It will provide the students about major players in cloud collaborating in cloud along with it various security challenges in cloud.

COURSE OUTCOME:-

After learning this paper ,students should be able to know :-

* Concept of cloud , types of cloud, services of cloud, various challenges, business models around cloud, major players in cloud computing.
* Students will understand in details various types of services offered in cloud also various service providers in cloud, introduction of map reduce technique and hadoop framework.
* Students will know various collaboration techniques in cloud and storing, sharing files in cloud.
* Need for virtualization , advantages and disadvantages of virtualization ,types of virtualizations, various types of hypervisors.
* Students acquaint themselves with various cloud security challenges, standards of cloud, end user access to clouds.

#### UNITI

Cloud computing definition,Private, public and hybrid cloud, Types of cloud services: IaaS,PaaS, SaaS, Benefits and challenges of cloud computing, Evolution of cloud computing,Usage scenarios and applications, Business models around cloud, Major players in cloudcomputing,Issues incloud, Eucalyptus, Nimbus,Open Nebula, CloudSim.

#### UNITII

Software as a Service, Platform as a Service, Infrastructure as a Service, Database as aService, Monitoring as a Service, Communication as a Service, Service providers: GoogleApp Engine, Amazon EC2, Microsoft Azure, Sales force, Introduction to MapReduce, GFS,HDFS, Hadoop Framework.

#### UNITIII

CollaboratingonCalendars,SchedulesandTaskManagement,CollaboratingEventManagement,ContactManagement,ProjectManagement,CollaboratingonWordProcessing,Database:StoringandSharingFiles,CollaboratingviaWeb-basedcommunicationtools,EvaluatingWebmailService,CollaboratingviaSocialNetworks,Collaboratingvia Blogsand Wikis.

#### UNITIV

Need for Virtualization, Pro and Cons of Virtualization, Types of Virtualization, System VM,Process VM, Virtual Machine Monitor, Virtual Machine Properties, Interpretation and binaryTranslation,HLLVM, Hypervisors,Xen,KVM,VMWare,VirtualBox,Hyper–V.

#### UNITV

Cloud security challenges, Software as a Service Security, Common Standards, The OpenCloudConsortium,TheDistributedManagementTaskForce,Standardsforapplicationdevelopers,StandardsforMessaging,StandardsforSecurity,Enduseraccesstocloudcomputing,MobileInternet device and the cloud.

TextBooks:

1. CloudComputingforDummies,byJ.Hurwitz,R.Bloor,M.Kanfman,andF.Haiper,WileyIndiaEdition, 2010 (Unit I).
2. CloudComputingImplementationManagementandSecuritybyJ.RittinghouseandJ.Ransome,CRCPress, 2010 (Unit II).
3. CloudComputing:APracticalApproachbyA.Velte,T.VelteandR.Elsenpeter,TataMcGrawHill, 2009 (Unit II).
4. CloudComputing:Web-basedApplicationsThatChangetheWayYouworkandCollaborateOnline byM.. Miller, QuePublishing, August2008 (Unit III).
5. VirtualMachinesbyJ.E.SmithandR.Nair,MorganKaufmannPublishers,2006(UnitIV).
6. <http://cloud-standards.org/wiki/index.php?title=Main_Page>(Unit–V).

ReferenceBooks:

1. ArchitectingtheCloud:DesignDecisionsforCloudComputingServiceModels(SaaS,PaaS,and IaaS), by M.Kavis, Wiley, 2014.
2. Mastering InCloudComputingbyR.Buyya,C.VecchiolaandT.Selvi,TataMcgraw-HillEducation,2013.
3. CloudComputing:SaaS,PaaS,IaaS,Virtualization,BusinessModels,Mobile,Securityandmore byK. Jamsa,Jones & Bartlett LearningCompany LLC, 2013.

## Bioinformatics(MIT-2.4.1B)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objectives:-**

* To provide an integrative approach to the understanding of both theory and practice of bioinformatics.
* To apply biological concepts at different levels to study gene / protein analysis, and the proteins implicated in diseases.
* The course is aimed at introducing the students to the field of Bioinformatics and enable them understand the concepts of statistics in biology.

**Course Outcomes:-**

* Learn application and scope of bioinformatics in various field of biology.
* Understand how bioinformatics methods can be used to relate genome sequence, structure and function.
* Know the various tools and methodologies used in multiple sequence alignment, phylogenetic analysis and genetic diversity analysis observed in biological sequences.
* Explain the concepts of secondary and tertiary structure prediction of proteins.
* Classify different types of biological databases.

#### UNITI

Whatisbioinformatics:anintroductionandoverview,applicationofbioinformaticsinvariousfieldsofbiology,scopeofbioinformatics,overviewofavailablebioinformaticsresourcesonweb: NCBI,EBI,EXPASY.

#### UNITII

Genome sequence, ORFs, genes, DNA, structure properties and classification of amino acids,primary, secondary and quaternary structure of proteins, globular protein, protein folding,Proteintertiary Structure.

#### UNITIII

Basicconceptsofsequencealignment:pairwiseandmultiplesequencealignment,significance of these methods in sequence analysis. Introduction to different online tools forsequencealignment, andinterpretation of results.

Phylogeny:Phylogeneticanalysis,Definitionanddescriptionofphylogenetictreesandvarious types of trees, Method of construction of Phylogenetic trees [distance based method(UPGMA, NJ), MaximumParsimony andMaximum Likelihood method]

#### UNITIV

CurrentAdvancementsinBioinformatics:IntroductiontoSystemBiology,Structuralbioinformatics, Prediction of secondary structure- PHD and PSI-PRED methods. TertiaryStructure:homologymodeling,foldrecognitionandab-initioapproaches.Structuresofoligomericproteinsandstudyofinteractioninterfaces,Chemoinformatics,Immunoinformatics.

#### UNITV

Overview ofbiological database, globalbiologicaldatabase search, overview of variousdatabasesasfollows:

Literature/Bibliographicaldatabase:PubMed,Nucleicacidsequencedatabase:GenBank,EMBL, Protein sequence database: UniProt, PIR, TrEMBL, Protein family and domaindatabase:Pfam,SMART,InterProscan,Prosite,BLOCKS,Superfamily,Gene3D,ProDom,PRINTS, Metabolic Pathway databae:KEGG, MetaCyc, BioCyc, Protein structuredatabase: PDB, CATH, SCOP, DALI, Enzyme, compound and reaction database: PubChem,LIGAND, BRENDA, ENZYME, Protein-protein interaction database: STRING, DIP, MINT,BIND

TextBooks:

1. IntroductiontoBioinformaticsbyAurtherMlesk.
2. DevelopingBioinformaticsComputerSkills,byCynthiaGibasandPerJambeck.
3. StructuralBioinformatics,byJ.GuandP.Bourne(Edited),Wiley-Blackwell,2009.

## Digital Image Processing(MIT-2.4.2A)

### Fullmarks–100(MidSemester:20;EndSemester:80)

Course Objectives:-

* To introduce the concepts of image processing and basic analytical methods to be used in image processing.
* To familiarize students with image enhancement and restoration techniques.
* To introduce segmentation and morphological processing techniques.
* To explain different image compression techniques.

Course Outcomes:-

After successful completion of the course, the learners would be able to

* Understand the need for image transforms different types of image transforms and their properties.
* Learn the spatial and frequency domain techniques of image compression.
* Learn different causes for image degradation and overview of image restoration techniques.
* Understand the different image segmentation and morphological image processing.
* Understand the need for image compression models.

#### UNITI

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Samplingand Quantization, Relationship between Pixels. Image Transforms:2-D FFT, Properties,Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, SlantTransform,KLTransform.

#### UNITII

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain,Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation,Linear and Non — Linear Gray Level Transformation, Local or Neighborhood Operation,MedianFilter,SpatialDomainHigh-PassFiltering.ImageEnhancement(FrequencyDomain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from SpatialFilters,GeneratingFiltersDirectlyintheFrequencyDomain,LowPass(Smoothing)andHighPass (Sharpening)Filters in Frequency Domain.

#### UNITIII

ImageRestoration: ImageDegradation,TypesofImageBlur,AlgebraicApproachtoRestoration,InverseFiltering,LeastMeanSquareFilters,ConstrainedLeastSquaresRestoration, Interactive Restoration. Image Denoising: Classification Noise in Image, MedianFiltering,TrimmedAvarage Filter,Performancemetricsin ImageRestoration.

#### UNITIV

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection,Thresholding, Region Oriented Segmentation. Morphological Image Processing: Dilation andErosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation andErosion,Opening and Closing, TheHitor MissTransformation.

#### UNITV

ImageCompression: RedundanciesandtheirRemovalMethods,FidelityCriteria,ImageCompressionModels,HuffmanandArithmeticCoding,ErrorFreeCompression,LossyCompression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG2000Standards.

TextBooks:

1. DigitalImageProcessing,byRafaelC.GonzalezandRichardE.Woods,3rdEdition,Pearson,2008
2. DigitalImageProcessing,byS.Jayaraman,S.EsakkirajanandTVeerakumar,TMH,2010.

ReferenceBooks:

1. DigitalImageProcessingandAnalysis-HumanandComputerVisionApplicationwithusingCVIPTools, by ScotteUmbaugh, 2nd Edition, CRCPress, 2011
2. DigitalImageProcessingusingMATLAB,byRafaelC.Gonzalez,RichardEWoodsandStevenL. Eddings, 2ndEdition, TMH, 2010.
3. FundamentalsofDigitalImageProcessing,byA.K.Jain,PHI,1989

## EMBEDDED SYSTEMS(MIT-2.4.2 B)

### Fullmarks–100(MidSemester:20;EndSemester:80)

**Course Objective:**

This course is intended to provide the knowledge about the basic functions, structure, concepts of embedded systems. The course emphasizes on comprehensive treatment of embedded solutions using real time operating systems in tune with the requirements of Industry.

**Course Outcomes:**

* Basics of Embedded System. Details of 8051 architecture.
* Design and testing microcontroller.
* Serial Communication with pc using RS232 and with other microcontroller using I2C,SPI and USB.
* Architecture and Limitation of various Processors and microcontroller.
* Working with Development tools like ATMEL Assembler and Simulator.
* Basics of PLC , I/O Modules and Programming using PLC.
* Designing and Debugging real time embedded systems using the concepts of RTOS.

#### UNITI

Introduction to embedded systems, classifications, processor in the system, microcontroller,introduction:8051architecture,featuresof8051,basicassemblylanguageprogrammingconcepts,instructionset,datatransfer,logicaloperations,arithmeticoperations,jump/callinstructions, interrupt handler, addressing modes, an 8051 microcontroller design & testing**UNITII**

InterfacingofKeyboard,displays,ADC/DAC,steppermotor,dcmotor;serialcommunicationwithPCusingRS232,SerialPeripheralInterface(SPI),Inter-IntegratedCircuit(I2C),serialcommunicationwithothermicrocontrollers/devicesusingI2C,SPI,RS232and USB

#### UNITIII

Introduction to 16-bit micro-controllers, ATMEGA, PIC and ARM processors: Generalarchitectureandtheirlimitations,clocking unit, RealTime Clockand Timers,Reset CircuitryandWatchdogTimer;developmenttools:ATMELassemblerandsimulator,ATMELAVRstudio;robotic control applications

#### UNITIV

Basic functions of PLC, advantages over microcontroller, basic architecture, register basics,timer functions, counter function, ladder diagram, overview of PLC systems, I/O modules,power supplies,isolators, programming PLC, Alarm signal generation for a process (e.g.heating,coolingorthreshold ofaprocess etc.),directdigitalcontrol (DDC)algorithm

#### UnitV

Operatingsystemservices,I/Osubsystem,Networkoperatingsystem,RealTimeandembedded system, Need of well tested and debugged Real time operating system (RTOS),Introductionto C/ OS- II.

TextBooks:

1. EmbeddedSystems:Architecture,programmingandDesign,byRajKamal,TMHNewDelhi.
2. 8051Microcontroller,byMazidiandMazidi,PenramPublishers,NewDelhi.
3. Microcontrollers:TheoryandApplications,byAjayV.Deshmukh,TataMcGraw-HillPublishingCompany Limited, NewDelhi, 2005.
4. Embedded Real time system Programming, by Sriram V. Iyer and Pankaj Gupta, TMH.ReferenceBooks:
5. PICControllers,byMikePredko,MGH.
6. EmbeddedSystemDesign,byF.Vahid&T.Gargivis,JohnWileyandSons.
7. Embedded System Design: An Introduction to Process Tools and Techniques, A. S.Berger,CMPBooks.

## SOFTWARE PROJECT MANAGEMENT(MIT-2.4.3)

### Fullmarks–100(Mid Semester:20; End Semester:80)

**Course Objectives:**

This course is aimed at introducing the primary important concepts of project management related to managing software development projects. They will also get familiar with the different activities involved in Software Project Management. Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

**Course Outcomes:**

         Identify the different project contexts and suggest an appropriate management strategy.

         Practice the role of professional ethics in successful software development.

         Identify and describe the key phases of project management.

         Determine an appropriate project management approach through an evaluation of the business context and scope of the project.

#### UNITI

IntroductiontoProjectManagement,ProjectPlanning,ProjectScopeManagement,ProjectScheduling.

#### UNITII

ProjectCostEstimate,ProjectCostEstimationModels.

#### UNITIII

ProjectQualityManagement,QualityManagementTools,ProjectResourceManagement,CaseStudy and IssuesInvolved.

#### UNITIV

PlanningandReporting,ProjectCommunication,RiskManagementandCaseStudy.

#### UNITV

ProcurementProcedures,ContractAdministration,ProjectManagementProcessGroups.

#### TextBooks:

1. Information Technology Project Management: Kathy Schwalbe, International StudentEdition,Thomson Course Technology, 2003.
2. Software Project Management: Bob Hughes and Mike Cotterell, Third Edition, TataMcGraw-Hill.
3. BasicsofSoftwareProjectManagement:NIIT,Prentice-HallofIndia,2004.
4. SoftwareProjectManagementinPractice:PankajJalote,PearsonEducation,2002.
5. Software Project Management – A Concise Study: S.A.Kelkar, Revised Edition, Prentice-Hallof India, 2003.

## Project(MITM-2.4.4)

### Fullmarks–300