FACULTYOFENGINEERING

SchemeofInstruction&Examination

And

Syllabi

B.E.VandVISemester

Of

ThirdYearDegreeProgramme
In
InformationTechnology

(Witheffectfromtheacademicyear2022-2023)
Asapprovedinthefacultymeetingheldon

BATCH2020-2024

Issued by
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OsmaniaUniversity,Hyderabad
19.05.2022

BATCH 2020-2024

PROFESSIONALELECTIVESTHREAD

THREAD NAME	CODE	PE-1	CODE	PE-2	CODE	PE-3	CODE	PE-4	CODE	PE-5
SoftwareEngineering	PE511IT	ObjectOrientedAnalysisandDesign	PE621IT	SoftwareTestingandQualityAssurance	PE731IT	SoftwareReuseTechniques	PE741IT	SoftwareProjectManagement	PE851IT	AgileSoftwareDevelopment
Networksandsecurity	PE512IT	MobileComputing	PE622IT	AdhocSensorNetworks	PE732IT	CyberSecurity	PE742IT	DigitalForensics	PE852IT	InformationSecurity
CloudEngineering	PE513IT	DistributedSystems	PE623IT	CloudComputing	PE733IT	ScalableArchitecturesorLargeApplications	PE743IT	BlockchainTechnologies	PE853IT	DevOpsandKubernetes
DataEngineering	PE514IT	DataMining	PE624IT	DataScience	PE734IT	NaturalLanguageProcessing	PE744IT	DeepLearning	PE854IT	ComputationalIntelligence
Miscellaneous	PE515IT	ComputerGraphics	PE625IT	InformationStorageandManagement	PE735IT	RealTimeSystems	PE745IT	Augmentedandvirtual Reality	PE855IT	QuantumComputing

BATCH 2020-2024

SCHEMEOFINSTRUCTION&EXAMINATION
B.E(INFORMATIONTECHNOLOGY)

VSemester(2022-23)

S. No.	Course Code	CourseTitle	SchemeofInstruction PeriodsPerweek			ContactHrs/Week	SchemeofExamination Maximum Marks		DurationinHrs	Credits
			L	T	D/P		CIE	SEE		
TheoryCourse										
1.	PC501IT	AutomataTheory	3	1	-	4	30	70	3	3
2.	PC502IT	OperatingSystems	3	1	-	4	30	70	3	3
3.	PC503IT	ArtificialIntelligence	3	1	-	4	30	70	3	3
4.	PC504IT	ComputerNetworks	3	1	-	4	30	70	3	3
5.	PC505IT	SoftwareEngineering	3	-	-	3	30	70	3	3
6.	PE-1	ProfessionalElective–I	3	-	-	3	30	70	3	3
Practical/LaboratoryCourses										
7.	PC551IT	ComputerNetworksandOperatingSystemLab	-	-	3	3	25	50	3	1.5
8.	PC552IT	ArtificialIntelligence Lab	-	-	2	2	25	50	3	1
9.	PC553IT	WebApplicationDevelopmentLab	-	-	2	2	25	50	3	1
Total			18	04	07	32	255	570	-	21.5

PC:ProfessionalCorePE:ProfessionalElective,HS:HumanitiesandsocialScienceMC:MandatoryCourse
L:LectureT:TutorialP:PracticalD:Drawing
CIE:ContinuousInternalEvaluation,SEE:SemesterEndExamination(Univ.Exam)

Note:1.EachcontacthourisaClockHour
2.Thepracticalclasscanbeoftwoandhalfhour(clockhours)durationaspertherequirementofaparticularlaboratory.

BATCH 2020-2024

SCHEMEOFINSTRUCTION&EXAMINATION
B.E(INFORMATIONTECHNOLOGY)
(witheffectfromtheacademicyear2022-23)

VISemester(2022-23)

S.No	Course Code	CourseTitle	SchemeofInstruction				SchemeofExamination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Durationi nHrs	
TheoryCourse										
1.	PC601IT	EmbeddedSystems	3	1	-	4	30	70	3	3
2.	PC602IT	DesignandAnalysisof Algorithms	3	1	-	4	30	70	3	3
3.	PC603IT	MachineLearning	3	1	-	4	30	70	3	3
4.	PC604IT	NetworkSecurityandcry ptography	3	-	-	3	30	70	3	3
5	OE-1	OpenElective-1	3	-	-	3	30	70	3	3
6.	PE-II	ProfessionalElective-II	3	-	-	3	30	70	3	3
Practical/LaboratoryCourse										
7.	PC651IT	EmbeddedSystemsLab	-	-	2	2	25	50	3	1
8.	PC652IT	MachineLearningLab	-	-	2	2	25	50	3	1
9.	PC653IT	MobileApplicationDeve lopmentLab	-	-	2	2	25	50	3	1
8.	PW654IT	MiniProject-I	-	-	2	2	25	50	3	1
Total			18	03	8	29	280	620	-	22

PC:ProfessionalCorePE:ProfessionalElective,HS:HumanitiesandsocialScienceMC:Mandatory
CourseL:LectureT:TutorialP:PracticalD:Drawing
CIE:ContinuousInternalEvaluation,SEE:SemesterEndExamination(Univ.Exam)

Note:1.EachcontacthourisaClockHour
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Note-2:* and **SubjectisnotofferedtotheCSE and IT Department students.

Open Elective-I

BATCH 2020-2024

Course Code	Course Title
OE601 IT	Database Systems**
OE602 IT	Data Structures**
OE 601 CE	Disaster Mitigation
OE 602 CE	Geo-Spatial Techniques
OE 601 CS	Operating Systems*
OE 602 CS	OOP using Java*
OE 601 EC	Principles of Embedded Systems
OE 602 EC	Digital System Design using HDL Verilog
OE 601 EE	Reliability Engineering
OE 602 EE	Basics of Power Electronics
OE 601 ME	Industrial Robotics

BATCH 2020-2024

SCHEMEOFINSTRUCTION&EXAMINATION
B.E(INFORMATIONTECHNOLOGY)

VIISemester(2022-23)

S. No.	Course Code	CourseTitle	SchemeofInstruction				Schemeof Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration inHrs	
TheoryCourses										
1	PC701IT	Internet of Things	3	1	-	4	30	70	3	3
2	PC702IT	BigDataAnalytics	3	1	-	4	30	70	3	3
3	PE-III	ProfessionalElective-III	3	-	-	3	30	70	3	3
4	OE-II	OpenElectiveII	3	-	-	3	30	70	3	3
5	PE-IV	ProfessionalElectiveIV	3	-	-	3	30	70	3	3
Practical/LaboratoryCourses										
5	PC751IT	Internet Of ThingsLab	-	-	2	2	25	50	3	1
6	PW753IT	ProjectWork–I	-	-	4	4	50	-	-	2
7	SI754IT	SummerInternship	`	-	-	-	25	50	-	2
			15	02	6	23	250	450	18	20

OpenElectiveII	
CourseCode	CourseTitle
OE701CS**	DataScienceandDataAnalytics
OE701IT**	CyberSecurity

PC:ProfessionalCorePE:ProfessionalElective,HS:HumanitiesandsocialScienceMC:MandatoryCourse
L:Lecture T:Tutorial P:Practical D:Drawing
CIE:ContinuousInternalEvaluation, SEE:SemesterEndExamination(Univ.Exam)
Note:

1. EachcontacthourisaClockHour
2. Thepracticalclasscanbeoftwoandhalfhour(clockhours)durationasperthereguirementofaparticularlaboratory.

Note-1:**SubjectisnotofferedtothestudentsofCSEandITDepartment.

BATCH 2020-2024

B.E(INFORMATIONTECHNOLOGY)

VIIISemester(2022-23)

S. No.	CourseCode	CourseTitle	SchemeofInstruction				SchemeofExamination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration inHrs	
TheoryCourses										
1	PE-V	ProfessionalElective–V	3	-	-	3	30	70	3	3
2	OE-III	OpenElective–III	3	-	-	3	30	70	3	3
Practical/LaboratoryCourses										
3	PW861IT	ProjectWork–II	-	-	16	16	50	100	-	8
			06	-	16	22	110	240	06	14

OpenElectiveIII	
CourseCode	CourseTitle
OE801CS**	FundamentalsofAL&ML
OE801IT**	SoftwareEngineering

PC: Professional Core MC:MandatoryCourse HS:HumanitiesandSciences
L:Lectures T:Tutorials P:Practical D:Drawing
CIE:ContinuousInternalEvaluation SEE:SemesterEndExamination(Univ.Exam)

Note-1:**SubjectisnotofferedtothestudentsofCSEandITDepartment.

Note-2:1)EachcontacthourisaClockHour
2)Thepracticalclasscanbeoftwoandhalfhour(clockhours)durationaspertherequirementofaparticularlaboratory.

SCHEMEOFINSTRUCTION&EXAMINATION

BATCH 2020-2024

B.E(INFORMATIONTECHNOLOGY)

VSemester(2022-23)

Course Code	CourseTitle						Core/Elective
PC501IT	AUTOMATATHEORY						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives:

- Providesbasicpropertiesofformallanguagesandformalgrammars, deterministicandnon-deterministicfiniteautomata, relationbetweentypesoflanguagesandtypesoffiniteautomata.
- ProvidesbasicpropertiesofPushdownAutomataandTuringmachinesandcomputingwithTuringmachinesandPDA.
- UnderstandthechallengesforTheoreticalComputerScienceanditscontributiontootherscience s

CourseOutcomes

Studentwillableto

- Designandusedeterministic, non-deterministic, andepsilontransitionfinitestateautomataandillustratestatetransitiononsymbolsofinputwordsandestablishthecorrespondinglanguageofautomata.
- AnalyzeRegularExpressionsanduseLawsandestablishthecorrespondingRegularLanguage.ProveagivenlanguageisregularorotherwiseUseClosureandDecisionPropertiesofRegularLanguage.
- Analyzeambiguity.DevelopContextFreeGrammars,ParseTreesandestablishContextFree Language.UseClosureandDecisionPropertiesofRegularLanguage.
- DesignPushdownAutomataandillustratetheworking.DevelopdeterministicPushdownAutomataandestablishequivalenceoflanguageofPDAandCFG.
- DesignTuringMachineandillustrateitsworking,implementprogrammingtechniquesforTuringMachines,analyzeextendedandrestrictedTuringMachinesforcomputationalabilities,andestablishtheRecursivelyEnumerablelanguageofTuringMachineandanalyzetheUndecidableproblems.

UNITI

Automata:IntroductiontoFiniteAutomata,CentralConceptsofAutomataTheory.
FiniteAutomata:AninformalpictureofFiniteAutomata,DeterministicFiniteAutomata,non-deterministicFiniteAutomata,AnApplication,FiniteAutomatawithEpsilonTransitions.

UNITII

RegularExpressionAndlanguages:RegularExpressions,FiniteAutomataandRegularExpression, ApplicationsofRegularExpressions,AlgebraicLawsforRegularExpression.
PropertiesofRegularLanguages:ProvingLanguagesnottobeRegular,ClosurePropertiesofRegularLanguages,DecisionPropertiesofRegularLanguages,EquivalenceandMinimizationofAutomata.

UNITIII

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ContextFreeGrammarsandLanguages:Context-FreeGrammars,ParseTrees,Applications,AmbiguityinGrammarsandLanguagePropertiesofContextFreeLanguages:NormalFormsforContext-FreeGrammars,PumpingLemma,ClosureProperties,DecisionPropertiesofCFL‘s.

UNITIV

PushdownAutomata:Definition,LanguageofPDA,EquivalenceofPDA‘sand;CFG‘s,DeterministicPushdownAutomata.

UNITV

TurningMachines:ProblemsthatComputerCannotSolve,TheTurningMachine,ProgrammingTechniquesforTurningMachines,ExtensionstotheTurningMachines,RestrictedTurningMachines,TurningMachineandComputers.UndecidableProblemsaboutTurningMachines,Post‘sCorrespondenceProblem,OtherUndecidableProblems.

SuggestedReading

1. JohnE.Hopcroft,RajeevMotwani,JefferyDUlman.IntroductiontoAutomataTheoryLanguagesandComputation,thirdedition,PearsonEducation,2009.
2. JohnC.Martin,IntroductiontoLanguagesandtheTheoryofcomputation,thirdEditio n,TataMcGrawHill,2003.

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Course Code	CourseTitle						Core/Elective
PC502IT	OPERATINGSYSTEMS						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives

- Tounderstandtheworkingofcomputersystemandthebasicconceptsofoperatingsystemandtheservicesprovidedbyit.
- Tounderstandthefunctionsandmanagementofdifferentresourcesoftheoperatingsystem(Processor,I/O,andMemoryetc)
- Tounderstandprocessmanagementconceptsincludingscheduling,synchronization,deadlocks
- Tolearnthemechanismsinvolvedinmemorymanagementand I/Osubsystemsofanoperatingsystem.
- Tounderstandissuesofprotectionandsecurity

CourseOutcomes

Studentwillableto

- Explainthefundamentalconceptsandfunctionsof operating System.
- Understand process scheduling in a multi-programmingenvironmentandimplementingprocessschedulingalgorithms.
- Writeapplicationandsystemcallsrelatedprogramsformanagingprocesses,memory,I/Oandinter-processCommunicationrelatedsystemcalls.
- Understandmemorymanagement,diskmanagementtechniques,includingvirtualmemoryandfilesystemstructure.
- Explainprotectionandsecurityrelatedissuesofthecomputersystem.

UNIT-I

Introduction:ComputerSystemorganization&Architecture,OperatingSystemStructure&Operations,Process,MemoryandStorageManagements,ProtectionandSecurity,DistributedandSpecial-PurposeSystems,ComputingEnvironments.

SystemStructures:Operating-SystemServices,UserOperatingSystemInterface,Systemcalls,TypesofSystemCalls,SystemPrograms,Operating-SystemStructure,VirtualMachines,Operating–SystemGeneration,SystemBoot.

ProcessConcept:Overview,ProcessScheduling,OperationsonProcesses,Interprocesscommunication,ExamplesofIPCSystems,CommunicationinClient/ServerSystems.

MultithreadedProgramming:Overview,MultithreadingModels,ThreadLibraries,ThreadingIssues,Operating-SystemExamples.

UNITII

ProcessScheduling:BasicConcepts,SchedulingCriteria,SchedulingAlgorithms,Multi-ProcessorScheduling,ThreadScheduling:Pthreads,OperatingSystemExamples,AlgorithmEvaluation Process Coordination and Synchronization: Background, The Critical-Section Problem, Peterson ‘s Solution, Synchronization, Monitors, Synchronization

Examples.

Deadlocks: System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNITIII

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation,Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium.

Virtual Memory Management: Background, Demand paging, Copy-on-write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations,

Storage Management: File System, File Concept, Access Methods, Directory Structure, File-System Mounting, Filesharing, Protection.

UNITIV

Implementing File Systems: File System-Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS.

Secondary –Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure.

I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystems, Transforming I/O Request to Hardware Operations, STREAMS, Performance.

UNITV

Protection and Security: Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of access rights, Capability-based Systems, Language-based protection.

System Security: The security problem, program Threats, System and System Network Threats, Cryptography as a Security tool, User Authentication, Implementing Security Defenses, firewalling to protect Systems and Networks, Computer Security Classification, Case Studies-Linux System.

Suggested Reading

1. Abraham Silber Schatz, Peter Galvin, Greg Gagne, Operating System principles, seventh Edition, John Wiley & sons' publication,2006.
2. A.Tanenbaum – Modern Operation Systems. Third edition,PearsonEducation,2008.
3. William Stallings-Operating Systems, Fifth Edition, Pearson Education,2005.
4. IdaM. Flynn, Understanding Operating Systems, Sixth Edition, Cengage,2011

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PC503IT	ArtificialIntelligence						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives:

➢ Understand the importance of the field of AI by discussing its history and various applications.

➢ Learn about one of the basic applications of A.I, search state formulations.

➢ Learn methods of expressing knowledge by a machine with appropriate reasoning and different mathematics involved behind it

➢ Learn how to reason when an agent has only uncertain information about its task.

➢ Know various supervised and unsupervised learning algorithms.

CourseOutcomes:

Studentwillableto

- After completing this course, the student will be able to:
- Formalize a problem in the language/framework of different AI methods
- Illustrate basic principles of AI in solutions that require problem solving, search, inference.
- Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks
- Differentiate between learning paradigms to be applied for an application

UNIT-I:

Introduction- What is intelligence? Intelligent Systems, Foundations of artificial intelligence (AI). History of AI, Subareas of AI, Applications, Structure of Agents.

Problem Solving - State-Space Search and Control strategies: Introduction, General Problem Solving, Characteristics of Problem,Formulating problems, problem types, states and operators, state space.

UNIT-II:

Search strategies. - Uninformed Search strategies-BFS,DFS, Iterative deepening DFS,Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*.

Adversarial Search/ Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.

UNIT-III:

Reasoning - Knowledge based agent, Propositional Logic, Inference, Predicate logic (first order logic), Resolution

Structured Knowledge Representation – Frames, Semantic Nets.

UNIT-IV:

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications.

Uncertainty - Basic probability, Bayes rule, Naive Bayes,Belief networks, Inference in Bayesian Networks

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UNIT-V:
Fuzzy sets, and fuzzy logic: Fuzzy logic system architecture, membership function, Fuzzy Inferences
Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees

Suggested Readings:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Third edition, Pearson Education Press,.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 3 rd ed, 2009.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009

References:

- Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011
- K.R.Chowdhary, Fundamentals of AI, Springer, 202

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Course Code	CourseTitle						Core/Elective
PC504IT	COMPUTERNETWORKS						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives:

- Tostudythedesignissuesinnetworklayerandvariousroutingalgorithms
- Tointroduceinternetroutingarchitectureandprotocols
- TolearntheflowcontrolandcongestioncontrolalgorithmsinTransportLayer
- TointroducetheTCP/IPsuiteofprotocolsandthenetworkedapplication supported byit
- Tolearnbasicandadvancedsocketsystemcalls

CourseOutcomes:

Studentwillableto

- ExplainthefunctionofeachlayerofOSIandtracetheflowofinformationfromone
- Nodetoanothernodeinthenetwork
- UnderstandtheprinciplesofIPaddressingandinternetrouting
- DescribetheworkingofvariousnetworkedapplicationssuchasDNS,mail,filetransferandw ww
- Implementclient-serversocket-basednetworkedapplications

UNIT–I

Introduction:UsesofComputer Networks, Network Hardware, Network Software:ReferenceModels(ISO-OSI,TCP/IP).NetworkLayer:NetworkLayerDesign Issues, RoutingAlgorithms, CongestionControlAlgorithms

UNIT–II

Internetworking:Concatenatedvirtual circuits, Connectionless internet working, Tunneling, Fragmentation.NetworklayerintheInternet:IPprotocol,IPaddresses, Internetcontrolprotocols,OSPF, BGP, MobileIP, IPv6.

UNIT–III

NetworkProgramming:SocketInterface:Sockets,SocketAddress,ElementarySockets, AdvancedSockets,SocketOptions,RemoteProcedureCalls: Introduction, Transparency IssuesandSunRPC.

UNIT-IV

THE TRANSPORT LAYER: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

UNIT–V

ApplicationLayer:DomainNameSystem:DNSNameSpace,Resource Records, Name Servers.ElectronicMail:ArchitectureandServices,UserAgent,MessageFormats,Mess agetransfer and Final Delivery.WorldWideWeb:ArchitecturalOverview, Static WebDocuments,DynamicWebDocuments,HTTP.

SuggestedReading:

1. AndrewS.Tanenbaurn,Computer Networks,FourthEdition,PearsonEducation.
2. W. Richard stevens, Unix Network Programming‖ PrenticeHall/PearsonEducation,2009.
3. JamesF.Kurose,KeithW,Ross,ComputerNetworking,Atop-DownApproachFeaturingtheInternet,ThirdEdition,PearsonEducation,2005.
4. William Stallings, Computer NetworkingwithInternetProtocolsandTechnology,PearsonEducation,2009

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PC505IT	SOFTWAREENGINEERING						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives

- Tointroducethebasicconceptsofsoftwaredevelopment-processesfromdefiningaproducttoshippingandmaintainingthatproduct
- Toimpartknowledgeonvariousphases, methodologiesandpracticesofsoftwaredevelopment
- Tounderstandtheimportanceoftestinginsoftwaredevelopmentandstudyvarioustestingstrategiesandsoftware equalitymetrics.

CourseOutcomes

Studentswillbeableto:

- Definedifferentsoftwaredevelopmentprocessesandtheirusabilityindifferentproblemdomains.
- Explain the process of requirements collection, analyzing, and modelingrequirementsforeffectiveunderstandingandcommunicationwithstakeholders.
- DesignandDevelopthearchitectureofrealworldproblemstowardsdevelopingablueprintforimplementation.
- Understandtheconceptsofsoftwareequality,testingandmaintenance.
- DiscusstheconceptsrelatedtoRiskmanagementandSoftwareprojectEstimation

UNIT-I

IntroductiontoSoftwareEngineering:Agenericviewofprocess,SoftwareEngineeringprocessframework,TheNatureofSoftware,SoftwareEngineering,SoftwareMyths.
ProcessModels:AGenericProcessModel,
AnAgileViewofProcess:IntroductiontoAgilityandAgileProcess.

UNIT-II

UnderstandingRequirements:RequirementsEngineering,EstablishingtheGroundwork,ElicitingRequirements,BuildingtheRequirementModel,NegotiatingRequirements,ValidatingRequirements.
DesignConcepts:DesignwithintheContextofSoftwareEngineering,theDesignProcess,DesignConcepts.
ArchitecturalDesign:Software Architecture, Architecture Genres,ArchitectureStyles,ArchitectureDesign,AssessingAlternativeArchitectureDesigns,ArchitectureMappingUsingDataFlow.

UNIT-III

SoftwareQualityAssurance:BackgroundIssues, ElementsofSoftwareQualityAssurance,SQATasks,GoalsandMetrics,FormalApproaches toSQA,StatisticalSoftwareQualityAssurance,SoftwareReliability,TheISO9000QualityS tandards,TheSQAPlan.

RiskManagement:RiskStrategies,SoftwareRisks,RiskIdentification,RiskProjection,Ris kRefinement,RiskMitigation,Monitoring,andManagement,TheRMMMPlan.

UNIT-IV

TestingConventionalApplications:SoftwareTestingFundamentals,InternalandExternal ViewsofTesting,White-BoxTesting,BasisPathTesting,ControlStructureTesting,Black–BoxTesting.

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging.

UNIT-V

ProductMetrics:AFrameworkforProductMetrics,MetricsfortheRequirementsModel,Metr icsfortheDesignModel,MetricsforTesting,MetricsforMaintenance.Estimation:SoftwareP rojectEstimation,DecompositionTechniques,EmpiricalEstimationModels,SpecializedEs timationTechniques.

SoftwareConfigurationManagement:SoftwareConfigurationManagement.SoftwareProc essImprovement:TheSPIProcess,TheCMMI.

SuggestedReading:

1. Roger S. Pressman, Software Engineering:APractitionersApproach,SeventhEdition,McGrawHill,2009.
2. AliBehforozand FredericJ.Hadson,SoftwareEngineeringFundamentals,OxfordUniversityPress, 1996.
3. PankajJalote–AnIntegratedApproachtoSoftwareEngineering,ThirdEdition,NarosaPubl ishinghouse,2008.

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PC551IT	ComputerNetworks&OperatingSystemLab						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
CProgr.UnixCommands	-	-	-	2	25	50	1

CourseObjectives:

- Tounderstandtheuseofclient/serverarchitectureinapplicationdevelopment.
- Tounderstandanduseelementarysocketsystemcalls, advancedsocketsystemcallsandTCPandUDPbasedsockets
- Toimplementnetworkroutingalgorithms,applicationlayerprotocolsandencryptionalgorithms.

CourseOutcomes:

Studentwillableto

- Understandtheusageofbasiccommandsipconig,ifconfig,netstat,ping,arp,telnet,ftp,finger,traceroute,whoisofLINUXplatform.
- DevelopandImplementClient-ServerSocketbasedprogramsusingTCP,andUDPsockets
- DevelopandImplementDistanceVectorRoutingAlgorithm
- Demonstratehowthreadscanbecreatedandsimultaneouslyhandledin LINUXPOSIXenvironment.
- UnderstandpossibleInter-ProcessCommunicationimplementationsusingLINUXIPCConstructs.DevelopandImplementRSAPublicKeyalgorithm
- ConstructsimplenetworkbyusinganymodernOpen-SourceNetworkSimulationTool

ListofPrograms

1. FamiliarizationofNetworkEnvironment,Understandingandusingnetworkutilities:ipconig,ifconfig,netstat,ping,arp,telnet,ftp,finger,traceroute,whois.
2. Writeaprogram toimplementconnectionorientedandconnectionlessclient for well-known servicesi.estandardports
3. Implementationofconcurrentserver serviceusingconnection-orientedsocketsystemcalls(Service:Daytime,Time)
4. Implementationofconcurrentserverusingconnectionlesssocketsystemcalls.(Service:Echoserver,String Concatenation)
5. Implementation of Iterative server using connection-oriented socket systemcalls.(Service:CalculateEmployeeSalary)
6. ImplementationofIterativeserverusingconnectionlesssocketsystemcalls.(Service:Student Grade)
7. Programtodemonstratetheuseofadvancedsocket system calls:readv(),writev(),getsockname(),setsockname(),getpeername(),gethostbyname(),gethostbyaddr(),getnetbyname(),getnetbyaddr(),getprotobyname(),getserv

byname(),getprotobynumber(),getserbyport().

8. ImplementationFamiliarityandusageofLinuxSystemcalls:
   - Processmanagement:fork(),exec(),wait(),sleep()...,
   - Filemanagement:open(),read(),write(),seek(),close()...,
9. WriteaprogramtoImplementtwoprocesscommunicationusingIPCconstructs.a)pipe sb)sharedmemoryc)messagequeues d)Semaphores.
10. DemonstratetheuseofthreadsunderLINUXplatformusingappropriatethreadAPI
11. WriteaprogramtoImplementProducerConsumerProblemsolution.
12. WriteaprogramtoImplementDiningphilosopher‘sproblemsolution.
13. WriteaprogramtoimplementProcessorSchedulingAlgorithms
    a) FCFSb)SJF c)RoundRobin.
14. WriteaprogramtosimulateBankersAlgorithmforDeadLockAvoidance.

SuggestedReading:

1. W.RichardStevens,-UnixNetworkProgramming‖,PrenticeHall,PearsonEducation,2009.
2. DouglasE.Comer,―HandsonNetworkingwithInternetTechnologies,PearsonEducation

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PC552IT	ArtificialIntelligenceLAB						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
Python Programming	-	-	-	2	25	50	1

Course Objectives :

- To apply programming skills to formulate the solutions for computational problems.
- To study implementation first order predicate calculus using Prolog
- To familiarize with basic implementation of NLP with the help of Python libraries NLTK
- To understand python library scikit-learn for building machine learning models
- To enrich knowledge to select and apply relevant AI tools for the given problem

Course Outcomes

- Design and develop solutions for informed and uninformed search problems in AI.
- Demonstrate reasoning in first order logic using Prolog
- Utilize advanced package like NLTK for implementing natural language processing.
- Demonstrate and enrich knowledge to select and apply python libraries to synthesize information and develop supervised learning models
- Develop a case study in multidisciplinary areas to demonstrate use of AI.

1. Write a program to implement Uninformed search techniques:
    a. BFS
    b. DFS
2. Write a program to implement Informed search techniques
    a. Greedy Best first search
    b. A* algorithm
3. Study of Prolog, its facts, and rules.
    a. Write simple facts for the statements and querying it.
    b. Write a program for Family-tree.
4. Write a program to train and validate the following classifiers for given data (scikit-learn):
    a. Decision Tree
    b. Multi-layer Feed Forward neural network

5. Case Studies: a. Smart Inventory Management System
    b. AI in Healthcare Digital Assistant

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PC553IT	WEBAPPLICATIONDEVELOPMENTLAB						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	25	50	1

CourseObjective:

- TodevelopwebpagesusingHTMLtagsandperformvalidationusingscripting
- ToimplementvarioustypesofstylingusingCSSandtransformdataintovariousforms
- ToimplementapplicationsusingJQueryandAngularJS
- TounderstandandimplementtheconceptsofMEANStackandSMACKstack

CourseOutcomes:

Studentwillableto

- DesignWebpagesandperformformvalidationusingHTML5.0inbuiltfunctions.
- ApplyStylestothewebcontentusingCSS.
- CreateandprocesswebpublishingcontentusingXMLandJSON.
- UseJQuerytoperform client-side Dynamics.
- Createsinglepageapplications(FrontEnd)usingAngularJS.
- DesignBigdataapplicationsusingMeanstackorSMACKstackFrameworks.

a. ImplementBasicHTMLTags
b. ImplementTableTag
    i. ImplementFRAMES
c. Designa forming HTML(CV/Photos/DataStorage/Publish)
    i. ValidationofformUsingJavaScript.
d. ImplementvarioustypesofCSS.
e. DisplaythevariousformsofXMLdocument
   i. RawXML ii.XMLusingCSS
f. UsingJQueryimplementthefollowing:
    i) SelectingElements,GettingValues,andSettingValues.
    ii) Events
g. UsingangularJSimplementthefollowing
    i) InputValidation
    ii) Back-end building
h. Casestudyoni)MEANStack

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PE511IT	OBJECTORIENTEDANALYSISANDDESIGN						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives:

- TointroducethebasicconceptsofUnifiedModelingLanguagefromdefiningUnifiedprocess andCore workflows
- ToimpartknowledgeonvariousUMLdiagramsforthesoftware development
- Tounderstandtheimportanceofeachdiagraminsoftwaredevelopmentandunderstandrulesto developeach diagram

CourseOutcomes
Studentwillableto

- Understandtheactivitiesinthedifferentphasesoftheobject-orienteddevelopmentlifecycle.
- Modelareal-worldapplicationbyusingaUML diagram.
- Provideasnapshotofthedetailedstateofasystemat appoint intimeusingobjectdiagram.
- Recognizewhentousegeneralization, aggregation,and compositionrelationships.Specifydifferenttypesofbusinessrulesinaclass diagram.

UNIT-I
UMLIntroduction:WhyweModel,IntroducingtheUML,ElementsofUML
BasicStructuralModeling: Classes, Relationships, Common Mechanisms, Diagrams, ClassDiagrams.
AdvancedStructuralModeling:AdvancedClasses,Advanced Relationships, Interfaces, Types andRoles,Packages,Instances,ObjectDiagrams,Components

UNIT-II
BasicBehavioralModeling:
Interactions,UseCases,UseCaseDiagrams,Interactiondiagrams,Activitydiagrams.
AdvancedBehavioralModeling:EventsandSignals,StateMachines,ProcessesandThreads, Timeandspace,StateChartDiagrams.

UNIT-III
ArchitecturalModeling:Artifacts,DeploymentCollaborations,PatternsandFrame-works,ArtifactDiagrams,DeploymentDiagrams,SystemsandModels

UNIT-IV

UnifiedSoftwareDevelopmentProcess:TheUnifiedProcess,TheFourPs,AUse-Case-DrivenProcess,AnArchitecture-CentricProcesses,AnIterativeandIncrementalProcess.

UNIT-V

CoreWorkflows:RequirementsCapture,Capturingrequirementsasusecases,Analysis,Design,Implementation,Test

SuggestedReading:

1. The Unified Modeling Language User Guide, PearsonEducation-GradyBooch,JamesRumbaugh,IvarJacobson
2. Object-Oriented Analysis And Design With Applications, PearsonEducation,3rdEdition-Booch,Jacobson,Rumbaugh

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE512IT	MOBILECOMPUTING						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives:

Studentshouldbeabletounderstand

- Basic concepts ofmobile computing.
- Basicsof mobiletelecommunicationsystem.
- Basicsof network, transport andapplicationlayerprotocols.
- Gainknowledge aboutdifferentmobileplatformsandapplicationdevelopment.

CourseOutcomes:

Studentwillbeableto

- Explainthebasicsof mobiletelecommunication systems
- Illustratethegenerationsoftelecommunicationsystemsinwirelessnetworks
- DeterminethefunctionalityofMAC,NetworklayerandIdentifyaroutingprotocolforagiven Adhocnetwork
- ExplainthefunctionalityofTransportandApplicationlayers
- Developamobileapplicationusing android/blackberry/Ios/WindowsSDK

UNITI - INTRODUCTION

Introduction to Mobile Computing – Applications of Mobile Computing- Generations ofMobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols –SDMA-TDMA-FDMA-CDMA

UNITII – MOBILETELECOMMUNICATIONSYSTEM

IntroductiontoCellularSystems-GSM–Services&Architecture–Protocols–ConnectionEstablishment–FrequencyAllocation–Routing–MobilityManagement–Security–GPRS-UMTS–Architecture–Handover-Security

UNITIII – MOBILENETWORKLAYER

MobileIP–DHCP–AdHoc–Proactiveprotocol-DSDV,ReactiveRoutingProtocols–DSR,AODV,Hybridrouting–ZRP,MulticastRouting-ODMRP,VehicularAdHocnetworks(VANET)–MANETVsVANET–Security.

UNITIV – MOBILETRANSPORTANDAPPLICATIONLAYER

Mobile TCP – WAP – Architecture - WDP – WTLS – WTP – WSP – WAE – WTA Architecture - WML

UNITV – MOBILEPLATFORMSANDAPPLICATIONS

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, Windows Phone – M- Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

TEXTBOOKS:

1. JochenSchiller,―MobileCommunications‖,PHI,SecondEdition,2003.
2. PrasantKumarPattnaik,RajibMall,―FundamentalsofMobileComputing‖,PHILearningPvt.Ltd,NewDelhi–2012

REFERENCE BOOKS:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobilesystems",ThomsonAsiaPvtLtd,2005.
2. UweHansmann,LotharMerk,MartinS.NicklonsandThomasStober,―Principlesof Mobile Computing‖,Springer, 2003.
3. William.C.Y.Lee,―MobileCellularTelecommunications-AnalogandDigitalSystems‖,SecondEdition,TataMcGraw HillEdition,2006.
4. C.K.Toh,―AdHocMobileWirelessNetworks‖,FirstEdition,PearsonEducation,2002.
5. AndroidDevelopers:http://developer.android.com/index.html
6. AppleDeveloper : https://developer.apple.com/
7. WindowsPhoneDevCenter:http://developer.windowsphone.com

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE513IT	DISTRIBUTEDDATABASES						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- To learn the concept and issues of distributed systems in detail.
- To study architectures and working of distributed file systems.
- To understand the processes in distributed system and communication.
- To make students understand how names are assigned in distributed systems.
- To learn examples of distributed file systems.

Course Outcomes:

Student will able to

- Understand the problems and issues associated with distributed systems.
- Understand how coordination occurs in distributed systems.
- How replicas are handled in distributed systems and consistency is maintained.
- How security is implemented in distributed systems.
- Understand design trade-offs in large-scale distributed systems

UNIT – I

Introduction: What is Distributed Systems?, Design Goals, Types of Distributed System.

Architectures: Architectural Styles, Middleware Organization, System Architectures, Example Architectures..

UNIT – II

Processes: Threads, Virtualization, Clients,Servers, Code migration.

Communication: Foundations, Remote Procedure Call, Message-Oriented Communication,Multicast Communication.

UNIT – III

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and AttributeBased Naming.

Coordination: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election Algorithms, Location System, Distributed event matching, Gossip-based coordination.

UNIT – IV

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Security: Introduction to security, Secure channels, Access control, Secure naming, Securitymanagement.

UNIT – V

BATCH 2020-2024

Distributed File Systems: Introduction, File service architecture, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments.

Distributed Multimedia Systems: Introduction, Characteristics of multimedia data, Quality of service management, Resource management, Stream adaptation, Case studies: Tiger, BitTorrent and End System Multicast.

Designing Distributed Systems: GOOGLE CASE STUDY Introduction, Overall architecture and design philosophy, Underlying communication paradigms,Data storage and coordination services, Distributed computation services.

Suggested Readings:

1 Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems, PHI 2nd Edition, 2009.
2 R. Hill, L. Hirsch, P. Lake, S. Moshiri, Guide to Cloud Computing, Principles and Practice,Springer, 2013.
3 R. Buyya, J. Borberg, A. Goscinski, Cloud Computing-Principles and Paradigms, Wiley, 2013.

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PE514IT	DATAMINING						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives

- Tounderstanddataclassification,datapreprocessinganddataminingapplications.
- Tounderstandhowpatterns,associationsandcorrelationscanbeobtainedondata.
- Tounderstandhowclassificationandclusteringtechniquescanbeimplementedandperformitsevaluation.
- Tolearnhowcomplexdataminingcanbeperformed.

Courseoutcomes

Studentwillableto

- Classifytypesofdata,performpreprocessingofdataandappreciateapplicationsofdatamining.
- Analyzedata for mining frequentpatterns,AssociationsandCorrelations.
- Performtheclassificationbyusingdecisiontree induction, Bayes classificationmethodsetc.andevaluatetheclassifier.
- Selectandperformclustering,outlieranalysisdetectionmethods.
- PerformTextmining,SpatialMining,Webminingand Multimedia mining.

UNIT-I

Introduction: FundamentalsofDataMining,KindsofPatternscanbemined, Technologiesused,ApplicationsandissuesinDataMining.TypesofData:Attributetypes, BasicStatisticalDescriptionsofData,MeasuringdatasimilarityandDissimilarity.DataPre-Processing:NeedofPre-processing,DataCleaning,DataIntegration,DataReduction,DataTransformation.

UNIT-II

MiningFrequentPatterns,AssociationsandCorrelations:MarketBasketAnalysis,Associationrule mining,frequentitemsetminingmethods,miningvariouskindsof association rule,Constraintbasedfrequentpatternmining.

UNIT–III

Classification:Generalapproachtoclassification,ClassificationbyDecisiontreeinduction,Classification byback Propagation,Lazylearners,otherclassificationmethods,Prediction,Evaluatingtheaccuracyofclassifier,Increasingtheaccuracyofclassifier.

UNIT—IV

ClusterAnalysis:BasicClusteringmethods,Partitioningmethods,Density-basedmethods,Grid-basedmethods,andEvaluationofclustering,OutlierAnalysisanddetectionmethods.

UNIT—V
MiningComplexData,ApplicationsandTrends:Miningcomplexdata:Spatialmining,TextMining, MultimediaMining,WebMining,DataMiningApplicationsandDataMiningTrends.

SuggestedReading:

1. HanJ&KamberM,
―DataMining:ConceptsandTechniques‖,HarcourtIndia,ElsevierIndia,SecondEdition.
2. Pang-Ning Tan. Michael Steinback, Vipin Kumar,–IntroductiontoDataMining‖,PearsonEducation,2008.
3. MargaretHDunham,S.Sridhar,–Datamining:IntroductoryandAdvancedTopics‖,PearsonEducation,2008.
4. Humphires,hawkins,Dy,―DataWarehousing:ArchitectureandImplementation‖,PearsonEducation,2009.
5. Anahory,Murray,–DataWarehousingintheRealWorld‖,PearsonEducation,2008.

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE515IT	COMPUTERGRAPHICS						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives:

- Acquireknowledgeaboutdevicelevel algorithmsfordisplayingtwodimensional output primitivesforraster graphicssystem.
- Acquireknowledgeaboutthebasicconcepts ofrepresenting3Dobjects in2D.
- Tointroducecomputer graphicstechniquestransformations,clipping,curvesan

CourseOutcomes

Student willableto

- Describethesteps in graphicsprogrammingpipline
- Applyaffine transformations forviewingandprojections
- Createrealisticimagesof geometrical objectsin2-Dandmodelingimplementation
- Describethemathematicalprinciplestorepresentcurvesandsurfaces

UNIT – I

Overview ofGraphics Systems-Video display devices, raster-scansystems, Random-scansystem, graphics monitors and workstations, InputDevices, hard copy devices, GraphicsSoftware. Output Primitives, Line driving, algorithms, Circle generating algorithms, ellipsegeneratingalgorithms,pixeladdressing, Filled-areaprimitives,Fillareafunctions,cellarray,charactergeneration.

UNIT – II

Attributes of output primitives:Line attributes, curve attributes, color and Gray scale level,Area fill attributes, character attributes, Bundled attributes, Enquiry function. Two dimensionalGeometric transformations:Basic transformations, Homogeneous coordinates, compositetransformations,othertransformations,transformationsbetweencoordinate systems,affinetransformations,transformationfunctions,Rastermethodsfortransformations.

UNIT – III

Twodimensionalviewing:Viewingpipeline,viewingtransformation,viewingfunctions,lineclipping-Cohen Sutherland line clipping Liang Bar skyline clipping. Sutherland-Hodgmanpolygonclipping, WellerAtherton polygonclipping.

UNIT – IV

Structures and Hierarchical Modeling: Structure concepts, editing structures, Basic modelingconcepts, hierarchical modeling with structures. Graphical user interfaces and Interactive inputmethods:TheuserDialogue,logicalclassification ofinputdevices, inputfunctionsand

Models,Interactivepictureconstructiontechniques..

UNIT – V

Three dimensional object representations: Polygon surface, curved lines and surfaces,splinere presentations, Bezeir curves and surfaces, B-spline curves and surfaces, CSGmethods: Octress, BSP Trees. Three Dimensional Transformation Three dimensionalviewing:Viewingcoordinates,projections,visible surfacedetectionmethods:Back-faceDetections,Depth-buffer methods,depthsortingmethods,Gourandshading,Phongshading.

Suggested Reading:

1.HeamDonald, PaulineBakerM.,"Computer Graphics",2nd edition, PHI,1995.
2.HaningtonS.,"ComputerGraphicsAProgramming Approach",2nd edition,McGraw Hill.
3.David F. Rogers.,"Procedural ElementsforComputerGraphics",2nd edition,TataMcGraw Hill, 2001.

BATCH 2020-2024

SCHEMEOFINSTRUCTION&EXAMINATION
B.E(INFORMATIONTECHNOLOGY)
(witheffectfromtheacademicyear2022-23)

VISemester(2022-23)

S.No	Course Code	CourseTitle	SchemeofInstruction				SchemeofExamination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Durationi nHrs	
TheoryCourse										
1.	PC601IT	EmbeddedSystems	3	1	-	4	30	70	3	3
2.	PC602IT	DesignandAnalysisof Algorithms	3	1	-	4	30	70	3	3
3.	PC603IT	MachineLearning	3	1	-	4	30	70	3	3
4.	PC604IT	NetworkSecurityandcry ptography	3	-	-	3	30	70	3	3
5	OE-1	OpenElective-1	3	-	-	3	30	70	3	3
6.	PE-II	ProfessionalElective-II	3	-	-	3	30	70	3	3
Practical/LaboratoryCourse										
7.	PC651IT	EmbeddedSystemsLab	-	-	2	2	25	50	3	1
8.	PC652IT	MachineLearningLab	-	-	2	2	25	50	3	1
9.	PC653IT	MobileApplicationDeve lopmentLab	-	-	2	2	25	50	3	1
8.	PW654IT	MiniProject-I	-	-	2	2	25	50	3	1
Total			18	03	8	29	280	620	-	22

PC:ProfessionalCorePE:ProfessionalElective,HS:HumanitiesandsocialScienceMC:Mandatory CourseL:LectureT:TutorialP:PracticalD:Drawing
CIE:ContinuousInternalEvaluation,SEE:SemesterEndExamination(Univ.Exam)

Note:1.EachcontacthourisaClockHour
2.Thepracticalclasscanbeoftwoandhalfhour(clockhours)durationaspertherequirementofaparticularlaboratory.

Note-2:**SubjectisnotofferedtothestudentsofCSEandITDepartment.

BATCH 2020-2024

Open Elective-I	
Course Code	Course Title
OE601 IT	Database Systems**
OE602 IT	Data Structures**
OE 601 CE	Disaster Mitigation
OE 602 CE	Geo-Spatial Techniques
OE 601 CS	Operating Systems*
OE 602 CS	OOP using Java*
OE 601 EC	Principles of Embedded Systems
OE 602 EC	Digital System Design using HDL Verilog
OE 601 EE	Reliability Engineering
OE 602 EE	Basics of Power Electronics
OE 601 ME	Industrial Robotics

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PC601IT	EMBEDDEDSYSTEM						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives:

- Tounderstandthearchitectureof8051microcontrollers.
- TounderstandthevariousapplicationsofEmbeddedSystemsusingtheconceptsofInterfacing.
- Tofamiliarizewithsmart sensorsandunderstandvarioussensorapplications.
- Tolearntheconceptsof RTOS andthe design processusingRTOS.
- Tofamiliarizewiththedesignprinciplesof SOC.

CourseOutcomes:

Studentwill beable to

- Studyand analysisofembeddedsystems.
- Designanddevelopembeddedsystems(hardware, software andfirmware)
- Analyze,realtimesystemsusingRTOSanddevelopapplications.
- Applyknowledgetointerfacevarioussensorsanditsapplicationsinembeddedsystems.
- UnderstandprinciplesofSOCdesign.

UNIT – I

EmbeddedComputing:Introduction,ComplexSystemsandMicroprocessor,EmbeddedSystemDesignProcess,Formalisms for SystemDesign, Design Examples.MicroprocessorsandMicrocontrollers:MicroprocessorsandMicrocontrollers,The8051Architecture:Introduction,8051MicrocontrollerHardware,Input/outputPortsandCircuits,ExternalMemory. CounterandTimers, SerialdataInput/output,Interrupts.

UNIT – II

Programming using 8051. Data Transfer and Logical Instructions. Arithmetic Operations, DecimalArithmetic. JumpandCall Instructions,Applications:Interfacing with Keyboards,Displays,D/A andA/DConversions, MultipleInterrupts, SerialDataCommunication.Busprotocols: I^2Cbus and CANbus.

UNIT – III

Smart Sensors Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters –Compensation– Information Coding/Processing - Data Communication – Standards for Smart SensorInterface–The Automation.
Sensors–ApplicationsIntroduction–On-boardAutomobileSensors(AutomotivemSensors)– HomeApplianceSensors–AerospaceSensors—Sensorsform Manufacturing– SensorsforenvironmentalMonitoring

UNIT – IV

BATCH 2020-2024

Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, andshareddata;messagequeues,mailboxesandpipes,timerfunctions,events,memorymanagement,interruptroutinesinanRTOSenvironment.BasicDesignUsingaReal-TimeOperatingSystem:Principles,semaphoresandqueues,hardreal-timeschedulingconsiderations,savingmemoryandpower.

UNIT – V

IntroductiontotheSystemApproachSystemArchitecture,Componentsofthesystem,Hardware&Software,ProcessorArchitectures,MemoryandAddressing.Systemlevelinterconnection,AnapproachforSOCDesign, SystemArchitecture and Complexity.

SuggestedReadings:

1. MuhammadAliMazidi,JaniceGillispieMazidi,RolinD.McKinlay,―The8051Microcontroller andEmbeddedSystemsusingAssemblyandC‖,PrenticeHallIndia,2ndEdition.
2. D.Patranabis–―SensorsandTransducers‖–PHILearningPrivateLimited.
3. WayneWolf,"Computersand Components",Elsevier,Second Edition.
4. KennethJ.Ayala,"The8051Microcontroller",Third Edition,,Thomson.
5. DavidE.Simon,"AnEmbeddedSoftwarePrimer",PearsonEducation

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PC602IT	DESIGNANDANALYSISOFALGORITHMS						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

CourseObjectives

- Toreviewelementarydatastructures,ordernotationandalgorithmanalysis.
- TolearnalgorithmdesignstrategiessuchasDivide-and-Conquer,greedymethod,dynamicprogramming,backtrackingandbranch&boundtechnique.
- TounderstandtheconceptsofNP-hardandNP-complete.

CourseOutcomes:

Studentswillbeable:

- Computeandanalysecomplexityofalgorithmsusingasymptoticnotations.
- Writealgorithmstosolvevariouscomputingproblemsandanalysetheirtimeandspacecomplexity.
- Understandandapply differential algorithmdesigntechniquestosolverealworldproblemsandanalysetheircomplexities.
- Todescribealgorithmiccomplexitiesofvariouswellknowncomputingproblems.

UNIT-I

Introduction:AlgorithmSpecification,Performanceanalysis,SpaceComplexity,TimeComplexity,AsymptoticNotation(O,Omega,Theta),PracticalComplexities,PerformanceMeasurement,Reviewofelementarydatastructures,HeapandHeapSort,Setrepresentation,UNION,FIND.

UNIT-II

Divide-andConquer:Thegeneralmethod,findingmaximumminimum.Mergesortquicksortandselection.

GreedyMethod:Knapsackproblem,OptimalStorageontapes,Jobsequencingwithdeadlines,Optimalmergepatterns,MinimumSpanningTrees.

UNIT-III

DynamicProgrammingandTraversalTechnique:Multistagegraph,AllPairShortestPath,OptimalBinarySearchtrees,0/1Knapsack,ReliabilityTravelingSalesmanProblem,BiconnectedComponentsandDepthFirstSearch.

UNIT-IV

BacktrackingandBranchandBounds:8-QueensProblem,GraphColoringHamiltoncycle,KnapsackProblem,0/1KnapsackProblem,Travelingsalespersonproblem.

UNIT-V

NP-HardandNP-Completeness:Basicconcepts,cook'stheorem,NP-hardgraphproblemsandschedulingproblem,NP-hardgenerationproblems,Decisionproblem,Nodecoveringproblem.

SuggestedReading

1. HorowitzE.SahaniS:FundamentalsofComputerAlgorithm,Secondedition,UniversityPress,2007.
2. AnanyLevitin,IntroductiontotheDesign&Analysis,ofAlgorithms,PearsonEducation,2003.
3. Aho,Hopcroft,Ulman,TheDesignandAnalysisofComputerAlgorithm,PearsonEducation,2000.
4. ParagH.Dave,HimanshuB.Dave,DesignandAnalysisofAlgorithms,PearsonEducation,2008.

BATCH 2020-2024

Course Code	CourseTitle						Core /
PE603IT	MachineLearning						
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To learn the concepts of machine learning and types of learning along with evaluation metrics.
- To study various supervised learning algorithms.
- To learn ensemble techniques and various unsupervised learning algorithms.
- To explore Neural Networks.
- To learn reinforcement learning and study applications of machine learning.

Course Outcomes

Student will able to:

- Extract features that can be used for a particular machine learning approach in various applications.
- Compare and contrast pros and cons of various machine learning techniques and to get an insight when to apply particular machine learning approach.
- Apply ensemble techniques for improvement of classifiers.
- Understand machine learning process along with algorithms.
- Understand how to apply machine learning in various applications.

Unit-I

Introduction: Learning,Machine Learning, Types of Machine Learning,the Machine Learning Process,Weight Space, curse of dimensionality, Overfitting, Training, Testing, and Validation Sets, The Confusion Matrix, Accuracy Metrics,The Receiver Operator Characteristic (ROC) Curve, Unbalanced Datasets. Some basic statistics: Averages, Variance and Covariance, The Gaussian, the bias-variance trade-off.

Unit-II

Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.

Supervised Learning :Classification Learning with Trees**:** Using Decision Trees**,** Constructing Decision Trees, CART, Classification Example Support vector machines: optimal separation, kernels Multilayer Perceptron (MLP): The Perceptron,Going Forwards, Backwards, MLP in practices, Deriving back Propagation**,** Linear Separability, K-Nearest Neighbours, Naïve Bayes Classifier **Regression:** Regression Model, Goals of Regression Analysis, Statistical Computing in Regression Analysis.

Unit-III

Unsupervised Learning: Clustering The K-Means Algorithm: Dealing With Noise, the K-Means Neural Network Normalisation, a Better Weight Update Rule Using Competitive Learning for Clustering, Vector Quantisation, the Self-Organising Feature Map: The Som Algorithm Neighbourhood Connections Self-Organisation Network Dimensionality and Boundary Conditions, Examples of Using the Som.

Unit-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming. **Ensemble Algorithms**: Bagging, Boosting. **Dimensionality Reduction:** Linear Discriminant Analysis (LDA), Principal Component Analysis (PCA).

Unit –V

Reinforcement learning Overview,Example,Markov Decision Processes,Values, The Q-Learning Algorithm,The Sarsa Algorithm,Using Reinforcement Learning,The Difference Between Sarsa And Q-Learning.

Suggested Reading

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Second Edition (Chapman & Hall/Crc Machine Learning & Pattern Recognition)
2. Machine Learning, Tom Mitchell, McGraw-Hill Science/Engineering/Math; (1997).
3. Linear regression analysis: theory and computing. Yan, Xin, and XiaogangSu. World Scientific, 2009.
4. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press(2017)

BATCH 2020-2024

Course Code	Course Title						Core/Elective
PC 604 IT	NETWORK SECURITY AND CRYPTOGRAPHY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- Discuss fundamentals of IoT and its applications and requisite infrastructure
- Describe Internet principles and communication technologies relevant to IoT
- Discuss hardware and software aspects of designing an IoT system
- Identify concepts of cloud computing and Data Analytics
- Discuss business models and manufacturing strategies of IoT products

Course Outcomes:

Student will be able to

- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT – I

Security Concepts:Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

UNIT – II

Symmetric key Ciphers:Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.

UNIT – III

Cryptographic Hash Functions:Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service.

UNIT – IV

Transport-level Security:Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless

Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT – V
E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations.

Suggested reading:

- Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
- Cryptography and Network Security: AtulKahate, McGraw Hill, 3rd Edition

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PC651IT	Embedded System Lab						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
CProgr.UnixCommands	-	-	-	2	25	50	1

Course Objective

- To understand basic concepts and structure of embeddedsystems.
- To design and develop real time applications of embedded ystems

Course Outcomes

Student will able to

- Apply the basic concepts to develop an Interface for 8051 and ARMprocessors.

Demonstrate the RTOS Concepts by designing real timeapplications.

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) Microcontroller and C compiler (Keil, Ride etc.)to:

1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, Sensors, ADCs,Timers
2. Demonstrate Communications: RS232, IIC and CANprotocols
3. Develop Control Applications such as: Temperature Controller, Elevator Controller, TrafficController

B. Development and Porting of Real Time Applications on to Target machines such as Intel or other Computers using anyRTOS

Understanding Real Time Concepts using any RTOS through Demonstrationof:

1. Multi-Tasking
2. Semaphores
3. MessageQueues
4. Round-Robin TaskScheduling
5. Preemptive Priority based TaskScheduling
6. PriorityInversion
7. Signals
8. Interrupt ServiceRoutines

BATCH 2020-2024

CourseCode	CourseTitle						Core/Elective
PC652 IT	Machine Learning Lab						Core
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
C Progr.Unix Commands	-	-	-	2	25	50	1

Course Objectives: The main objectives of this course are:

- Demonstration of different classifiers on different data.
- Demonstrate unsupervised learning algorithms.
- To demonstrate dimensionality reduction techniques.
- Make use of real world data to implement machine learning models.

Course Outcome: Student will able to:

- Apply machine learning algorithms: dataset preparation, model selection, model building etc.
- Evaluate various Machine Learning approaches.
- Use scikit-learn, Keras and Tensorflow to apply ML techniques.
- Design and develop solutions to real world problems using ML techniques.
- Apply unsupervised learning and interpret the results.

1. Basic Data Preprocessing
   a) Installation of python environment/Anaconda IDE for machine learning: installing python modules/Packages like scikit-learn, Keras and Tensorflow etc.
   b)Programs involving pandas, Numpy and Scipy libraries.

2. Programs for classification
   1. Build models using linear regression and logistic regression and apply it to classify a new instance
   2. Write a program to demonstrate the following classifiers. Use an appropriate data set for building the model. Apply the model to classify a new instance.
      a) Decision tree
      b) K nearest neighbour
      c) Naïve bayes
      d) Support vector machine

3. Demonstration of Clustering algorithms using
a. k-means,
   b. Competitive learning
   Interpret the clusters obtained.

4. Implement Self-Organising Feature Map.

5. Write a program to implement
a) Linear Discriminant Analysis b)Principal Component Analysisin Python

BATCH 2020-2024

<table>
<tr><td>Course Code</td><td colspan="5">CourseTitle</td><td>Core/Elective</td></tr>
<tr><td>PC653 IT</td><td colspan="5">Mobile Application Development Lab</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">ContactHoursperWeek</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>JAVA Programming</td><td>-</td><td>-</td><td>-</td><td>2</td><td>25</td><td>50</td><td>1</td></tr>
<tr><td colspan="7">CourseObjectives
➢ To facilitate students to understand android SDK
➢ To help students to gain a basic understanding of Android application development
➢ To inculcate working knowledge of Android Studio development tool
CourseOutcomes
Studentwill able to
➢ Identify various concepts of mobile programming that make it unique from programming for other platforms.
➢ Critique mobile applications on their design pros and cons,
➢ Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
➢ Program mobile applications for the Android operating system that use basic and advanced phone features, and
➢ Deploy applications to the Android marketplace for distribution.</td></tr>
</table>

1. To develop a Simple Android/iOS Application that uses GUI components, Font and Colors.
2. To develop a Simple Android/iOS Application that uses Layout Managers and Event Listeners.
3. To develop a Simple Android//iOS Application that draws basic Graphical Primitives on the screen.
4. To develop a Simple Android//iOS Application that makes use of Database.
5. To develop an Android//iOS Application that makes use of Notification Manager.
6. To develop an Android/iOS Application that implements Multi threading.
7. To develop an Android//iOS Application that uses GPS location information.
8. To develop an Android//iOS Application that writes data to the SD Card.
9. To develop an Android//iOS Application that creates an alert upon receiving a message.
10. To develop an Android//iOS Application that makes use of RSS Feed.
11. To develop an Android//iOS Application to send an Email.
12. To develop a Simple Android/iOS Application for Native Calculator.
13. To develop a Android/iOS Application that creates Alarm Clock.

BATCH 2020-2024

<table>
<tr><td>Course Code</td><td colspan="5">CourseTitle</td><td>Core/Elective</td></tr>
<tr><td>PW654 IT</td><td colspan="5">MINI PROJECT–I</td><td>ProjectWork</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">ContactHoursperWeek</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>25</td><td>50</td><td>1</td></tr>
<tr><td colspan="8">CourseObjectives
➢ Todevelopcapabilitytoanalyseandsolverealworldproblemswithanemphasisonapplying/integratingknowledgeacquired.
➢ Totakeresponsibilityof the endproduct.
CourseOutcomes
Studentwill able to
➢ ImplementthesystemusingSQL,datastructures,C/C++,JAVA,Pythonand Differentsoftwareengineeringmodels</td></tr>
</table>

The Students are required to take one of larger projects listed in the suggested readings or assigned by the teacher, implement and submit the report. The workbooks and project reports should be evaluated.

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE621 IT	SOFTWARE TESTING AND QUALITY ASSURANCE						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- Study importance of Software Testing in Software Development
- Explore appropriate Software Testing Techniques for finding bugs in Software.
- Study various Software Testing Tools and Quality Assurance Methods

Course Outcomes:

Students will able to:

- Solve the problems using Software Testing techniques and Approaches.
- Apply various Software testing Techniques to find bugs in software.
- Use open source software Testing Tools.

  Apply various Software Quality Assurance Techniques to ensure the quality in software.

Unit-I

Basics of Software Testing: Testing in the Software Life Cycle & Test Levels: The General V-Model, W-Model, Component Test, Integration Test, System Test, Acceptance Test, Generic types of Testing Functional, Non Functional, Testing software structure, Regression Testing.

Unit-II

Static Testing, Dynamic Analysis: Structured Group Examinations – Reviews, Static Analysis -Control Flow Analysis & Data Flow Analysis, Tools for Static Testing

Unit-III

Test Management: Test Planning, Test Management, Test Process, Test Reporting, Incident Management – Test Log, Incident Reporting, Classification, Status 08

Unit-IV

Test Automation, Software Quality: Design and Architecture for Automation, Test Automation, Design and Architecture for Automation, Generic Requirements for test Tool/Framework, Criteria for selecting test tools, Testing of Object Oriented Systems 08

Unit-V

Software Measurement & Metrics: Measurement during Software Life Cycle Context, Defect Metrics, Metrics for software Maintenance & Requirements, Measurement Principles, Case study for Identifying Appropriate Measures & Metrics for Projects.

BATCH 2020-2024

Text Books:

- Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors
- Foundations of Software Testing, by Aditya P. Mathur – Pearson Education custom edition 2000.

Reference Books:

- Software Testing: Principles and Practices, by Srinivasan D and Gopalswamy R, PearsonEd, 2006.
- Software Testing & Quality Assurance Theory &PracticeByKshirasagarNaik&PriyadarshiTripathi, Wiley Student Edition.
- Software Quality Assurance Principles & Practice, by Nina S. Godbole, Narosa.
- Stephan H.Kan, Metric and Model in Software Quality Engineering, Addison Wesley, 1995.
- Roger S. Pressman, Software Engineering – A Practitioners Approach, Fifth Edition,McGraw Hill, 2001
- Advanced Software Testing, Vol. 2, Rex Black, SPD.

BATCH 2020-2024

CourseCode	CourseTitle						Core/Elective
PE622 IT	AdhocSensorNetworks						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives:

- Fundamentals of Ad hocnetworkandSensornetwork
- Differentroutingprotocols
- In-depth knowledgeonsensornetworkarchitectureand designissues
- SecurityissuespossibleinAdhocandSensor networks
- Programming platformsandtools

CourseOutcomes:

Studentwillbeableto

- KnowthebasicsofAdhocnetworksandWirelessSensor Networks
- Applythisknowledgeto identifythesuitable routingalgorithmbasedonthenetworkanduserrequirement
- Applytheknowledgetoidentifyappropriate physical andMAC layerprotocols
- Understandthetransportlayerandsecurityissuespossibleinadhocandsensornetworks.
- Befamiliarwith theOS usedinWirelessSensorNetworksandbuildbasicmodules

UNITI – ADHOCNETWORKS–INTRODUCTIONANDROUTINGPROTOCOLS

ElementsofAdhocWirelessNetworks,IssuesinAdhocwirelessnetworks,Examplecommercialapplicationsof Adhocnetworking,AdhocwirelessInternet,IssuesinDesigninga Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, TableDriven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–DemandRoutingprotocols–AdhocOn–DemandDistanceVectorRouting(AODV)

UNITII – SENSORNETWORKS–INTRODUCTION&ARCHITECTURES

ChallengesforWirelessSensorNetworks,EnablingTechnologiesforWirelessSensorNetworks, WSN application examples, Single-Node Architecture - Hardware Components,Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios,TransceiverDesignConsiderations,OptimizationGoals andFigures ofMerit.

UNITIII – WSNNETWORKINGCONCEPTSANDPROTOCOLS

MACProtocolsforWirelessSensorNetworks,LowDutyCycleProtocolsAndWakeupConcepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS,Schedulebasedprotocols—LEACH,IEEE802.15.4MACprotocol,RoutingProtocols-Energy EfficientRouting,ChallengesandIssues in Transportlayerprotocol.

UNITIV – SENSORNETWORKSECURITY

Network Security Requirements, Issues and Challenges in Security Provisioning, NetworkSecurityAttacks,Layerwiseattacksinwirelesssensornetworks,possiblesolutionsforjamming, tampering, black hole attack, flooding attack. Key Distribution and Management,SecureRouting—SPINS,reliabilityrequirementsinsensornetworks.

UNITV – SENSORNETWORKPLATFORMSANDTOOLS

Sensor Node Hardware – Berkely Motes, Programming Challenges, Node =level software platforms – TinyOS, nesC, CONTIKIOS,Node-levelSimulators–NS2anditsextensionto sensor networks, COOJA, TOSSIM, Programming beyond individual nodes — State centricprogramming.

Text Books:

1.C.SivaRamMurthyandB.S.Manoj,―AdHocWirelessNetworksArchitecturesandProtocols‖,Prentice Hall,PTR,2004.(UNITI)

2.HolgerKarl,Andreaswillig,―ProtocolandArchitectureforWirelessSensorNetworks‖,Johnwileypublication,Jan2006.(UNITII-V)

REFERENCE BOOKS

1. FengZhao,LeonidasGuibas,―WirelessSensorNetworks:aninformationprocessingapproach‖,Elsevierpublication,2004.
2. CharlesE.Perkins,―AdHocNetworking‖,AddisonWesley,2000.
3. I.F.Akyildiz,W.Su,Sankarasubramaniam,E.Cayirci,―Wirelesssensornetworks:asurvey‖,computer networks,Elsevier,2002,394-422.

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE623 IT	CLOUD COMPUTING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- To introduce basic concepts cloud computing and enabling technologies
- To learn about Auto-Scaling, capacity planning and load balancing in cloud
- To introduce security, privacy and compliance issues in clouds
- To introduce cloud management standards and programming models

Course Outcomes

Student will be able to

- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Create virtual machine images and deploy them on cloud
- Identify security and compliance issues in clouds.

UNIT – I

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning

UNIT – II

Scaling in the Cloud, Capacity Planning , Load Balancing, File System and Storage

UNIT – III

Multi-tenant Software, Data in Cloud , Database Technology, Content Delivery Network, Security Reference Model , Security Issues, Privacy and Compliance Issues

UNIT – IV

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT – V

Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Readings:

1. Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017
2. Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.
3. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―Distributed and Cloud Computing From ParallelProcessing to the Internet of Things‖,Elsevier, 2012.

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE624 IT	DATA SCIENCE						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Introduce the mathematical foundations of data science.
- Introduce data science algorithms.
- Introduce data analytics problem solving framework.
- Introduce R as a programming language.

Course Outcomes

Student will be able to

- Understand flow process for data science problems ¬ Classify data science problems
- Use various data structures and packages in R for data visualization and summarization
- Use linear, non-linear regression models and techniques for data analysis
- Use clustering methods ,time series forecasting and text mining

UNIT-I Introduction: Introduction to data science , Linear Algebra for data science , Solving Linear equations, Linear Algebra - Distance, Hyperplanes, Halfspaces, Eigenvalues, Eigenvectors

UNIT-II Statistical Modeling: Random variables,Probability mass/density functions,samplestatistics,Hypothesis testing Predictive Modeling:Linear Regression, Simple Linear Regression Model Building, Multiple Linear Regression,Logistic Regression

UNIT-III Introduction to R: Downloading and Installing R, IDE and Text Editors, Handling Packages in R. Getting Started with R: Working with Directory, Data Types in R, Few Commands for Data Exploration. Loading and Handling Data in R: Expression,Variables, Functions, Missing Values Treatment in R, Vectors, Matrices, Factors, List, Aggregation and Group Processing of a Variable, Simple Analysis Using R, Methods for Reading Data.

UNIT-IV Exploring Data in R: Introduction, Data Frames, R Functions for Understanding Data I DataFrames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values,InvalidValuesandOutliers,DescriptiveStatistics,Spotting Problems in Data with Visualization. Linear Regression and Logistic Regression Implementation in R, K - Nearest Neighbours (kNN), K-Nearest Neighbours implementation in R, K - means Clustering, K - means Implementation in R.

UNIT-V Text Mining: Definition, Challenges,Text Mining in R,General Architecture of Text Mining Systems,Preprocessing of Documents in R. Time Series in R: Introduction,What is Time Series Data, Reading Time Series Data, Decomposing Time Series Data,Forecasts Using Exponential Smoothing,ARIMAModels Social Network Analysis, Reading data from relational databases-MySQL,Reading data from NoSQL databases- MongoDB.

Suggested Readings:

1.Data Science for Engineers by Prof.RagunathanRengasamy, Prof. Shankar Narasimham, IIT Madras.

2. Data Analytics using R by Seema Acharya ,McGraw Hill, 2018
3. R-Viswa Viswanathan, Shanthi Viswanathan - R Data Analysis Cookbook -Packt Publishers.
4. Introduction to Linear Algebra by Gilbert Strang
5. Applied Statistics and Probability for Engineers by Douglas Montgomery
6. Nina Zumel, Practical Data Science with R,ManningPublications,2014.
7. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists,O'Reilly,2017. 8. Hadley Wickham and Garrett Grolemund, Rfor DataScience,O'Reilly,2017

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
PE625 IT	INFORMATION STORAGE AND MANAGEMENT						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Tointroducetheconcept ofstorage,emphasizethesignificanceofstoragetechnologiesinITinfrastructure..
- Toprovidesa comprehensive eunderstandingofthevariousstorageinfrastructurecomponentsin datacenterenvironments.
- Tolearnaboutthearchitectures,features,andbenefitsofIntelligentStorageSystems.
- TounderstandvariousstoragenetworkingtechnologiessuchasFC-SAN,NAS,andIP-SAN;long-termarchivingsolution– CAS.
- Toknowabout variousbusinesscontinuitysolutionssuchasbackupandreplication.
- Tounderstandinformationsecurityroleinstoragenetworksandthe emergingfieldofstoragevirtualizationincludingstorageresourcemanagement

Course Outcomes

Aftercompletingthiscourse,thestudentwillbeableto

- Evaluatestoragearchitecture;understandlogicalandphysicalcomponentsofastorage infrastructureincludingstoragesubsystems.
- DescribestoragenetworkingtechnologiessuchasFC-SAN,NAS,IP-SANanddataarchival solution–CAS.
- Identifydifferentstoragevirtualizationtechnologiesandtheirbenefits.
- Understandandarticulatebusinesscontinuitysolutionsincluding,backupandrecovery technologies,andlocalandremotereplicationsolutions.
- Identifyparametersomanagingandmonitoringstorage infrastructure anddescribecommon Storage

UNIT – I

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, DataCenterInfrastructure,VirtualizationandCloudComputing.DataCenterEnvironment:Application,Database Management System (DBMS), Host, Connectivity, Storage, Disk Drive Components, DiskDrivePerformance,HostAccesstoData,Direct-AttachedStorage,StorageDesignBasedonApplication,DiskNativeCommandQueuing,IntroductiontoFlashDrives.

UNIT – II

DataProtection:RAID,ImplementationMethods,ArrayComponents,Techniques,Levels,RAIDImpacton DiskPerformance,RAIDComparison,HotSpares.IntelligentStorageSystems:ComponentsofanIntelligent StorageSystem,StorageProvisioning,TypesofIntelligent StorageSystems.

UNIT – III

Fibre Channel Storage Area Networks: Overview, The SAN and Its Evolution, Components of FCSAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Zoning, FC SAN Topologies,Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network-Attached Storage:General-

BATCH 2020-2024

PurposeServersversusNASDevices,BenefitsofNAS,FileSystemsandNetworkFileSharing,Components of NAS, I/O Operation, Implementations, File-Sharing Protocols, Factors Affecting NASPerformance,FileLevelVirtualization.Object-BasedandUnifiedStorage:Object-BasedStorageDevices,ContentAddressedStorage,CASUseCases.

UNIT – IV

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning LifeCycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive:BackupPurpose,BackupConsiderations,BackupGranularity,RecoveryConsiderations,Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NASEnvironments. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency,LocalReplicationTechnologies.RemoteReplication:ModesofRemoteReplication,Remote ReplicationTechnologies,Three-SiteReplication.

UNIT – V

Cloud Computing:Cloud Enabling Technologies, CharacteristicsofCloud Computing, BenefitsofCloud Computing Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure,Cloud Challenges. Securing the Storage Infrastructure: Information Security Framework, Risk Triad,Storage Security Domains, Storage Security Domains. Managing the Storage Infrastructure:
MonitoringtheStorageInfrastructure,StorageInfrastructureManagementActivities,StorageInfrastructure ManagementChallenges,DevelopinganIdealSolution,InformationLifecycleManagement.

SuggestedReadings:

1. EMCCorporation,InformationStorageandManagement, WileyIndia,2ndEdition,2011.
2. RobertSpalding,StorageNetworks:TheComplete Reference,TataMcGrawHill,Osborne,2003.
3. MarcFarley,BuildingStorageNetworks,TataMcGrawHill,Osborne,2ndEdition,2001.
4. MeetaGupta,StorageAreaNetworkFundamentals,PearsonEducationLimited,2002.

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
OE601IT	DATABASESYSTEMS(openElective)						Elective
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

CourseObjectives:

- TointroduceE-RModelandNormalization
- TolearnformalandcommercialquerylanguagesofRDBMS
- Tounderstandtheprocessofdatabaseapplicationdevelopment
- Tostudydifferentdatabasearchitectures
- Tointroducesecurityissuesindatabases

CourseOutcomes:

Studentwillbeableto:

- UnderstandthemathematicalfoundationsofDatabasedesign
- ModelasetofrequirementsusingtheEntityRelationship(E-R)Model,transformanBE-Rmodelintoarelationalmodel,andrefinetherelationalmodelusingtheoryofNormalization
- UnderstandtheprocessofdevelopingdatabaseapplicationusingSQL
- UnderstandthesecuritymechanismsinRDBMS

UNITI

Introduction to DBMS and its architecture, Design:Conceptualdesign(E-Rmodeling),therelationalmodel,normalization: 1NF, 2NF, 3NF, BCNF

UNITII

Queries:Basic SQL queries,relationalalgebra,relationalquerylanguagesandqueries(namelySQL),select,project,join, union,intersection,except,,DML, DDL

UNITIII

Applications:applicationdevelopment,databaseapplicationinterfaces(e.g.,JDBC),internetapplications,properdatabaseapplicationparadigms,transactions,transactionmanagement,concurrency control,

UNITIV

DistributedDB,Architecture,QueryprocessingandOptimizationinDistributedDB,IntroductiontoNoSQLDatabases,Graphdatabases,ColumnarDatabases

UNITV

IntroductiontoDatabaseSecurityIssues,Securitymechanism,DatabaseUsersandSchemas,Privileges

SuggestedBooks

1. JimMeltonandAlanR.Simon.SQL1999:UnderstandingRelationalLanguageComponents.FirstEdition,1999.MorganKaufmannPublishers.
2. Don Chamberlin.Using the New DB2: IBM's Object-Relational DatabaseSystem.FirstEdition, 1996.Morgan Kaufmann Publishers.
3. DatabaseSystemConceptsSixthEdition,byAbrahamSilberschatz,HenryFKorth,SSudarshan,McGraw-Hill Education
4. FundamentalsofDatabaseSystems,Elmasri,Navathe,SixthEdition,Addison-Wesley

BATCH 2020-2024

Course Code	CourseTitle						Core/Elective
OE 602 IT	Introduction to DataStructures						OpenElective
Prerequisites	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
PPS	3	-	-	-	30	70	03

CourseObjectives:

- Todevelop basic understandingoftimeandspacecomplexityofan algorithm
- Tounderstandneedofdatastructuresforefficientstorageandeasyaccessofdata.
- Tointroducebasiclineardatastructuresandoperationsonthem.
- Tointroducenon-linear datastructuresandtheirrepresentations.
- Tounderstandvarioussortingandsearchingtechniquesandtheirefficiency.

CourseOutcomes:

Aftercompletingthiscourse, students willbeableto:

- Emphasizeonneedof data structureinwritingefficient algorithms.
- Distinguishbetweenlinearandnon-lineardatastructuresandtheirapplicationsinrealworld problems.
- Explainrepresentationofdifferentdatastructuresincomputersystems.
- Explaindifferentoperationsondatastructuresandwritealgorithmsforthem.
- Explaindifferentsortingtechniquesandwritealgorithmsforthem.

Unit–I:

IntroductiontoDataStructures–Definition,BasicConcepts,ImplementationofDataStructures.
Arrays:Definition,Terminology,OneDimensionalArrays,
MemoryAllocationandBasicOperationson arrays.

Unit–II:

Stacks:Introduction,Definition,RepresentationofaStack,OperationsonaStack,ApplicationsofaStack:Recursion, andEvaluationofanArithmetic Expression.
Queues:Introduction,Definition,RepresentationofaQueue,VariousQueueStructures:CircularQueue.

Unit–III:

LinkedLists:Definition,SingleLinkedList–RepresentationandbasicOperations,CircularLinked List,DoubleLinkedList,ImplementingStackandQueueusingLinkedList.

Unit–IV:

Trees –Basic Terminologies, Definition, Representation of Binary Trees, Operations onBinaryTrees,BinarySearch Trees.
Graphs: Introduction, Terminology, Representation of Graphs, Graph Traversal Techniques,MinimumSpanningCostTrees.

BATCH 2020-2024

Unit–V:

Searching and Sorting: Linear Search, Binary Search, SortingAlgorithms:SelectionSort,BubbleSort,InsertionSort,andMergeSort.

SuggestedReadings:

1. ClassicDataStructures, DebasisSamanta,SecondEdition,PHI,2006.
2. FundamentalsofDatastructuresinC,SecondEdition,E.Horowitz,S.SahniandSusan,Anderson-Freed,Universities Press, 2007.