Panchajanya Vidya Peetha Welfare Trust (Regd)

Dr. Ambedkar Institute of Technology

An Autonomous Institution, Affiliated to Visvesvaraya Technological University, Belagavi,
Aided by Govt. of Karnataka, Approved by All India Council for Technical Education (AICTE), New Delhi
Accredited by NBA and NAAC with 'A' Grade
BDA Outer Ring Road, Mallathalli, Bengaluru - 560 056

Ref. No. ..... *Date :* .....

M. Tech in Computer Science & Engineering
2020-2022 Scheme

The following list of subjects are identified as courses focused on Employability and Skill Development in the scheme 2020-2022

Sl. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ , Entrepreneurship/ Skill development
1	Advanced Operating System	20SCS151	Employability &Skill development
2	Advances in Computer Network	20SCS152	Employability &Skill development
3	Deep Learning	20SCS262	Employability &Skill development
4	Parallel Computing with GPU Architecture	20SCS154	Employability &Skill development
5	Introduction to Block chain Technology	20SCS161	Employability &Skill development
6	Advanced Algorithms and Data structure	20SCS162	Employability &Skill development
7	Cyber Security and Cyber Laws	20SCS163	Employability &Skill development
8	Wireless Networks & Mobile Computing	20SCS254	Employability &Skill development
9	Natural Language Processing	20SCS251	Employability &Skill development
10	Cryptography & Network Security	20SCS253	Employability &Skill development
11	Computational Intelligence	20SCS164	Employability &Skill development
12	Business Analytics	20SCS261	Employability &Skill development
13	Agile Methodologies	20SCS262	Employability &Skill development
14	Storage Area Network	20SCS263	Employability &Skill development
15	Intelligent Systems	20SCS264	Employability &Skill development

HOD,CSE

Principal

Dr. Ambedkar Institute of Technology
Bengaluru-560 056

	Course Title: Advanced Operating System		
	Course Code: 20SCS151	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week :**
	Exam Duration :3hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours :**

CourseObjectives:	**Description**
	1. To learn the fundamentals of Operating Systems. 2. To learn the mechanisms of OS to handle processes and threads and their communication 3. To learn the mechanisms involved in memory management in contemporary OS 4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, dead lock detection algorithms and agreement protocols 5. To know the components and management aspects of concurrency management 6. To learn programmatically to implement simple OS mechanisms

Unit No	**Syllabus Content**	**No of Hours**
1	Operating System Overview, Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems: What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIXSVR4 Process Management TextBook 2: Chapter2& 3	**10**
2	Threads, SMP, and Microkernel, Processes and Threads, Symmetric Multiprocessing(SMP), Microkernel, Solar is Thread and SMP Management, Virtual Memory: hardware and control structures, Operating System Software, UNIX and Solaris Memory Management. TextBook2: Chapter4 &8	**11**
3	Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX process Scheduling, Distributed Operating System: Motivation, Types of Network-based OS, Network structure, TextBook 1:Chapter10 TextBook 2:Chapter16	**10**

4	Distributed File system: Background, Naming and transparency, Remote File Access, State full and Stateless services. Distributed Synchronization: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election algorithm and Reaching agreement TextBook 1:Chapter17& 18	**11**
5	**Self-StudyComponent:** File Management: Overview, file Organization and access, file directories, File sharing, Record blocking, secondary storage management, File System Security, UNIX file Management. Case Study: Linux system, Design Principles, kernel modules, process management, scheduling, memory management, file system, input and output, inter process communication, network structure, security Text Book 1: Chapter 21 Text book 2: Chapter 12	**10**

NOTE:

1. IncludeSelf studycomponent inanyoneof theUnit.

2. TotalnumberofCOsisdecidedby concernedCourseCoordinator

CourseOutcomes	**Description**	**RBTLevels**
CO1	Understand the structure and components of Sand their working mechanism	**R1R2 R3**
CO2	Analyze and design the applications to run in parallel using OS Modules	**R3R4**
CO3	Analyze and implement the mechanisms involved for sharing Resources in distributed and time sharing environments	**R2R4**
CO4	Conceptualize the components involved in designing contemporaryOS	**R3**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**2**			
CO2	**3**	**3**	**3**		**2**
CO3	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**2**	

Strong-3 Medium-2 Weak-1

TEXTBOOKS:

1. AviSilberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 9th Edition,John wiley&Sons, Inc.ISBN:978-1-118-09375-7, ©2013
2. William Stallings, Operating Systems: Internals and Design Principles, 8th editionPearsonEducation Limited,2014ISBN: 1292061944,9781292061948

REFERENCEBOOKS:

1. D.MDhamdhere:Operatingsystems-AconceptbasedApproach,3rdEdition,TataMcGraw-Hill, 2012.
2. P.C.P.Bhatt:IntroductiontoOperatingSystemsConceptsandPractice,3rdEdition,PHI, 2010.
3. HarveyMDeital:Operatingsystems,3rdEdition,PearsonEducation,2011.

SELFSTUDYREFERENCES/WEBLINKS:

1. **Operating System By Prof. Sorav Bansal, IIT Delhi,https://swayam.gov.in/nd1_noc20_cs04/preview**
2. **LinuxKernel Programming- IPCb/w User space and Kernel Space by udemy https://www.udemy.com/course/netlinksockets/**
3. **Introuction to Operating Systems from Udemy https://classroom.udacity.com/courses/ud923/lessons/3056258560/concepts/33061990140 923**

COURSE COORDINATOR:	**Dr. K R Shylaja**

	Course Title: Advances in Computer Networks		
	Course Code: 20SCS152	**No. of Credits: 3:0:0(L-T-P)**	**Number of lecture hours/week: 4**
	Exam Duration :3hours	**CIE + SEE = 50+50**	**Total Number of Contact Hours:52**

Course Objectives:	**Description**
	1. Discuss with the basics of Computer Networks. 2. Compare various Network architectures. 3. Discuss various fundamental network protocols.. 4. Define and analyze network traffic, Congestion Control and Resource Allocation.

Unit No	**SyllabusContent**	**No of Hours**
1	**Foundation:** Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Reliable Transmission, Exercise Problems Stop-and-Wait Protocol, Sliding Window protocol.	**11**
2	**Inter networkingI:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internet working(IP), Exercise Problems. What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and class less addressing, Address Translation (ARP), Host Configuration(DHCP), Error Reporting(ICMP),	**11**
3	**Internetworking-II:** Network as a Graph, Distance Vector(RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version6(IPv6).	**10**
4	**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP),End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmitand Fast Recovery	**10**

5	**Congestion Control and Resource Allocation** Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management(SNMP)	**10**

CourseOutcomes	Description
CO1	List and classify network services, protocols and architectures, explain Why they are layered.
CO2	Compare various network architectures
CO3	Analyze various Network protocols and their applications
CO4	Explain develop effective communication mechanisms using techniques Like connection establishment, queuing theory, recovery etc.
CO5	Define and analyze network traffic, congestion control and resource allocation

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**			
CO2	**3**	**2**			**1**
CO3		**3**			**2**
CO4			**3**	**2**	**1**
CO5	**3**	**2**			

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. LarryPetersonandBruceSDavis"ComputerNetworks:ASystemApproach"5thEdition, Elsevier -2014
2. DouglasEComer,"InternetworkingwithTCP/IP,Principles,ProtocolsandArchitecture"6th Edition, PHI-2014

REFERENCEBOOKS:

1. Uyless Black, "Computer Networks Protocols , Standards and Interfaces" 2nd Edition-PHI.
2. BehrouzA Forouzan,"TCP/IPProtocolSuite"4thEdition–TataMcGraw-Hill

COURSECOORDINATOR: **SHAMSHEKHARPATIL**

	Course Title: Deep Learning		
	Course Code: 20SCS262	**No. of Credits: 3: 0:0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3 hours	**CIE+Assignment + SEE = 50+50=100**	**Total No. Of Contact Hours : 52**

Course Objectives:	**Description**
	1. Enable students to understand the basic concepts of deep leaning 2. Studentswillacquire knowledgeon differentarchitectures ofANN 3. Enable students to analyze and solve real-time problems using deeplearning techniques

Unit No	**Syllabus Content**	**No ofHours**
1	**Deep Feed forward Networks:** Gradient Based Learning, Hidden Units, Architecture Design, Back-Propagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and ParameterSharing, Sparse Representations, Bagging, Dropout.	**10**
2	**Optimization for Training Deep Models:** How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling asan Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.	**11**
3	**Sequence Modelling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Longshort-term memory	**10**
4	**Auto encoders:** Under complete Auto encoders, Regularized Auto encoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Auto encoders, Contractive Auto encoders, Applications of Auto encoders	**10**

5	**Self Study Component:** Structured Probabilistic Models For Deep Learning: The challenge of unstructured modelling, Using graphs to describe model structure: Directed, Undirected, Partition function, Energy-based models, Factor graphs; Sampling from graphical models, Advantages of structured modelling, learning about dependencies, Inference and approximate inference, The deep learning approach to structured probabilistic models	**11**

Course Outcomes	Description	RBT Levels
CO1	Understand and state basic concepts of neural network, its applications and its learning mechanisms	R1 R2
CO2	Understand and Analyze the requirement of Recurrent, Recursive Nets and Auto-encoder models in real time applications	R2 and R3
CO3	Analyze different Network Architectures, learning asks, Convolutional networks	**R3**
CO4	Evaluate and compare the solutions by various Neural Network approaches for a given problem	**R4**

CO-PO Mapping	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**
CO1	**3**	**3**	**2**	**2**	**2**	
CO2	**3**	**3**	**3**	**2**	**2**	
CO3	**3**	**3**	**3**	**3**	**2**	
CO4	**3**	**3**	**3**	**3**	**3**	**2**

Strong-3 Medium-2 Weak-1

TEXTBOOKS:

1. IanGoodfellow,YoshuaBengio,andAaronCourville:Deeplearning:The MITPress, 2016, 800 pp, ISBN: 0262035618.

REFERENCE BOOKS:

1. NeuralNetworks:AsystematicIntroduction,RaúlRojas1996.SpringerPublisherISBN 978-3-642-61068-4
2. PatternRecognitionandmachineLearning,ChristopherBishop2007.Springerpublisher,ISBN 978-0-387-31073-2
3. NeuralNetworks–AComprehensiveFoundation,SimonHaykin,SecondEdition,PHI, 2005.
4. Introduction to Artificial Neural Networks, GunjanGoswami, S.K. Kataria& Sons;2012 Edition, ISBN-13: 978-9350142967.
5. Fundamentalsof Deep Learning: Designing Next-Generation Machine IntelligenceAlgorithms, Nikhil Buduma, by O'Reilly Publications, 2016 Edition, ISBN-13: 978-1491925614.

WEBLINKS:

	Course Title: Parallel Computing with GPU architecture.		
	Course Code: 20SCS154	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours :52**

Course Objectives:	**Description**
	1. Understand the need of parallel algorithms. 2: Decomposition strategies of problem. 3: Knowledge about the measure the performance of parallel algorithm. 4. Study applications of parallel computing. 5. Understanding the programming with MPI, Open MP.

Unit No	**Syllabus Content**	**No ofHours**
1.	Introduction to Parallel Computing: Implicit Parallelism, Limitations of Memory, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.	**10**
2.	Design Decomposition Techniques: Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models Basic Communication Operations One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather.	**10**
3.	Performance Metrics for parallel systems. The effect of Granularity and Data Mapping on Performance. The Scalability of parallel systems, Iso efficiency Metric of scalability, sources of parallel overhead, Minimum execution time and minimum cost-optimal execution time.	**10**
4.	Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues, Sorting Networks, Bubble Sort and its Variants, Quick sort ,Bucket and Sample Sort.	**10**
5.	**Self Study Components**:Open MP, MPI, CUDA/OpenCL, Chapel, etc. Thread basics, Work Sharing constructs, Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers, The MPI Programming Model, MPI Basics, Global Operations, Asynchronous Communication, Modularity, Other MPI Features Basic of GPGPU,CUDA Programming model, CUDA memory type Performance Issues.	**12**

Course Outcomes	**Description**

CO1	Students are able to describe principles of parallel algorithm design.
CO2	Students are able to analyze analytical modeling of parallel programs, programming Models for shared-and distributed-memory systems.
CO3	Students are able to analyze performance evaluation of Prallel algorithms.
CO4	Students are able to design parallel algorithms for matrix, graph and sorting operations.
CO5	Students are able to explore how to use a GPU as a general proceesing device.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**2**

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. IntroductiontoParallelComputing(2nded.),byAnanthGrama,AnshulGupta,GeorgeKarypis,and VipinKumar.
2. HighPerformanceClusterComputing:ProgrammingandApplications,Volume2ByBuyy aRaijkumar.
3. CUDAProgramming: ADeveloper'sGuidetoParallelComputingwithGPUsbyshanecook.

REFERENCEBOOKS:

1. Introduction to High-Performance Scientific Computing, Victor Eijkhout, 2011. http://taccweb.austin.utexas.edu/staff/home/veijkhout/public_html/Articles/EijkhoutIntroToHPC.pdf
2. High Performance Computing, Charles Severance, 1998.http://cnx.org/content/col11136/latest/
3. MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, DavidWalker, andJackDongarra,1996.http://www.netlib.org/utk/papers/mpi-book/mpi-book.html
4. MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, DavidWalker, andJackDongarra,1996.http://www.netlib.org/utk/papers/mpi-book/mpi-book.html
5. Designing and Building Parallel Programs, Ian Foster, 1995.http://www.mcs.anl.gov/~itf/dbpp/
6. Parallel Programmingin CwithMPIandOpenMP, Michael J.Quinn,McGraw-Hill.

COURSE COORDINATOR:	**Dr. PrabhaR**

	Course Title: Introduction to Block chain Technology		
	Course Code: 20SCS161	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3hours	**CIE+ SEE= 50+50**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To learn fundamentals of Blockchain Technology. 2. To apply the crypto graphic primitives in making the Block chain model robust. 3. To be familiar with Consensus Algorithm. 4. To learn and apply concept of Decentralized in real life applications.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction to Block chain** What is Block chain, Reality about Block chain and How Block chain works, Block chain Architecture and Platforms (BigChainDB, corda, Etherumetc.), Digital Ledger Technology, Peer–to-Peer Network, Centralized, Decentralized and Distributed Networks, Layers of Block chain, why Block chain is important, Smart Contracts, Block in a Block chain, Transaction, Permission less and Permissioned Block chain, Consortium Block chain, The Chain and the Longest Chain, Distributed Consensus, By zantine Fault Tolerant Consensus Methods	**11**
2	**Crypto Primitives Cryptographic** Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency. **Bitcoin:** Creation of coins, Payments and double spending, FORTH–the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.	**10**

3	**Mining and Consensus** Why Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW), Hash cash PoW, Attacks onPoW and the monopoly problem, Proof of Stake (POS), Round Robin Consensus Algorithm, Proof of Authority, Proof of Burn (POB), Proof of Elapsed Time, Consensus Comparison Matrix, Ledger Conflicts and resolution.	**10**
4	**Privacy, Security Issues in Block chain** Pseudo-anonymity vs. anonymity, ZcashandZk –SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51%attacks –advent of algorand, and Sharding based Consensus algorithms to prevent these attcks.	**10**
5	**Self-Study Component** DECENTRALIZED APPLICATIONS(DAPPS) Applications - Applications of Block chain in Healthcare, egovernance, anomaly detections, use cases, trends on blockchains, serverless blocks, scalability issues, blockchain on clouds. hyperledger– Fabric architecture, implementation, networking, fabric transactions, demonstration, smart contracts.	**11**

Course Outcomes	**Description**	**RBTLevels**
CO1	Acquire the basic knowledge of Blockchain technology	**L1,L2**
CO2	Apply the cryptographic primitives in making the Blockchain Model robust.	**L3**
CO3	Analyze various mining and Consensus algorithms used in Blockchain	**L4**
CO4	Aware about privacy and security issues in Blockchain	**L2**
CO5	Design and understand various applications using Blockchain.	**L5**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**
CO1	**3**		**1**		**1**	**1**
CO2	**2**	**1**	**1**	**1**	**1**	**1**

CO3	**2**	**2**	**2**	**1**	**1**	**1**
CO4	**1**	**2**	**1**	**1**	**1**	**1**
CO5	**1**	**2**	**2**	**2**	**3**	**1**

Strong-3 Medium-2 Weak-1

TEXTBOOKS:

1. ArvindNarayanan,"BitcoinandCryptocurrencyTechnologies:AComprehensiveIntroduction",PrincetonUniversityPress,July 19, 2016
2. "S.Shukla,M.Dhawan, S.Sharma,S.Venkatesan,'BlockchainTechnology: CryptocurrencyandApplications',OxfordUniversityPress,2019.

REFERENCEBOOKS:

1. AndreasM. Antonopoulos, Mastering Bitcoin,O'Reilly,2014
2. MelanieSwa,Blockchain:BlueprintforanewEconomy,O'Reilly,2015
3. Antony Lewis, The Basics of Bitcoin and Blockchain.
4. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain-ABeginner'sGuidetoBuildingBlockchainSolutions,APress,2018

SELFSTUDYREFERENCES/WEBLINKS:

1. **Imran Bashir, Mastering Blockchain, Packt Publishing, Birmingham, UK 2016**
2. **https://swayam.gov.in/nd1_noc19_cs63/preview**

COURSECOORDINATOR:	**Dr.SIDDARAJU**

	Course Title: Advance Algorithms and Data Structure		
	Course Code: 20SCS162	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week : 04**
	Exam Duration :3hours	**CIE+ SEE= 50+50**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To learn implement in iterative and recursive optimized solutions 2. To learn the graph search algorithms. 3. To study network flow problems. 4. To study the working mechanism of advanced data structures 5. To understand the application of hashing technique

Unit No	**Syllabus Content**	**No of Hours**
1	**Review of Analysis Techniques:** Growth of Functions: Asymptoticnotations; Standard notations and common functions; Recurrences andSolution of Recurrence equations- The Course substitution method, Therecurrence – tree method, The master method; Amortized Analysis:Aggregate, Accounting and Potential Methods	11
2	**Graph Algorithms:** Bellman - Ford Algorithm; Single source shortestpathsinaDAG;Johnson'sAlgorithmforsparsegraphs;FlownetworksandFord-Fulkerson method; Maximum bipartite matching.	10
3	**Hash Tables**, Direct-address tables, Hash tables, Hash functions, Open addressing, Perfect hashing, Heaps Maintaining the heap property, Building a heap, The heap sort algorithm, Priority queues, Binomial heaps, Fibonacci heaps.	10
4	**Binary Search Trees**, What is a binary search tree? Querying a binary search tree, Insertion and deletion, Randomly built binary search trees, Red-Black Trees, Properties of red-black trees, Rotations, Insertion Deletion	11
5	**Application to Splay Trees. External Memory ADT-B-Trees. Priority Queues, B-Trees**, Definition of B-trees, Basic operations on B-trees, Deleting a key from a B-tree, Structure of Fibonacci heaps,	10

NOTE:

1. IncludeSelf studycomponent inanyoneof theUnit.

2. TotalnumberofCOsisdecidedby concernedCourseCoordinator

Course Outcomes	Description	RBTLevels
CO1	Analyze and solve the time complexity of iterative, recursive and graph based algorithms	**R2,R3,R4**
CO2	Interpret the logic and determine the suitable operational mechanism of data structures for a real-time applications	**R2,R3,R4**
CO3	Investigate and Analyze the optimized operations on data structures	**R4**
CO4	Implement projects using best suitable data structures for real Time applications using modern programming tool/simulation.	**R5**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**		
CO2	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**

Strong-3 Medium-2 Weak-1

TEXTBOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rdEdition,Prentice-Hall ofIndia,2010.ISBN:9780262033848

REFERENCEBOOKS:

1. EllisHorowitz,SartajSahni,S.Rajasekharan:FundamentalsofComputerAlgorithms,2nd Edition, Universitiespress, 2007,ISBN8173716129, 9788173716126
2. Horowitz,Sahani,DineshMehata,—FundamentalsofDataStructuresinC++‖,Galgotia Publisher, ISBN: 8175152788, 9788175152786.
3. M Folk, B Zoellick, G. Riccardi, —File Structures‖, Pearson Education, ISBN:81-7758-37-5
4. Peter Brass, —Advanced Data Structures‖, Cambridge University Press, ISBN: 978-1-107-43982-5

SELFSTUDYREFERENCES/WEBLINKS:

1. **Introduction to algorithms and analysis By Prof. SouravMukhopadhyay | IITKharagpur**
   https://swayam.gov.in/nd1_noc20_cs93/preview
2. **KhanAcademycourseonadvanced algorithmsanddatastructure**

COURSECOORDINATOR:	**Dr.KRShylaja**

	Course Title: Cyber Security and Cyber laws		
	Course Code: 20SCS163	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours :52**

Course Objectives:	**Description**
	1. To provide an understanding Computer forensics fundamentals 2. To analyze various computer forensics technologies 3. To provide computer forensics systems 4. To identify methods for data recovery. 5. To apply the methods for preservation of digital evidence

Unit No	**Syllabus Content**	**No of Hours**
1.	**Computer Forensics Fundamentals** **I**ntroduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/ Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology.	**10**
2.	**Types of Computer Forensics Technology** Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware. Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised, Internet Tracing Methods, Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls, Biometric Security Systems.	11
3.	**Types of Computer Forensics Systems** Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems. Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems, Identity Theft, Biometric Security Systems, Homel and Security Systems	11

4.	**Data Recovery** Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data. **Evidence Collection and Data Seizure** Why Collect Evidence?, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of Collection, Art facts.	10
5.	**Self study component:** Duplication and Preservation of Digital Evidence Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image Verification and Authentication Special Needs of Evidential Authentication, Practical Considerations.	**10**

Course Outcomes	**Description**
CO1	To explore the definition of computer forensics fundamentals.
CO2	Describe the types of computer forensics technology
CO3	Analyze various computer forensics systems
CO4	Illustrate the methods for data recovery, evidence collection and data seizure.
CO5	Summarize duplication and preservation of digital evidence.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**3**	**2**

TEXTBOOKS:

1.JohnR.Vacca,ComputerForensics:Computer CrimeScene Investigation,2ndEdition,Charles,RiverMedia, 2005 ISBN-13: 978-1584503897.

REFERENCEBOOKS:	
REFERENCEBOOKS/WEBLINKS: 1. ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students andPractitioners,2ndEdition, Springer's,2010ISBN978-3-642-04101-3 2. AliJahangiri,LiveHacking:TheUltimateGuidetoHackingTechniques&Countermeasures forEthical Hackers & IT Security Experts, Ali Jahangiri, 2009ISBN-13:978-0984271504 3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-CouncilPressSeries:Computer Forensics), 2010ISBN-13:978-1435483521	
COURSECOORDINATOR:	**Dr. PrabhaR**

	Course Title: Wireless and Mobile Computing		
	Course Code: 20SCS164	**No. of Credits: 3: 0 :0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours :52**

Course Objectives:	**Description**
	Course objectives: 1. To introduce the concepts of wireless communication 2. To understand CDMA, GSM, MobileIP, WImax. 3. To understand Different Mobile OS. 4. To learn various Markup Languages and CDC, CLDC, MIDP Programming for CLDC, MID let model and security concerns.

Unit No	**Syllabus Content**	**No of Hours**
1.	Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages(SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS	11
2.	Mobile Client: Moving beyond desktop, Mobile hand set overview, Mobile phones and their features, PDA, Design Constraints in applications for hand held devices. Mobile IP: Introduction, discovery, Registration, Tunneling, CellularIP.	10
3.	Self study component: Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source,Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS.	10

4.	Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol(WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML	11
5.	J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MID let model, Provisioning, MID let life cycle, Creating new application, MID let event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations inMIDP.	**10**

Course Outcomes	**Description**
CO1	To Work on state of art techniques in wireless communication.
CO2	Explore CDMA, GSM, MobileIP, WiMax.
CO3	Explore on Different MobileOS, Develop program for CLDC, MIDP let Model and security concerns.
CO4	To build Mobile Applications.
CO5	To build applications using J2ME technology.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

Strong-3 medium -2 weak-1

TEXTBOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing,Technology, ApplicationsandServiceCreation,2ndEdition,TataMcGrawHill,2010.
2. MartynMallik:MobileandWirelessDesignEssentials,WileyIndia,2003.

REFERENCEBOOKS:

1. Rajkamal:MobileComputing,OxfordUniversity Press,2007.

2. ItiSahaMisra:Wireless CommunicationsandNetworks,3GandBeyond, TataMcGrawHill, 2009

COURSECOORDINATOR:	**DR.Prabha R**

	Course Title: Natural Language Processing		
	Course Code: 20SCS251	**No. of Credits: 3: 0:0 (L-T-P)**	**No. of lecture hours/week: 4**
	Exam Duration :3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours: 52**

Course Objectives :	**Description**
	1. Learn the techniques in natural language processing. 2. Be familiar with the natural language generation. 3. BeexposedtoTextMining. 4. Analyze the information retrieval techniques

Unit No	**Syllabus Content**	**No of Hours**
1	**Overview And Language Modeling:** Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages-NLP Applications Information Retrieval. Language Modeling: Various Grammar-based Language Models-Statistical Language Model.	10
2	**Word Level And Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Syntactic Analysis:** Context free Grammar-Constituency-Parsing-Probabilistic Parsing	10
3	**Extracting Relations from Text:** From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learningto Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **Self-Study Component:** A Case Study in Natural Language Based Web Search: In Fact System Overview, The Global Security. Org Experience. Implement a CNN model for word prediction	11

4	**Evaluating Self- Explanations in iSTART:** Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, CohMetrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.	11
5	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame NetStemmers-POS Tagger- Research Corpora.	10

NOTE:

1. Include Self study component in any one of the Unit.

2. TotalnumberofCOsisdecidedbyconcernedCourseCoordinator

Course Outcomes	Description	RBT Levels
CO1	Analyze and understanding the mathematical modeling techniques innatural language text processing.	**R2, R3**
CO2	Generate the natural language using semantic analysis of languages.	**R4**
CO3	Construct Text mining models using tool savailable.	**R3**
CO4	Apply information retrieval techniques for real-time applications	**R4**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**2**	
CO2	**3**	**3**	**3**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**

Strong-3 Medium -2 Weak-1

TEXTBOOK:

1. TanveerSiddiqui,U.S.Tiwary,"NaturalLanguageProcessingandInformationRetrieval", Oxford University Press, 2008.
2. AnneKaoandStephenR.Poteet(Eds),"NaturalLanguageProcessingandTextMining",Springer-VerlagLondon Limited2007.

REFERENCE BOOKS:

1. DanielJurafskyandJamesHMartin,"SpeechandLanguageProcessing:Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishingcompany, 1995.
3. GeraldJ.KowalskiandMark.T.Maybury,"InformationStorageandRetrievalsystems", Kluwer academic Publishers, 2000.
4. StevenBird,EwanKlein,EdwardLoper,"NaturalLanguageProcessingwithPython," Publisher: O'Reilly Media, June 2009
5. Christopher D.Manning and HinrichSchutze, "Foundations of Statistical NaturalLanguage Processing", MITPress, 1999.

SELF STUDY REFERENCES/WEBLINKS:

1. Natural Language Processing from coursera
https://www.coursera.org/learn/language-processing
2. Any relevant course from top international universities on NLP can be referred to implement

COURSECOORDINATOR :	**Dr. K R Shylaja**

	Course Title: Cryptography and Network Security		
	CourseCode: 20SCS23	**No. of Credits:3:0:0 (L-T-P)**	**Number of lectures hours/ week: 4**
	Exam Duration :3 hours	**CIE + SEE = 50+50**	**Total Number of Contact Hours: 52**

Course Objectives :	**Description**
	1. Explain standard algorithms used to provide confidentiality, integrity and authenticity. 2. Distinguish key distribution and management schemes. 3. Deploy encryption techniques to secure data in transit across data networks. 4. To be Familiar with security mechanisms with different applications.

Unit No.	**Syllabus Content**	**No of Hours**
1	**Classical Encryption Techniques:** Symmetric Cipher Model, Cryptography, Crypt analysis and Brute Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Play fair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipherstructure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, The feistel Cipher, The data encryption standard, DES encryption, DES decryption, The strength of DES, the use of 56 Bit Keys, The nature of The DES algorithm, Timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm	**11**
2	**Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key crypto systems. Applications for public-key crypto systems, requirements for public-key crypto systems. Public-key crypt analysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Crypto systems:** Diffie hellman key exchange, The algorithm, Key exchange protocols, Man in the middle attack, Elgamal Crypto graphic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves over GF(2m), Elliptic curve cryptography, Analog of Diffie –hellman key exchange, Elliptic curve encryption/decryption.	**11**

3	**Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, Session key lifetime, A transparent key control scheme, Decentralized key control, Controlling key usage, Symmetric key distribution using asymmetric encryption, Simple secret key distribution, Secret key distribution with confidentiality and authentication, A hybrid scheme, Distribution of public keys, Public announcement of publickeys, Publicly available directory, Publickey authority, public keys certificates, X-509certificates. Certificates,X-509version3, publickey infrastructure.	**10**
4	**User Authentication:** Remote user Authentication principles, Mutual Authentication, oneway Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication. **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations.	**10**
5	**Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IPSecurity: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes,	**10**

Course Outcomes	**Description**
CO1	Analyze the vulnerabilities in any computing system
CO2	Aware of various security algorithms used in Cryptography
CO3	Identifythesecurityissuesinthenetworkandresolveit.
CO4	AbletoPropose/designasecuritysolution.
CO5	Evaluatesecuritymechanismsusingrigorousapproaches,includingtheoretical.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**2**			
CO2	**3**	**2**			

CO3	**3**		**1**		
CO4			**3**		**2**
CO5			**3**	**2**	

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. WilliamStallings,CryptographyandNetworkSecurity,Pearson6thedition.
2. V.K.Pachghare,CryptographyandinformationsecurityPHI2ndEdition.

REFERENCEBOOKS:

1. Behrozn A Forozen and DebdeepMukhopadhyay, Cryptographyand Network Securty.McGrawHillEducationIndianPvtLtd
2. BruuiceSchmeier,Applied Cryptography 2nd Edition Wiley India Edition.

COURSECOORDINATOR:	**SHAMSHEKHARPATIL**

	Course Title: Computational Intelligence		
	Course Code: 20SCS254	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 04**
	Exam Duration : 3 hours	**CIE+ Assignment + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications. 2. To comprehend the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic. 3. To interpret the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Unit No	**Syllabus Content**	**No of Hours**
1	Computational Intelligence and Knowledge: What Is Computational Intelligence? Agents in the World, Representation and Reasoning Applications, Overview, A Representation and Reasoning System :Introduction, Representation and Reasoning Systems ,Simplifying Assumptions of the Initial RRS , Data log, Semantics , Questions and Answers , Proofs , Extending the Language with Function Symbols	**11**
2	Using Definite Knowledge :Introduction, Case Study: House Wiring , Databases and Recursion, Verification and Limitations, Case Study: Representing Abstract Concepts, Case Study: Representing Regulatory Knowledge, Applications in Natural Language Processing ; Representing Knowledge : Introduction, Defining a Solution, Choosing a Representation Language, Mapping from Problem to Representation, Choosing an Inference Procedure	**10**
3	Knowledge Engineering , Introduction, Knowledge-Based System Architecture, Meta- Interpreters, Querying the User, Explanation, Debugging Knowledge Bases, A Meta-Interpreter with Search, Unification, Beyond Definite Knowledge :Introduction, Equality ,Integrity Constraints ,Complete Knowledge Assumption , Disjunctive Knowledge, Explicit Quantification , First-Order Predicate Calculus, Modal Logic	**10**

4	Using Uncertain Knowledge ,Introduction , Probability , Independence Assumptions , Making Decisions Under Uncertainty	**11**
5	Self-Study Component: Introduction , Learning as Choosing the Best Representation , Case-Based Reasoning , Learning as Refining the Hypothesis Space , Learning Under Uncertainty , Explanation-Based Learning	**10**

NOTE:
1. Include Self study component in any one of the Unit.
2. Total number of COs is decided by concerned CourseCoordinator

Course Outcomes	Description	RBT Levels
CO1	Identify and describe different types of AI agents	**R2**
CO2	Apply various AI search algorithms and knowledge representation technique in designing AI agents	**R4**
CO3	Analyze and Build knowledge based agents with inference reasoning and reasoning in uncertainty	**R3**
CO4	Apply knowledge representation, reasoning, and machine learning techniques to real-world problems	**R4**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**1**	**2**		
CO2	**2**	**1**	**3**	**2**	**2**
CO3	**3**	**1**	**3**	**3**	**2**
CO4	**3**	**1**	**3**	**3**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. David Poole, Alan Mackworth, Randy Goebel: Computational Intelligence – a logical approach, Oxford University Press,

REFERENCE BOOKS:

1. Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation, by James M. Keller, Derong Liu, David B. Fogel ISBN: 978-1-119-21434-2
SELF STUDY REFERENCES/WEBLINKS:
1. **Siddique, Nazmul; Adeli, Hojjat (2013). Computational Intelligence: Synergies of Fuzzy Logic, Neural Networks and Evolutionary Computing. John Wiley & Sons. ISBN 978-1-118-53481-6.** 2. **Alberto Fernandez ; Francisco Herrera ; Oscar Cordon ; Maria Jose del Jesus ; Francesco Marcelloni ; Evolutionary Fuzzy Systems for Explainable Artificial Intelligence: Why, When, What for, and Where to? IEEE Computational Intelligence Magazine, Publication Year: 2019, Page(s): 69 – 81** 3. **IEEE papers on Artificial agent systems, swarm intelligence**

COURSE COORDINATOR:	**Dr. K R Shylaja**

	Course Title: Business Analytics		
	Course Code: 20SCS261	**No. of Credits: 3: 0:0 (L-T-P)**	**No. of lecture hours/week: 4**
	Exam Duration :3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours: 52**

Course Objectives :	**Description**
	1. Assess Advanced Business Analytics Iconcepts and core IT concepts. 2. Critique problems, issues, and trends using predictive analysis. 3. Perform predictive analytics and data science. 4. In still a sense of ethical decision-making and a commitment to thelong- run welfare of both organisations and the communities they serve.

Unit No	**Syllabus Content**	**No of Hours**
1.	**Business Analytics:** Overview of Business Analytics, Scope of Business Analytics, Business Analytics Process, relationship of Buisness Analytics process and organization, Competative advantages of Business Analytics. **SatsticalTools:** Satstical Notation, Desvrptive Stastical methods, review of probability distribution and data modelling.	**10**
2.	**Trendiness and Regression Analysis:** Modelling Relationships and trends in Data. Simple Linear regression. Important resources, BusinessAnalytics Personal, Data and Model for Business Analytics, problem solving, Visualizing and Exploring data, Business Analysis Technology.	**11**
3.	**Self study component:** Organization Structures of Business Anlytics: Team Management, Management Issues, Desiging Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business Analytics, Manging Changes, Descrptive Analytics Predictive Analytics, Predicative Modelling, Predictive Analytics analysis.	**11**
4.	**Forecasting Techniques:** Qualitative and Judgemental Forecasting, Stastical forecasting Models ,Forecasting Models for Time series with linear trend. Forecasting Time series with seasonality, regression fore casting with casual variables, selecting appropriate Forecasting Models.	**10**
5.	**Decision Analysis:** Formulating Decision Problems, Decision Statergies With are without outcome, Probablities, decisiontrees, The value of Information, Utility and Decision Making.	**10**

Course Outcomes	Description
CO1	Explore the Concepts, data and models for Business Analytics.
CO2	Analyze various techniques for modelling and prediction.
CO3	Design the clear and actionable insights by translating data.
CO4	To design and analyse fore casting models.
CO5	Formualte decision problems to slove business applications.

CO-PO Mapping	PO 1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	2
CO5	3	3	3	3	2

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. Business Analytics Principles, Concepts, and Applications FT Press Analytics, by Marc J.Schniederjans,DaraG.Schniederjans,Christopher M. Starkey, 1 st Edition 2014,ISBN-13:978-0133989403,ISBN-10:ISBN-12.
2. Thevalue of BusinessAnalytics: Identify the pathto Profitability, Evan Stubs, JohnWiley and sons,ISBN:9781118983881,1stEdition2014.

REFERENCEBOOKS:

1. BusinessAnalytics,James R. Evans, Pearson education 2nd Edition,ISBN-13:978-032199782,ISBN-10:0321.
2. Predictive BusinessAnalytics Forwardlooking capabilitiestoimprove Business, Gary CokinsandlawrenceMaisel,wiley1st Edition,2014.

COURSECOORDINATOR:	**Dr.PrabhaR**

	Course Title: Storage Area Network		
	Course Code: 20SCS263	**No. of Credits: 3: 0:0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration :3 hours	**CIE + SEE = 50+50=100**	**Total No. of Contact Hours:52**

Course Objectives :	**Description**
	1. To understand the fundamentals of storage centric and serve rcentric systems 2. To understand the metrics used for Designing storage area networks 3. To understand the RAID concepts 4. To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction:** Information Storage, Evolution of Storage Architecture, Data Centre Infrastructure, Virtualization and Cloud Computing. Data Centre Environment: Application, DBMS, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives.	**11**
2	**Data Protection:** RAID Implementation Methods, Array Components, Techniques ,Levels, Impact on Disk Performance, Comparison, HotSpares. Intelligent Storage System: Components, Storage Provisioning, Types.	**10**
3	**Fiber Channel Storage Area Networks:** FC Overview, Evolution, Components, FC Connectivity, Ports, FC Architecture, Fabric Services, Login Types ,Zoning, FCT opologies, Virtualization in SAN. IPSAN and FCoE: iSCSI,FCIP,FCoE.	**11**
4	**Network-Attached Storage:** Benefits, Components, NAS I/O Operation, Implementations, File Sharing Protocols, I/O Operations, Factors Affecting NAS Performance, File-Level Virtualization. Object Based and Unified Storage: Object Based Storage Devices, Content Addressed Storage, CAS Use Cases, Unified Storage. BackupArchive and Replication.	**10**
5	**Self Study Component:** Information Availability, Terminology, Planning Lifecycle, Failure Analysis, Impact Analysis, Challenges, Adoption Considerations. Securing the Storage Infrastructure: Framework, Risk Triad,Domains Managing the Storage Infrastructure: Monitoring, ManagementActivities, Management Challenges, Information Lifecycle Management,StorageTiering.	**10**

Course Outcomes	Description	RBTLevels
CO1	Identify the need for storage centric network and its benefits of its adoption.	L2
CO2	Design a storage solution for an application depending on the IOPS and RAID requirements.	L3
CO3	Have an understanding of the Fiber channel stack and working of the different layers.	L2
CO4	Have an understanding of NAS, object oriented storage and backup and recovery.	L2
CO5	Have a business continuity plan and ILM of an enterprise.	L2

CO-PO Mapping	PO1	PO2	PO3	PO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	2	3	3
CO5	3	2	3	3

Strong-3 Medium-2 Weak-1

TEXTBOOKS:

1.EMC EducationServices,editedbySomasundaramG.,AlokShrivastava"InformationStorageandManagement";2nd edition,WileyIndia,2012,ISBN9788126537501.

REFERENCEBOOKS:

1. UlfTroppens,RainerErkensandWolfgangMuller:StorageNetworksExplained,1st Edition,Wiley India, 2012.
2. RobertSpalding:StorageNetworks,TheCompleteReference,1st Edition,TataMcGrawHill, 2011.

COURSE COORDINATOR: **Suresha.D**

	Course Title: Intelligent Systems		
	Course Code: 20SCS264	**No.ofCredits: 3: 0:0 (L-T-P)**	**No. of lecture hours/week: 4**
	Exam Duration :3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours: 52**

Course Objectives:	**Description**
	1. To provide understanding of intelligent systems and the various methods and tools in implementing Intelligent Systems. 2. To demonstrate the implementation of individual methods within the scope of Intelligent systems 3. To compare the pros and cons of each method of developing Intelligent Systems. 4. To develop the ability to implementa particular Intelligent system of choice

Unit No	**Syllabus Content**	**No of Hours**
1.	**Overview of Artificial Intelligence:** Artificial Intelligence and its Application areas; Knowledge Representation and Search: The Predicate Calculus :The Propositional Calculus, The Predicate Calculus, Using Inference Rules to Produce Predicate Calculus Expressions, Application: A Logic-Based Financial Advisor; Structures and strategies for state space search: Introduction, Structures for state space search ,Strategies for State Space Search, Using the State Space to Represent Reasoning with the Predicate Calculus;And/Or Graphs;	**10**
2.	**Heuristic Search:** Introduction, Hill Climbing and Dynamic Programming, The BestFirst Search Algorithm, Admissibility, Monotonicity and Informedness, Using Heuristics in Games, Complexity Issues. Control and Implementation of State Space Search: Introduction, Recursion-Based Search, Production Systems, The Blackboard Architecture for Problem Solving.	**10**
3.	**Other Knowledge Representation Techniques:** Semantic Networks, Conceptual Dependencies, Scripts and Frames, Conceptual Graphs. Knowledge Intensive Problem Solving : Overview of Expert System Technology, Rule Based Expert Systems, Model-Based, Case Based,andHybridSystemsPlanning:IntroductiontoPlanning,Algorithmsas State- Space Search, Planning graphs	**10**

4.	**Automated Reasoning:** Introduction to Weak Methods in TheoremProving,TheGeneralProblemSolverandDifferenceTables,Resolution Theorem Proving; Uncertain Knowledge and Reasoning: Introduction toUncertainty, Inference using Full-Joint Distribution, Independence,Bayes'Ruleanditsuse.RepresentingKnowledgeinUncertainDomain:Semantics of Bayesian Networks, Efficient Representation ofConditional Distributions, Exact Inference in Bayesian Network,Approximate Inference in Bayesian Network	**10**
5.	**Self study component:** IntroductiontoLearning:FormsofLearning:Supervisedlearning,Unsupervised Learning, Semi-Supervised and Reinforcement Learning;Parametric Models & Non-Parametric Models, Classification and Regression problems Artificial Neural Networks: ANN Structures, Single Layer feed-forward neural networks, Multi-Layer feed-forward neural networks, Learning in multilayer networks, networks. Artificial Intelligence Current Trends : The Science of Intelligent Systems, AI: Current Challenges and Future Directions;	**12**

Course Outcomes	**Description**
CO1	Students are able to Explore various Artificial Intelligence problem solvingtechniques.
CO2	StudentsareabletoIdentifyanddescribethedifferentAIapproachessuchasKnowledgerepresentation,Searchstrategies,learningtechniquestosolve uncertain imprecise, stochastic and nondeterministic nature inAI problems.
CO3	Students are able to analyze Knowledge Representation Techniques:Semantic Networks, Conceptual Dependencies, Scripts and Frames, Conceptual Graphs.
CO4	Students are able toApply theAI techniques to solvevariousAI problems.
CO5	Students are able toAnalyze and compare the relativechallenges pertaining to design of Intelligent Systems.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**	**3**	**3**	**3**	**3**

CO2	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. GeorgeFLuger,"ArtificialIntelligence – Structures and Strategies for ComplexproblemSolving",6thEdition,PearsonPublication,2009,ISBN-10:0-321-54589-3,ISBN-13: 978- 0-321-54589-3
2. StuartRussel,PeterNorvig,"ArtificialIntelligenceAModernApproach",3rdEdition, Pearson Publication, 2015, ISBN-13: 978-93-325-4351-5.

REFERENCE BOOKS:

1. ElaineRich,KevinKnight,"ArtificialIntelligence",3rdEdition,TataMcGrawHill,2009, ISBN-10: 0070087709, ISBN-13: 978-0070087705
2. Grosan, Crina,Abraham,Ajith,"IntelligentSystems-AModernApproach",SpringerVerlagBerlinHeidelberg2011,ISBN9783642269394, 2011

COURSECOORDINATOR:	**Dr.PrabhaR**

	Course Title: Agile Methodology		
	Course Code:20SCS253	**No. of Credits: 3:0:0(L-T-P)**	**Number of lectures hours/week: 4**
	Exam Duration : 3hours	**CIE + SEE = 50+50**	**Total Number of Contact Hours: 52**

Course Objectives:	**Description**
	1. To understand how an iterative, incremental development process leads to faster delivery of more useful software 2. To understand the essence of agile development methods 3. To understand the principles and practices of extreme programming 4. To understand the roles of prototyping in the software process 5. To understand the concept of Mastering Agility

Unit No.	**Syllabus Content**	**No of Hours**
1	**Why Agile?:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:**Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor	**10**
2	Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility	**10**
3	**Practicing XP: Thinking:** Pair Programming, Energized Work, Informative Workspace, Root Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	**11**
4	**Mastering Agility Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things ,Build the Process for the People, **Eliminate Waste:** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, PursueThroughput	**10**

5	**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, DeliverBusinessResults, Deliver Frequently, **Seek Technical Excellence :** SoftwareDoesn't Exist, Design Is for Understanding, Design Tradeoffs, Quality with aName, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	**11**

Course Outcomes	**Description**
CO1	Understand The XP Lifecycle, XP Concepts, Adopting XP
CO2	Work on Pair Programming, Root-Cause Analysis, Retrospectives ,Planning, Incremental Requirements, Customer Tests
CO3	Implement Concepts to Eliminate Waste

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**3**	**3**		**1**							
CO2	**3**	**1**	**2**	**2**	**1**	**1**						
CO3	**3**	**2**	**1**	**2**		**1**						

Strong-3 medium-2 weak-1

TEXTBOOKS:

1. The Art of Agile Development (Pragmatic guide to agile software development), James shore,Chromatic,O'ReillyMedia,ShroffPublishers&Distributors,2007ISBN978-159-904-68-39

REFERENCEBOOKS:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin,PrenticeHall; 1st edition, 2002

2. ,"AgileandIterativeDevelopmentaManger'sGuide",CraigLarmanPearsonEducation,First Edition, India, 2004.

COURSECOORDINATOR:	**Dr.Siddaraju**

Panchajanya Vidya Peetha Welfare Trust (Regd)

Dr. Ambedkar Institute of Technology

An Autonomous Institution, Affiliated to Visvesvaraya Technological University, Belagavi,
Aided by Govt. of Karnataka, Approved by All India Council for Technical Education (AICTE), New Delhi
Accredited by NBA and NAAC with 'A' Grade
BDA Outer Ring Road, Mallathalli, Bengaluru - 560 056

Ref. No. .....

Date : .....

M. Tech in Computer Science & Engineering
2018-2019 Scheme

The following list of subjects are identified as courses focused on employability and Skill Development in the scheme 2018-2019.

Sl. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
1	Advances in Storage Area Networks	18SCS151	Employability &Skill development
2	Software Quality Assurance, Testing and Metrics	18SCS152	Employability &Skill development
3	Artificial Neural Networks	18SCS153	Employability &Skill development
4	Multicore Architecture	18SCS154	Employability &Skill development
5	Digital Image Processing	18SCS251	Employability &Skill development
6	Data Science with R-Programming	18SCS252	Employability &Skill development
7	Cyber Security	18SCS253	Employability &Skill development
8	Sensor Networks Infrastructure	18SCS254	Employability &Skill development
9	Internet of Things (IoT)	18SCS321	Employability &Skill development
10	Agile Methodologies	18SCS322	Employability &Skill development
11	Network Programming in UNIX	18SCS323	Employability &Skill development
12	Mobile Computing and Wireless Network	18SCS324	Employability &Skill development
13	Natural Language Processing and Text mining	18SCS331	Employability &Skill development
14	Data ware house and Data mining	18SCS332	Employability &Skill development
15	Cryptography and Network Security	18SCS333	Employability &Skill development
16	Computational Intelligence	18SCS334	Employability &Skill development

HOD, CSE

Principal
PRINCIPAL
Dr. Ambedkar Institute of Te
Bengaluru-560 056

	Course Title: Artificial Intelligence and Prolog Programming		
	Course Code: SCS151	**No. of Credits = 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30 + 70**	**Total No. of Contact Hours :52**

Course objectives:

1. To Implement non-trivial AI techniques in a relatively large system
2. To understand uncertainty and Problem solving techniques.
3. To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
4. To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
5. To understand how to write a Prolog programs for Artificial Intelligence
6. Analyzing and Solving Artificial Intelligence programs by using Backtracking methods

UNIT No	Syllabus Content	No of Hours
1	What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, real world Problems, problem spaces and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. Intelligent Agents: Agents and Environments, The nature of environments, The structure of agents. (Text Book 1: Chapter 1 & 2 Text Book 2: Chapter 2)	10
2	Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction. Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Agents based on propositional logic. (Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6)	10

3	Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem solver, Implementation: Depth-first search, Implementation: Breadth-first search, Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13	10
4	Prolog Programming for Artificial Intelligence, An Overview of Prolog, An example program: defining family relations, Extending the example program by rules, A recursive rule definition, How Prolog answers questions, Declarative and procedural meaning of programs; Syntax and Meaning of Prolog Programs, Data objects, Matching Declarative meaning of Prolog programs, Procedural meaning, Example: monkey and banana, Order of clauses and goals, Remarks on the relation between Prolog and logic. (Text Book 3: Chapters 1 & 2)	11
5	Lists, Operators, Arithmetic, Representation of lists, Some operations on lists, Operator notation, Arithmetic, Using Struclures: Example Programs, Retrieving structured information from a database, Doing data abstraction, Simulating a non-deterministic automaton,Travel planning, The eight queens problem, Controlling, Backtracking, Preventing backtracking, Examples using cut, Negation as failure, Problems with cut and negation, Input and Output, Communication with files. (Text Book 3: Chapter 3, 4 ,5 & 6)	11

<u>Note 1:</u> Unit 3 and Unit 5 will have internal choice. One question each from Unit 1, Unit 2 and Unit 4.

Course Outcomes:

CO1: Design intelligent agents for problem solving, reasoning, planning, decision making, and learning specific design and performance constraints, and when needed, design variants of existing algorithms.

CO2: Apply AI technique on current applications.

CO3: Problem solving, knowledge representation, reasoning, and learning.

CO4: Demonstrating how to write a programs for Artificial Intelligence

CO5: Solving recursive programs in Prolog

CO6: Analyzing and Solving Artificial Intelligence programs by using Backtracking methods

CO's	**Mapping with POs**

CO1	PO1, PO2, PO5, PO9
CO2	PO1, PO5, PO11, PO12
CO3	PO1, PO2, PO7, PO9
CO4	PO1, PO2, PO9, PO11
CO5	PO1, PO2, PO11,PO12
CO6	PO1, PO2, PO5, PO11, PO12

TEXT BOOK:

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013, ISBN 10: 0070087709 ISBN 13: 9780070087705

2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013, ISBN: 0-13-604259-7

3. Ivan Bratko Prolog Programming for Artificial Intelligence , (International Computer Science Series) 4th Edition, Publisher**:** Pearson Education Canada; 4th edition, 2011, ISBN-10: 0321417461; ISBN-13: 978-0321417466

REFERENCE BOOKS/WEBLINKS:

1. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, ISBN-13: 9780934613101

Course Coordinator: Dr. M.V. Vijayakumar

	Course Title: **Advances in Storage Area Networks**		
	Course Code: **18SCS151**	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ Assignment + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. Define and contrast storage centric and server centric systems 2. Define metrics used for Designing storage area networks 3. Illustrate RAID concepts 4. Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction**: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks, The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent Disk Subsystems;	**11**
2	**I/O Techniques**: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, File Systems, network file system and file servers.	**11**
3	**Storage Virtualization**: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or filelevel; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	**10**
4	**Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture. **Storage Area Network:** Architecture Overview: Creating a Network for storage, SAN Hardware devices, Software components.	**10**
5	**Management of Storage Network**: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Out-band management.	**10**

Course Outcomes	Description	RBT Levels
CO1	Identify the need for performance evaluation and the metrics used for it	R1, R2,R3
CO2	Apply the techniques used for data maintenance.	R4 and R5
CO3	Realize strong virtualization concepts	R3
CO4	Develop techniques for evaluating policies for LUN masking, file systems	R5

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	2	-	3	3	2
CO2	2	-	3	-	2
CO3	-	-	3	-	2
CO4	-	2	3	2	-

Strong -3 Medium -2 Weak -1

TEXT BOOKS: TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2013. ISBN 978-81-265-1832-6

REFERENCE BOOKS: REFERENCES:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011. ISBN 978-0-07-053292-2
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2011. ISBN-10: 1-58705-162-1ISBN-13: 978-1-58705-162-3
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials "A Complete Guide to understanding and Implementing SANs", Wiley India, 2012. ISBN: 978-0-471-03445-2

COURSE COORDINATOR:	**Course Coordinator: Prof. Shamshekar S. Patil**

	Course Title:	**Software Quality Assurance, Testing and Metrics**	
	Course Code: **18SCS152**	**No. of Credits: 3 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ Assignment + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To adapt different methodologies and models for design development of software product. 2. To Apply SQA and SOA function for testing of frameworks . 3. To understand different Software testing process and mechanisms used in Industry 4. To formulate different Matrices used for measuring software quality 5.To compare different tools used for software quality Improvement

Unit No	**Syllabus Content**	**No of Hours**
1	What is Software Quality? McCall Model Boehm Model, FURPS Model, Dromey Model ISO 9126 Model Who Cares for Software Quality? Benefits of Software Quality Phases in Software Development Software Development Life Cycle Models Types of Defects Cost of Fixing Defects ,Cost of Poor QualityDefinitions Used in Software Quality Engineering, Software Quality Assurance and Quality Control , Scenarios of Application of Different QC Activities . Software Configuration Management (SCM) , Challenges in Developing Quality Software	**12**
2	Benefits of SQA, Role of SQA ,SQA Functions ,SQA People,SQA Plan What is a Process? Process Frameworks, ISO 9001:2008 ,SEI's CMMI Six Sigma Test Maturity Model Integration (TMMi)	**10**
3	**Software Testing** Guiding Principles of Testing , Composition of a Testing Team Role of a Test Manager Role of a Tester Essential Skills of a Tester Types of Testing,White Box Testing Integration Testing System Testing Acceptance Testing Re-Testing or Confirmation Testing Regression Testing Positive Testing Negative Testing Error Guessing Exploratory Testing Sanity Testing Database Testing Risk-Based Testing	**12**

4	**Metrics for Software Quality** Categories of Software Metrics Metrics Program: Goal Question Metric (GQM) Method Types of Metrics Metrics Based on Method of Measurement: Direct and Indirect Measurement Metrics Based on Type of Data Some Commonly Used Software Metrics Process Metrics Product Metrics Metrics for Resources	**12**
5	**Tools for Quality Improvement** Basic Quality Control Tools Check Sheet Cause and Effect Diagram (C&E Diagram) Pareto Diagram Histogram Scatter Plot Run Chart Control Chart Orthogonal Defect Classification	**06**

Course Outcomes	**Description**	**RBT Levels**
CO1	Able to adapt different methodologies and models for design development of software product.	R1, R2
CO2	Able apply SQA and SOA function for testing of frameworks .	R3, R2
CO3	Able to understand different Software testing process and mechanisms used in Industry	R1, R3
CO4	Able to formulate different Matrices used for measuring software quality	R4, R3
CO5	Able to compare different tools used for software quality Improvement	R2,R3,R4

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	-	2	3
CO2	2	3	2	3	2
CO3	2	2	3	2	3
CO4	2	2	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

Anirban Basu "Software Quality Assurance, Testing and Metrics" First Edition, PHI Publication

REFERENCES:

1. Metrics and Models in Software Quality Engineering by Stephen Kan Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA ©2002 ISBN:0201729156

COURSE COORDINATOR:	**Dr. Prakash**

	Course Title: Artificial Neural Networks		
	Course Code: 18SCS153	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand and compare the learning algorithms. 2. To understand the perceptron convergence theorem, and the relationship between the perceptron and the Bayes classifier operating in a Gaussian Environment. 3. To understand SOM development which follows the principles of Self-organization. 4.To understand dynamical systems and HOPFIELD Models

Unit No	**Syllabus Content**	**No of Hours**
1	**INTRODUCTION** - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks LEARNING PROCESS 1 – Error Correction learning, Memory based learning, Hebbian learning.	**10**
2	**LEARNING PROCESS 2**: Competitive, Boltzmann learning, Credit Assignment Problem, Statistical nature of the learning process, SINGLE LAYER PERCEPTRONS – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception –convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.	**11**

3	**MULTILAYER PERCEPTRON** – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection, BACK PROPAGATION - back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.	**11**
4	**SELF ORGANIZATION MAPS** – Two basic feature mapping models, Self-organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps.	**10**
5	**NEURO DYNAMICS – Dynamical systems, stability of equilibrium** states, attractors, neurodynamical models, manipulation of attractors' as a recurrent network paradigm, HOPFIELD MODELS – Hopfield models, computer experiment.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Able to apply ANN concepts /techniques for real time applications	R1, R2,R3
CO2	Able to design and development of codes for different learning	R3, R4
CO3	Able to learn multi-layer perceptions using different techniques for critical thinking and to design common goals	R2, R3.R4
CO4	**A**ble to solve Engineering problems using various ANN tools and Design techniques for real time applications.	R4, R3

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	-	2
CO2	2	2	3	3	3
CO3	2	2	3	3	2
CO4	2	3	2	3	3

Strong -3 Medium -2 Weak -1

TEXT BOOK:

1. Neural networks a comprehensive foundations, Simon Haykin, Pearson Education 2nd Edition 2004 ISBN 10: 0023527617 ISBN 13: 9780023527616

REFERENCE BOOKS:

1. Artificial neural networks - B.Yegnanarayana Prentice Hall of India P Ltd 2005ISBN:8120312538
2. Neural networks in Computer intelligence, Li Min Fu TMH 2003 ISBN 0079118178, 9780079118172

3. Neural networks James A Freeman David M Skapura Pearson Education 2004 ISBN 10: 0201513765 ISBN 13: 9780201513769

Course Co-ordinator	**Dr. Siddaraju**

	Course Title: Multi Core Architectures		
	Course Code: 18SCS154	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ Assignment + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the recent trends in the field of Computer Architecture and identify performance related parameters. 2. To appreciate the need for parallel processing. 3. To expose the students to the problems related to multiprocessing - To understand the different types of multicore architectures. 4. To understand the concepts of multicore architectures 5. To understand concepts of multi-threading, OPENMP

Unit No	**Syllabus Content**	**No of Hours**
1	Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization	**11**

2	Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.	**10**
3	Threading APIs : Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework. Structures: Conceptual dependency, scripts, CYC. OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning,	**10**
4	Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait , Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks,	**10**
5	Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency,	**11**

Course Outcomes	**Description**	**RBT Levels**
CO1	Identify the limitations of ILP and the need for multicore architectures	R1, R2,R3
CO2	Analyze the parallel programming techniques and design issues to solve the issues related to multiprocessing	R4 and R5
CO3	Interpret the salient features of different multicore architectures and how they exploit parallelism	R3

CO4	Design loops in Open MP to find solutions to parallel programming concept.	R5
CO5	Analyze Threads and Reductions in parallel programming problems	

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	2	3	1
CO2	-	-	2	3	2
CO3	-	-	3	3	2
CO4	2	-	2	3	3
CO5	1	2	2	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Multicore Programming, Increased Performance through Software, Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2012

REFERENCE BOOKS:

COURSE COORDINATOR:	**Dr. M V Vijayakumar**

	Course Title :DIGITAL IMAGE PROCESSING		
	Course Code: 18SCS251	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques. 2. To understand the image segmentation and representation techniques. 3. To understand how image are analyzed to extract features of interest. 4. To introduce the concepts of image registration and image fusion. 5. To analyze the constraints in image processing when dealing with image data sets.

Unit No	**Syllabus Content**	**No of Hours**
1.	Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, and Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing DigitalImages, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	**10**
2.	Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters.	**11**

3.	Image Segmentation and Object Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Methods. .	**10**
4.	Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering.	**11**
5.	Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand image formation and the role human visual system plays in perception of gray and color image data.	R3
CO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.	R3
CO3	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.	R4,R5
CO4	Conduct independent study and analysis of feature extraction techniques.	R4
CO5	Understand the concepts of image registration and image fusion.	R1,R3
CO6	Analyze the constraints in image processing when dealing with image data sets and to apply image algorithms in practical applications	R4

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	1	-	3	3	1
CO2	-	1	3	3	2
CO3	-	-	3	3	2
CO4	-	2	3	2	1

TEXT BOOK:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati "WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications" John Wiley & Sons, Inc. Publications.

2. Holge Karl and Andreas Willing " Protocols and Architectures for Wireless Sensor Networks" 2011 John Wiley & Sons, Inc. Publications.

REFERENCE BOOKS / WEBLINKS:

1. **Matthijs Kooijman Building Wireless Sensor Networks Using Arduino (Community Experience Distilled).**
2. **Edgar H. Callaway Jr Wireless Sensor Networks: Architectures and Protocols (Internet and Communications)**

Course Coordinator:

	Course Title: **Data Science with R-Programming**		
	Course Code: 18SCS252	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the data analytics basics 2. To understand the construction of R programming 3. To understand linear regression for regression 4. To understand parametric and non-parametric classification 5. To understand text mining techniques

Unit No	**Syllabus Content**	**No of Hours**
1	Overview of the R Programming Language Basic Data Types Control Structures. Functions, help System, Running R Code , Packages, Getting Data into R, Data Visualization	11
2	Exploratory Data Analysis, Summary Statistics, Getting a Sense of Data Distribution, Putting It All Together: Outlier Detection	10
3	Regression: Introduction, Parametric Regression Models, Nonparametric Regression Models	10
4	Classification, Introduction, Parametric Classification Models, Nonparametric Classification Models	10
5	Text Mining, Introduction, Dataset, Reading Text Input Data, Common Text Pre-processing Tasks, Term Document Matrix, Text Mining Applications	11

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand and Apply the data analytics basics	R1,R3
CO2	Apply the construction of R Programming to design real time applications	R3
CO3	Apply Linear Regression for Regression problems in real time	R3
CO4	Understand and Apply parametric and non-parametric classification	R1,R3
CO5	Understand and Apply text mining techniques	R1,R3

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	-	-	3	3	2
CO2	-	-	3	3	3
CO3		-	3	3	2
CO4	2	-	3	3	2
CO5	2	-	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Beginning Data Science with R, Manas A Pathak, 2014, ISBN 978-3-319-12065-2 ISBN 978-3-319-12066-9 (eBook) DOI 10.1007/978-3-319-12066-9

REFERENCE BOOKS:

1. Data Science and Big Data: An Environment of Computational Intelligence, **Pedrycz**, Witold, **Chen**, Shyi-Ming (Eds.) ISBN 978-3-319-12066-9

2. A First Level Book to expedite Statistics through R: An Inquisitive approach, Dr. N B Venkateshwaralu , Amazon Asia-Pacific Holdings Private Limited, 2018

COURSE COORDINATOR:	**Dr. Siddaraju & Dr. K R Shylaja**

	Course Title: Cyber Security		
	Course Code: 18SCS253	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To provide an understanding Computer forensics fundamentals 2. To analyze various computer forensics technologies 3. To provide computer forensics systems 4. To identify methods for data recovery. 5. To apply the methods for preservation of digital evidence

Unit No	**Syllabus Content**	**No of Hours**
1	**Computer Forensics Fundamentals** Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology.	10
2	**Types of Computer Forensics Technology** Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware. Encryption Methods and Vulnerabilities ,Protecting Data from Being Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls ,Biometric Security Systems.	11

3	**Types of Computer Forensics Systems** Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems. Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems ,Identity Theft , Biometric Security Systems, Homeland Security Systems	11
4	**Data Recovery** Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data Evidence Collection and Data Seizure Why Collect Evidence?, Collection Options ,Obstacles ,Types of Evidence ,The Rules of Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of Collection, Artefacts.	10
5	**Duplication and Preservation of Digital Evidence** Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image Verification and Authentication Special Needs of Evidential Authentication, Practical Considerations.	10

Course Outcomes	Description	RBT Levels
CO1	Understand the definition of computer forensics fundamentals.	R1,R3
CO2	Describe the types of computer forensics technology.	R4
CO3	Analyze various computer forensics systems.	R4
CO4	Illustrate the methods for data recovery, evidence collection and data seizure.	R4
CO5	Summarize duplication and preservation of digital evidence.	R4

CO-PO Mapping	PO 1	PO 2	PO3	PO4	PO5
CO1	-	-	3	3	-
CO2	-	-	3	3	1
CO3	-	-	3	3	2
CO4	1	-	3	3	2
CO5	1	-	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKs:

1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles,River Media, 2005 ISBN-13: 978-1584503897

REFERENCE BOOKS/WEBLINKS:

1. ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners,2nd Edition, Springer's, 2010ISBN 978-3-642-04101-3
2. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures forEthical Hackers & IT Security Experts, Ali Jahangiri, 2009ISBN-13: 978-0984271504
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series:Computer Forensics), 2010ISBN-13: 978-1435483521

Course Coordinator: Prof. Madhu B

	Course Title:	**Sensor Networks Infrastructure**	
	Course Code: **18SCS254**	**No. of Credits: 3 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	2. Understand of Wireless Sensor Networks and its applications. 3. Understanding of Basic Wireless Sensor Technology. 4. Discuss Wireless Transmission Technology and Protocols. 5. .Operating Systems for Wireless Sensor Networks.

Unit No	**Syllabus Content**	**No of Hours**
1.	Introduction and Overview of Wireless Sensor Networks: Introduction, Basic Overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of WSN Applications.	10
2.	Basic Wireless Sensor Technology: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies,	11
3.	Available Wireless Technologies: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study.	10
4.	Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks,	11
5.	Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems, 1 TinyOS, 276 2 Mate, 277 3 MagnetOS, 278 4 MANTIS, 278 5 OSPM, 279 6 EYES OS, 279 7 SenOS, 280 8 EMERALDS, 280 9 PicOS,	10

Course Outcomes	**Description**	**RBT Levels**
1.	Explain the wireless sensor networks and its applications	R4,R3
2.	Explain Basic technologies for WSN.	R4

3.	Different types of Protocols for WSN.	R4
4.	Understand different types of Operating system for WSN.	R3,R4

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	3	1
CO2	-	-	3	3	2
CO3	-	-	3	3	2
CO4	-	2	3	2	1

TEXT BOOK:

3. Kazem Sohraby, Daniel Minoli, Taieb Znati "WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications" John Wiley & Sons, Inc. Publications.
4. Holge Karl and Andreas Willing " Protocols and Architectures for Wireless Sensor Networks" 2011 John Wiley & Sons, Inc. Publications.

REFERENCE BOOKS / WEBLINKS:

3. Matthijs Kooijman Building Wireless Sensor Networks Using Arduino (Community Experience Distilled).
4. Edgar H. Callaway Jr Wireless Sensor Networks: Architectures and Protocols (Internet and Communications)

Course Coordinator: Prof. Shamshekar S. Patil

	Course Title: Internet Of Things		
	Course Code: 18SCS321	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+SEE = 50+50=100**	**Total No. of Contact Hours :52**

Course Objectives:	**Description**
	1. To understand the basic concepts of IoT with overview of its Physical and Logical design 2. To understand and analyze different IoT enabling Technologies 3. To understand different IoT levels and their deployment templates 4. To understand application of IoT for different domains. 5. To understand the importance of software defined networking and Network virtualization function from IoT perspective. 6. To discuss and analyze a case study for Environment monitoring using IoT

Unit No	**Syllabus Content**	**No of Hours**
1	**INTRODUCTION & CONCEPTS**: Definition & Characteristics of IoT, **Physical Design of IoT:** Things in IoT , IoT Protocols **Logical Design of IoT:** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs **IoT Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems	**10**
2	**IoT Levels & Deployment Templates:** IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6 **Domain Specific IoTs: Home Automation**: Smart Lighting, SmartAppliances,, Intrusion Detection, Smoke/Gas Detectors. **Cities:** Smart Parking, Smart Lighting, Smart Roads, Structural HealthMonitoring, Surveillance, Emergency Response. **Environment:** Weather Monitoring, Air Pollution Monitoring, NoisePollution Monitoring, Forest Fire Detection, River Floods Detection.	**11**

3	**Domain Specific IoTs.: (Contd)** **Energy:** Smart Grids, Renewable Energy Systems, Prognostics. **Retail:** Inventory Management, Smart Payments, Smart Vending Machines. **Logistics:** Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics. **Agriculture:** Smart Irrigation, Green House Control. **Industry:** Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring. **Health & Lifestyle:** Health & Fitness Monitoring, Wearable Electronics.	**11**
4	**IoT and M2M:** Difference between IoT and M2M SDN and NFV for IoT: Software Defined Networking, Network Function Virtualization.	**10**
5	**IoT Design Methodology:** Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Application Development Specification wise Case Study: Environment Monitoring	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand the concepts of IoT with overview of its Physical and Logical design	R1,R3
CO2	Analyze different Technologies used in IoT	R4
CO3	Interpret different domain specific IoT diagrams and illustrations	R3,R4
CO4	Analyze specification document for Environment Monitoring using IoT	R4,R3

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	3	3
CO2	2	2	3	2	2
CO3	2	1	3	2	3
CO4	-	-	3	2	3

Strong -3 **Medium -2** **Weak -1**

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga "Internet of things, A hands-on-approach" 2014
2. Jean-Philippe Vasseur & Adam Dunkels "Interconnecting smart objects with IP", Morgan Kaufmann Publishers, 2010

REFERENCES:

1.Cuno Pfister, "Getting Started with the Internet of Things", Maker Media Inc, 2011
2.Adrian Mcewen and Hakim, "Designing the Internet of Things", Wiley publication, 2013
3.Zhao, Feng, and Leonidas J. Guibas., "Wireless sensor networks: an information processing approach", Morgan Kaufmann, 2004.
4. Karl, Holger, and Andreas Willig, "Protocols and architectures for wireless sensor networks", John Wiley & Sons, 2007.
5. Dargie, Waltenegus W., and Christian Poellabauer, "Fundamentals of wireless sensor Networks: theory and practice", John Wiley & Sons, 2010.
6. McKinsey Global Institute report, "Unlocking the potential of the Internet of Things".

COURSE COORDINATOR:	**Dr. Prakash**

	Course Title: AGILE METHODOLOGIES		
	Course Code: 18SCS322	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand how an iterative, incremental development process leads to faster delivery of more useful software 2. To understand the essence of agile development methods 3. To understand the principles and practices of extreme programming 4. To understand the roles of prototyping in the software process 5. To understand the concept of Mastering Agility

UNIT No	**Syllabus Content**	**No of Hours**
1	**Why Agile?:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor	**10**
2	Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility	**10**
3	**Practicing XP: Thinking:** Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	**11**
4	**Mastering Agility Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	**10**

Course Outcomes	Description	RBT Levels
CO1	Understand The XP Lifecycle, XP Concepts, Adopting XP	R1,R3
CO2	Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer T	R4
CO3	Implement Concepts to Eliminate Waste	R3,R4

CO-PO Mapping	PO 1	PO 2	PO3	PO4	PO5
CO1	1	1	3	3	2
CO2	-	2	3	3	2
CO3	-	-	3	2	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013, ISBN 10: 0070087709 ISBN 13: 9780070087705

2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013, ISBN: 0-13-604259-7

3. Ivan Bratko Prolog Programming for Artificial Intelligence , (International Computer Science Series) 4th Edition, Publisher**:** Pearson Education Canada; 4th edition, 2011, ISBN-10: 0321417461; ISBN-13: 978-0321417466

REFERENCE BOOKS/WEBLINKS:

1. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, ISBN-13: 9780934613101

COURSE COORDINATOR:	**Dr. M.V. Vijayakumar & Dr. K. R. Shylaja**

	Course Title: Network Programming in UNIX		
	Course Code: **18SCS323**	**No. of Credits: 3 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To familiarize students with advanced concepts of network programming in UNIX environment. 2. To enable them to write programs for network programming 3. To enable them to understand the daemon programs 4. To enable them to understand network protocol stacks 5. To enable them to understand client server communications

Unit No	**Syllabus Content**	**No of Hours**
1	OSI model, client server model, TCP/IP protocols, introduction to Unix; Process, groups, job control and non-job control shells, reliable and unreliable signals.	**11**
2	Inter process communication in Unix, pipes, half duplex and full duplex pipes, FIFOs, properties of pipes and FIFOs, POSIX message queues, system V message queues, semaphores, shared memory, mmap function and its use, RPC, authentication, timeout and retransmission, call semantics, Daemon processes and inetd daemon.	**10**
3	Introduction to Berkeley sockets, socket addressing, TCP and UDP socket functions, sockets and Unix signals, socket implementation, client and server examples for TCP and UDP and their behaviour under abnormal conditions.	**10**
4	Socket options, IPv4, IPv6, TCP, I/O multiplexing, Unix I/O models, select and poll functions, Unix domain protocols	**11**
5	Routing sockets, raw sockets, example programs, ping, traceroute, methods for writing client and server in Unix, iterative server, concurrent server, preforking, prethreads programming	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze basic network programming tools available in UNIX	R4
CO2	Design programs for network communications	R4

CO3	Interpret the network protocol stacks in UNIX	R3
CO4	Use commands to understand the network configure	R1,R3

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**
CO1	-	-	2	3	1
CO2	1	2	2	3	1
CO3	-	2	3	3	3
CO4	-	-	2	3	3

TEXT BOOK:

1. Stevens, W.R., Fenner, B. and Rudoff A.M., "Unix Network Programming: Vol. I", 3rd Ed., Pearson Education 2004
2. Stevens, W.R., "Unix Network Programming: Vol. II", 2nd Ed., Pearson Education

REFERENCE BOOKS / WEBLINKS:

1. Stevens, W.R., "Advanced Programming in Unix Environment", Pearson Education 2002
2. Bovet, D.A. and Cesati, M., "Understanding the Linux Kernel", 2 nd Ed., O'Reilly.

COURSE COORDINATOR:	**Dr. K R Shylaja**

	Course Title: Mobile Computing and Wireless Network		
	Course Code: 18SCS324	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To introduce the concepts of wireless communication 2. To understand CDMA, GSM, Mobile IP, WImax. 3. To understand Different Mobile OS. 4. To learn various Markup Languages and CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

Unit No	**Syllabus Content**	**No of Hours**
1	Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS.	**11**
2	Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP.	**10**
3	Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS.	**10**
4	Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML	**11**

5	J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet lifecycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Work on state of art techniques in wireless communication	R3
CO2	Explore CDMA, GSM, Mobile IP, WiMax.	R4,R6
CO3	Work on Different Mobile OS, Develop program for CLDC, MIDP let model and security concerns	R3,R4

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**
CO1	3	1	-	1	2
CO2	2	1	3	-	1
CO3	1	-	2	1	3

Strong -3 Medium -2 Weak -1

TEXT BOOK:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.

2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS / WEBLINKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.

2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

COURSE COORDINATOR:	**Prof. Shamshekar Patil**

	Course Title: **Natural Language Processing and Text Mining**		
	Course Code: 18SCS331	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. Learn the techniques in natural language processing. 2. Be familiar with the natural language generation. 3. Be exposed to Text Mining. 4. Analyze the information retrieval techniques

Unit No	**Syllabus Content**	**No of Hours**
1	**OVERVIEW AND LANGUAGE MODELING:** Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.	**10**
2	**WORD LEVEL AND SYNTACTIC ANALYSIS:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Syntactic Analysis:** Contextfree Grammar-Constituency-Parsing-Probabilistic Parsing	**10**
3	**Extracting Relations from Text:** From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. **A Case Study in Natural Language Based Web Search:** InFact System Overview, The GlobalSecurity.org Experience.	**11**

4	**Evaluating Self-Explanations in iSTART:** Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.	**11**
5	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame NetStemmers-POS Tagger-Research Corpora.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze the natural language text.	R4
CO2	Generate the natural language.	R3
CO3	Demonstrate Text mining.	R4
CO4	Apply information retrieval techniques	R3

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**
CO1	-	1	2	3	1
CO2	-	-	2	2	3
CO3	-	2	3	2	2
CO4	-	-	2	3	3

Strong -3 Medium -2 Weak -1
TEXT BOOK: 1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessingandText Mining",Springer- Verlag London Limited 2007.
REFERENCE BOOKS / WEBLINKS: 1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008. **2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.** **3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.** **4. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python," Publisher: O'Reilly Media, June 2009** 5. **Christopher D.Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.**

COURSE COORDINATOR:	**Prof. Shamshekhar Patil**

	Course Title: Data ware house and Data mining		
	Course Code: 18SCS332	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. Explain Data mining principles and techniques and Introduce DM as a cutting edge business intelligence 2. Interpret association rule mining for handling large data 3. Classification for the retrieval purposes 4. Explain clustering techniques in details for better organization and retrieval of data

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction and Data Preprocessing :**Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining. **Data Preprocessing:** An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.	**10**
2	**Data warehousing and online analytical processing:** Data warehousing: Basic concepts, Data warehouse modeling: Data cube and OLAP, Data warehouse design and usage, Data warehouse implementation, Data generalization by attribute-oriented induction	**11**
3	**Classification: Basic Concepts:** Basic Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy	**11**
4	**Cluster Analysis:** Basic concepts and methods: Cluster Analysis, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods, Evaluation of clustering.	**10**
5	**Data mining trends and research frontiers:** Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society.	**10**

Course Outcomes	Description	RBT Levels
CO1	Demonstrate Storing voluminous data for online processing, Preprocess the data for mining applications	R4
CO2	Apply the association rules for mining the data	R3
CO3	Design and deploy appropriate classification techniques	R4
CO4	Cluster the high dimensional data for better organization of the data	R4,R5
CO5	Discover the knowledge imbibed in the high dimensional system	R1,R5

CO-PO Mapping	PO 1	PO 2	PO3	PO4	PO5
CO1	-	-	2	3	1
CO2	-	2	2	3	2
CO3	-	-	3	2	2
CO4	2	-	2	3	3
CO5	1	2	2	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOK:

1. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining Concepts and Techniques, ELSEVIER(MK) 3rd edition 2012.

REFERENCE BOOKS / WEBLINKS:

1. Data Mining and Warehousing" by Khushboo and Sandeep
2. The Encyclopedia of Data Warehousing and Mining" by John Wang

Course Coordinator: Prof. Shamshekhar Patil

	Course Title: Cryptography and Network Security		
	Course Code: 18SCS333	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. Explain standard algorithms used to provide confidentiality, integrity and authenticity. 2. Distinguish key distribution and management schemes. 3. Deploy encryption techniques to secure data in transit across data networks 4. • Implement security applications in the field of Information technology

Unit No	**Syllabus Content**	**No of Hours**
1	Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.	11
2	**Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffiehellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption.	11

3	**Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication.	10
4	**Wireless network security:** Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations.	10
5	**Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes,	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security Solution.	R4,R5
CO2	Identify the security issues in the network and resolve it.	R4
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical.	R4,R5

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**	
CO1	1	1	3	3	2	
CO2	-	-	3	3	2	
CO3	-	-	3	2	2	
CO4	2	1	3	3	3	

TEXT BOOK:

1. William Stallings, Cryptography and Network Security, Pearson 6th edition.

REFERENCE BOOKS / WEBLINKS:

1. V K Pachghare: Cryptography and Information Security

Course Coordinator: Prof. Shamshekar S. Patil

	Course Title : **COMPUTATIONAL INTELLIGENCE**		
	Course Code: 18SCS334	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications. 2. To comprehend the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic. 3. To interpret the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Unit No	**Syllabus Content**	**No of Hours**
1	Computational Intelligence and Knowledge : What Is Computational Intelligence? , Agents in the World , Representation and Reasoning Applications, Overview , A Representation and Reasoning System :Introduction , Representation and Reasoning Systems ,Simplifying Assumptions of the Initial RRS , Data log, Semantics , Questions and Answers , Proofs , Extending the Language with Function Symbols	**11**
2	Using Definite Knowledge :Introduction, Case Study: House Wiring , Databases and Recursion, Verification and Limitations, Case Study: Representing Abstract Concepts, Case Study: Representing Regulatory Knowledge, Applications in Natural Language Processing ; Representing Knowledge : Introduction, Defining a Solution, Choosing a Representation Language, Mapping from Problem to Representation, Choosing an Inference Procedure	**10**
3	Knowledge Engineering , Introduction, Knowledge-Based System Architecture, Meta- Interpreters, Querying the User, Explanation, Debugging Knowledge Bases, A Meta-Interpreter with Search, Unification, Beyond Definite Knowledge :Introduction, Equality ,Integrity Constraints ,Complete Knowledge Assumption , Disjunctive Knowledge, Explicit Quantification , First-Order Predicate Calculus, Modal Logic,	**10**
4	Using Uncertain Knowledge ,Introduction , Probability , Independence Assumptions , Making Decisions Under Uncertainty	**11**

5	Learning 08 Hours Introduction , Learning as Choosing the Best Representation , Case-Based Reasoning , Learning as Refining the Hypothesis Space , Learning Under Uncertainty ,Explanation-Based Learning	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Identify different types of AI agents	R3
CO2	Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction,genetic algorithms)	R4
CO3	Exhibit the fundamental usage of knowledge representation (logic-based, frame-based,semantic nets), inference and theorem proving	R4,R5
CO4	Build simple knowledge-based systems	R4
CO5	Express working knowledge of reasoning in the presence of incomplete and/or uncertaininformation	R4
CO6	Apply knowledge representation, reasoning, and machine learning techniques to real-world problems	R4

CO-PO Mapping	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**
CO1	-	1	2	3	1
CO2	-	-	2	3	2
CO3	-	1	3	3	2
CO4	-	-	2	3	3

Text Books:

1. David Poole, Alan MAckworth, Randy Goebel: Computational Intelligence – a logical approach, Oxford University

Reference Books:

1. Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary

Computation,by James M. Keller, Derong Liu, David B. Fogel ISBN: 978-1-119-21434-2

Course Coordinator: Prof. Shamshekar S. Patil

Panchajanya Vidya Peetha Welfare Trust (Regd)

Dr. Ambedkar Institute of Technology

An Autonomous Institution, Affiliated to Visvesvaraya Technological University, Belagavi,
Aided by Govt. of Karnataka, Approved by All India Council for Technical Education (AICTE), New Delhi
Accredited by NBA and NAAC with 'A' Grade
BDA Outer Ring Road, Mallathalli, Bengaluru - 560 056

Ref. No. .....

Date : .....

M. Tech in Computer Science & Engineering

Scheme 2017-2018

The following list of subjects are identified as courses focused on employability and Skill Development in the scheme 2017-2018.

Sl. No.	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
1	Artificial Intelligence & Prolog Programming	SCS151	Employability &Skill development
1	Digital Image Processing	SCS152	Employability &Skill development
2	Advances in Storage Area Network	SCS153	Employability &Skill development
3	Machine Learning Techniques	SCS241	Employability &Skill development
4	Computer Vision	SCS242	Employability &Skill development
5	Cyber Security	SCS243	Employability &Skill development
6	Information and Network Security	SCS251	Employability &Skill development
7	Soft Computing	SCS252	Employability &Skill development
8	Neural Networks	SCS253	Employability &Skill development
9	Wireless networks and Mobile Computing	SCS421	Employability &Skill development
10	Advanced Data Structures	SCS422	Employability &Skill development
11	Agile Methodologies	SCS423	Employability &Skill development

HOD,CSE

Principal

PRINCIPAL
Dr. Ambedkar Institute of Technology
Bengaluru-560 056

	Course Title: Digital Image Processing		
	Course Code: SCS152	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques. 2. To understand the image segmentation and representation techniques. 3. To understand how image are analyzed to extract features of interest. 4. To introduce the concepts of image registration and image fusion. 5. To analyze the constraints in image processing when dealing with image data sets.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction:** What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, and Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	11
2	I**mage Enhancement in the Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters.	11
3	**Image Segmentation and Object Recognition:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Methods.	10

4	**Image Restoration:** A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering.	10
5	Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand image formation and the role human visual system plays in perception of gray and color image data.	**R1, R2**
CO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.	**R3**
CO3	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation	**R4, R5**
CO4	Conduct independent study and analysis of feature extraction techniques.	**R4**
CO5	Understand the concepts of image registration and image fusion.	**R5**
CO6	Analyze the constraints in image processing when dealing with image data sets and to apply image algorithms in practical applications	**R3,R4**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**
CO3	-	-	**3**	**2**	**2**

CO4	**-**	**-**	**3**	**2**	**2**
CO5	**-**	**1**	**3**	**2**	**2**
CO6	**-**	**1**	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Rafel C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005 ISBN-13: 978-0201180756 ISBN-10: 0201180758
2. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997 ISBN 81-7808-087-7

REFERENCE BOOKS:

A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004. Published by Prentice-Hall of India Pvt.Ltd (2004) ISBN 10: 8120309294 ISBN 13: 9788120309296

2. Z. Li and M.S. Drew: Fundamentals of Multimedia, 2004. ISBN: 0130618721, Prentice-Hall,

3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Procesing, TataMcGraw Hill, 2014. ISBN 9780070144798.

COURSE COORDINATOR:	**Prof Nithya.E**

	Course Title: Advances in Storage Area Networks		
	Course Code: SCS154	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the fundamentals of storage centric and server centric systems 2. To understand the metrics used for Designing storage area networks 3. To understand the RAID concepts 4. To enable the students to understand how data centre's maintain the data with the 5. concepts of backup mainly remote mirroring concepts for both simple and complex systems

Unit No	**Syllabus Content**	**No of Hours**
1	Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels;	11
2	I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fiber Channel Protocol Stack; Fiber Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture,	11
3	Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	10

4	SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fiber channel switch; Host Bus Adaptors ;Putting the storage in SAN; Fabric operation from a Hardware perspective.	10
5	Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Identify the need for performance evaluation and the metrics used for it	R1, R2
CO2	Apply the techniques used for data maintenance.	R3
CO3	Realize strong virtualization concepts	R4
CO4	Develop techniques for evaluating policies for LUN masking, file systems	R4 & R5

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	3	3	2
CO2	2	-	3	-	2
CO3	-	-	3	-	2
CO4	-	2	3	2	-

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2013. ISBN 978-81-265-1832-6

REFERENCE BOOKS:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011. ISBN 978-0-07-053292-2
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.ISBN-10: 1-58705-162-1ISBN-13: 978-1-58705-162-3
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials “A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.ISBN: 978-0-471-03445-2

COURSE COORDINATOR:	**Prof Nithya.E**

	Course Title: Machine Learning Techniques		
	Course Code: SCS241	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the basic concepts of Probability Theory 2. To understand the Probability Distributions and Binary Variables 3. To understand the Bayesian inference for the Gaussian 4. To understand the Neural Networks concepts 5. To understand the linear-Gaussian models 6. To understand the graphical models and Inference methods

Unit No	**Syllabus Content**	**No of Hours**
1	Introduction ,Example: Polynomial Curve Fitting, Probability Theory, Probability densities, Expectations and covariance's, probabilities, The Gaussian distribution, Curve fitting re-visited, Bayesian curve fitting, Model Selection, The Curse of Dimensionality, Decision Theory, Minimizing the misclassification rate Minimizing the expected loss, The reject option, Inference and decision, Loss functions for regression, Information Theory, Relative entropy and mutual information.	11
2	Probability Distributions, Binary Variables, The beta distribution , Multinomial Variables, The Dirichlet distribution ,The Gaussian Distribution Conditional Gaussian distributions, Marginal Gaussian distributions, Bayes' theorem for Gaussian variables, Maximum likelihood for the Gaussian.	10
3	Sequential estimation, Bayesian inference for the Gaussian, Student's t-distribution, Periodic variables, Mixtures of Gaussians, Exponential Family, Maximum likelihood and sufficient statistics , Conjugate priors, Non informative priors, Nonparametric Methods, Kernel density estimators, Nearest-neighbour methods.	10

4	Neural Networks, Feed-forward Network Functions, Weight-space symmetries Network Training, Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization, Error Back propagation of error-function derivatives, A simple example Efficiency of backpropagation, The Jacobian matrix.	10
5	Graphical Models, Bayesian Networks, Example: Polynomial regression Generative models, Discrete variables Linear-Gaussian models, Conditional Independence Three example graphs, separation, Markov Random Fields, Conditional independence properties, Factorization properties, Illustration: Image de-noising to directed graphs Inference in Graphical Models, Inference on a chain Trees, Factor graphs, The sum-product algorithm ,The max-sum algorithm.	11

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze and Apply the curve fitting techniques and Probability Theory	R3, R4
CO2	Point out the salient features of Gaussian Distribution	R1, R2
CO3	Understand and apply the statistics methods	R3, R6
CO4	Understand and implement Neural network concepts	R5
CO5	Analyze and apply linear-Gaussian models	R3,R4
CO6	Choose and differentiate graphical models and Inference methods	R4, R6

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**
CO3	-	**2**	**3**	**2**	**2**
CO4	-	**2**	**3**	**2**	**2**
CO5	-	-	**3**	**2**	**2**
CO6	-	-	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Christopher M. Bishop's *Pattern Recognition and Machine Learning*, Publisher: Springer Verlag, Edition: 1st, 2010, ISBN: 9780387310732,0387310738

REFERENCE BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013, ISBN: 0070428077
2. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013., ISBN: 9780262012430

COURSE COORDINATOR:	**Dr. M V Vijayakumar**

	Course Title: Computer Vision		
	Course Code: SCS242	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To review image processing techniques for computer vision 2. To understand shape and region analysis 3. To understand Hough Transform and its applications to detect lines, circles, ellipses 4. To understand three-dimensional image analysis techniques 5. To understand motion analysis 6. To study some applications of computer vision algorithms

Unit No	**Syllabus Content**	**No of Hours**
1	CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local	11
2	Shading Models, Application: Photometric Stereo, Inter-reflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image color.	11
3	Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives	10
4	Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	10

5	Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Implement fundamental image processing techniques required for computer vision	R5
CO2	Perform shape analysis	R3 and R4
CO3	Implement boundary tracking techniques	R4
CO4	Apply chain codes and other region descriptors	R3
CO5	Implement motion related techniques.	R4
CO6	Develop applications using computer vision techniques.	R5

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**
CO3	-	**2**	**3**	**2**	**2**
CO4	-	**2**	**3**	**2**	**2**
CO5	-	-	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition) ISBN-13: 978-0136085928 ISBN-10: 013608592X

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.ISBN: 9780123869081

COURSE COORDINATOR:	**Prof Nithya. E**

	Course Title: Cyber Security		
	Course Code: SCS243	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	To provide an understanding Computer forensics fundamentals 2. To analyze various computer forensics technologies 3. To provide computer forensics systems 4. To identify methods for data recovery. 5. To apply the methods for preservation of digital evidence.

Unit No	**Syllabus Content**	**No of Hours**
1	**Computer Forensics Fundamentals** **I**ntroduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology.	10
2	**Types of Computer Forensics Technology** Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware. Encryption Methods and Vulnerabilities ,Protecting Data from Being Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls ,Biometric Security Systems.	11

3	**Types of Computer Forensics Systems** Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems. Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems ,Identity Theft , Biometric Security Systems,Homeland Security Systems	11
4	**Data Recovery** Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data **Evidence Collection and Data Seizure** Why Collect Evidence?, Collection Options ,Obstacles ,Types of Evidence ,The Rules of Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of Collection, Artifacts.	10
5	**Duplication and Preservation of Digital Evidence** Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image Verification and Authentication Special Needs of Evidential Authentication, Practical Considerations.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand the definition of computer forensics fundamentals.	R3
CO2	Describe the types of computer forensics technology.	R1 and R2
CO3	Analyze various computer forensics systems.	R4
CO4	Illustrate the methods for data recovery, evidence collection and data seizure.	R2
CO5	Summarize duplication and preservation of digital evidence.	R6

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	3	-

CO2	-	-	3	3	1
CO3	-	-	3	3	2
CO4	1	-	3	3	2
CO5	1	-	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles,River Media, 2005 ISBN-13: 978-1584503897

REFERENCE BOOKS:

1. ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners,2nd Edition, Springer's, 2010ISBN 978-3-642-04101-3
2. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures forEthical Hackers & IT Security Experts, Ali Jahangiri, 2009ISBN-13: 978-0984271504
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series:Computer Forensics), 2010ISBN-13: 978-1435483521

COURSE COORDINATOR:	**Prof Madhu B**

	Course Title: Information And Network Security		
	Course Code: **SCS251**	**No. of Credits: 4 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand the fundamentals of Cryptography 2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. 3. To understand the various key distribution and management schemes. 4. To understand how to deploy encryption techniques to secure data in transit across data networks 5. To design security applications in the field of Information technology

Unit No	**Syllabus Content**	**No of Hours**
1	Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono alphabetic Cipher, Play fair Cipher, Hill Cipher, Polyalphabetic Cipher, One TimePad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, ADES example, results, the avalanche effect, the strength of DES.	11

2	Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.	11
3	Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates.	10
4	Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, and protected data transfer phase.	**10**
5	Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution	R4,R5
CO2	Identify the security issues in the network and resolve it.	R2
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical	R4
CO4	Compare and Contrast different IEEE standards and electronic mail security	R4

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**

CO3	**-**	**2**	**3**	**2**	**2**
CO4	**-**	**2**	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013ISBN-10: 0133354695ISBN-13: 978-0133354690

REFERENCE BOOKS:

1. V k Pachghare: Cryptography and Information Security, PHE,2013.ISBN8120350820, 9788120350823

COURSE COORDINATOR:	**Prof Nithya E**

	Course Title: Soft Computing		
	Course Code: SCS252	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To learn the key aspects of Soft computing 2. To know about the components and building block hypothesis of Genetic algorithm. 3. To gain insight onto Neuro Fuzzy modeling and control. 4. To gain knowledge in machine learning through Support vector machines

Unit No	**Syllabus Content**	**No of Hours**
1	Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.	11
2	Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).	11

3	Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.	10
4	Fuzzy decision making, and applications.	10
5	Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze the basics of soft computing, ANN and Terminologies to relate and understand the real time problems	R3,R4
CO2	Apply supervised and unsupervised learning representations for analyzing real time problems	R3 and R4
CO3	Analyze and adopt fuzzy logic in implementing soft computing applications.	R4
CO4	Analyze and apply genetic algorithms to solve the optimization problems	R3, R4

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	3	3
CO2	-	-	3	3	3
CO3	1	3	3	2	2
CO4	2	2	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India,) ISBN 13: 9788126527410, 2011 (Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

REFERENCE BOOKS:

Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012, ISBN 0-13-261066-3

COURSE COORDINATOR:	**Dr. M. V. Vijaykumar**

	Course Title: Neural Networks		
	Course Code: **SCS253**	**No. of Credits: 4 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand and compare the learning algorithms. 2. To understand the perceptron convergence theorem, and the relationship between the perceptron and the Bayes classifier operating in a Gaussian Environment. 3. To understand SOM development which follows the principles of Self-organization. 4. To understand dynamical systems and HOPFIELD Model

Unit No	**Syllabus Content**	**No of Hours**

1	**INTRODUCTION** - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks LEARNING PROCESS 1 – Error Correction learning, Memory based learning, Hebbian learning.	10
2	**LEARNING PROCESS 2**: Competitive, Boltzmann learning, Credit Assignment Problem, Statistical nature of the learning process, SINGLE LAYER PERCEPTRONS – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception – convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.	11
3	**MULTILAYER PERCEPTRON** – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection, BACK PROPAGATION - back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.	11
4	**SELF ORGANIZATION MAPS** – Two basic feature mapping models, Self-organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps.	10
5	**NEURO DYNAMICS –** Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors' as a recurrent network paradigm, HOPFIELD MODELS – Hopfield models, computer experiment**.**	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Choose the learning techniques with basic knowledge of Neural networks.	R6
CO2	Apply effectively neural networks for appropriate applications.	R3
CO3	Apply Bayer's techniques and derive effectively the learning rules.	R3
CO4	Design organized topographic maps with several useful properties.	R5

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**

CO3	**-**	**2**	**3**	**2**	**2**
CO4	**-**	**2**	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

Neural networks a comprehensive foundations, Simon Haykin, Pearson Education 2nd Edition 2004ISBN 10: 0023527617 ISBN 13: 9780023527616

REFERENCE BOOKS:

1. Artificial neural networks - B.Vegnanarayana Prentice Hall of India P Ltd 2005ISBN:8120312538

2. Neural networks in Computer intelligence, Li Min Fu TMH 2003 ISBN0079118178, 9780079118172

3. Neural networks James A Freeman David M Skapura Pearson Education 2004 ISBN 10: 0201513765 ISBN 13: 9780201513769

COURSE COORDINATOR:	**Dr. Siddaraju**

	Course Title: Wireless Networks And Mobile Computing		
	Course Code: SCS421	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To introduce the concepts of wireless communication 2. To understand CDMA, GSM, Mobile IP, WImax. 3. To understand Different Mobile OS. 4. To learn various Markup Languages and CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

Unit No	**Syllabus Content**	**No of Hours**

1	Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS.	11
2	Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP.	10
3	Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS.	10
4	Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML	11
5	J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet lifecycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Work on state of art techniques in wireless communication	**R1, R4**
CO2	Explore CDMA, GSM, Mobile IP, WiMax.	**R3**
CO3	Work on Different Mobile OS, Develop program for CLDC, MIDP let model and security concerns	**R4**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	

CO1	3	1	-	1	2
CO2	2	1	3	-	1
CO3	1	-	2	1	3

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.

2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.

2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

COURSE COORDINATOR:	**Prof Shamshekhar patil**

	Course Title: Advances Data structure		
	Course Code: SCS422	**No. of Credits: 3 : 0 : 0 : 1 (L-T-P-S)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand using basic data structure stack, queues, linked list and trees 2. To understand hashing technique and heaps 3. To understand the binary search trees and their applications 4. To understand B-trees and their applications 5. To demonstrate the implementation of the basic to advanced data structures

Unit No	**Syllabus Content**	**No of Hours**

1	Elementary Data Structures, Stacks and queues, Linked lists, Implementing pointers and objects, Representing rooted trees,	10
2	Hash Tables, Direct-address tables, Hash tables, Hash functions, Open addressing, Perfect hashing, Heaps Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues	11
3	Binary Search Trees, What is a binary search tree? Querying a binary search tree, Insertion and deletion , Randomly built binary search trees, Red-Black Trees, Properties of red-black trees, Rotations, Insertion Deletion	11
4	B-Trees, Definition of B-trees, Basic operations on B-trees , Deleting a key from a B-tree, Structure of Fibonacci heaps Mergeable-heap operations	10
5	Laboratory Exercises: Implementation using C++ or higher languages on LINUX platform • To implement functions of Dictionary using Hashing. • To perform various operations i.e, insertions and deletions on AVL Trees • To perform various operations i.e., insertions and deletions on binary search tree. • To implement operations on binary heap • To create and implement insertion, deletion and rotations on red-black • To create and implement operations on B-Trees	10

Course Outcomes	**Description**	**RBT Levels**
CO1	To apply the knowledge of data structures in designing and building real time applications	**R4**
CO2	To demonstrate the usage of Heaps and hashing techniques in solving real time problems	**R3 and R4**
CO3	To apply the logical use of different types of trees to optimize the performance of a solutions in real time problems	**R3**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	**3**	**2**	**2**
CO2	-	**2**	**3**	**2**	**2**
CO3	-	-	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:
1. T. H. Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010. ISBN:9780262033848
REFERENCE BOOKS: 1. E. Horowitz, s. Sahni and dineshmehta, fundamentals of data structures in c++, Galgotia, 2006. ISBN8175152788, 9788175152786 2. Ellis Horowitz, SartajSahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007, ISBN 8173716129, 9788173716126

COURSE COORDINATOR:	**Dr. K R Shylaja**

	Course Title: Agile Methodologies		
	Course Code: SCS423	**No. of Credits: 4 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30+70=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To understand how an iterative, incremental development process leads to faster delivery of more useful software 2. To understand the essence of agile development methods 3. To understand the principles and practices of extreme programming 4. To understand the roles of prototyping in the software process 5. To understand the concept of Mastering Agility

Unit No	**Syllabus Content**	**No of Hours**

1	**Why Agile?:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don'tMake Your Own Method, The Road to Mastery, Find a Mentor	10
2	Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility	10
3	**Practicing XP:Thinking:** Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	11
4	**Mastering Agility Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	10
5	**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, DeliverFrequently,**Seek Technical Excellence :** Software Doesn't Exist, Design Is for Understanding, Design Tradeoffs,Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	11

Course Outcomes	**Description**	**RBT Levels**
CO1	Understand The XP Lifecycle, XP Concepts, Adopting XP	R3
CO2	Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests	R5
CO3	Implement Concepts to Eliminate Waste	R3, R5, R6

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**-**	**-**	**3**	**2**	**2**
CO2	**-**	**2**	**3**	**2**	**2**

CO3	**-**	**-**	**3**	**2**	**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007 ISBN 978-159-904-68-39

REFERENCE BOOKS:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002

2., "Agile and Iterative Development a Manger's Guide", Craig Larman Pearson Education, First Edition,India, 2004.

COURSE COORDINATOR:	**Prof Nithya E**