Dr. Ambedkar Institute of technology, Bengaluru-56

Department of Computer Science & Engineering

The enclosed documents are verified & approved.

Prof & Head

Dr. Siddaraju

Department of Computer Science & Engineering

Professor & Head
Department of Computer Science & Engineerir
Dr. Ambedkar Institute of Technology
Bangalore-560 056.

Dr. Ambedkar Institute of Technology

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

Department of Telecommunication Engineering

SCHEME OF TEACHING AND EXAMINATION I SEMESTER (Autonomous) 2020-21, 2021-22

M. Tech in Computer Science & Engineering

I semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1	20SCS11	Probability Statistics and Queueing Theory (Maths)	**MAT**	4	-	-	50	50	100	**3**
2	20SCS12	Cloud Computing Theory and Practices	**CSE**	4	-	-	50	50	100	**3**
3	**20SCS13**	**Internet of Things**	**CSE**	4	-	-	50	50	100	**3**
4	**20SCS14**	**Soft Computing**	**CSE**	4	-	-	50	50	100	**3**
5	**20SCS15X**	**ELECTIVE – I**	**CSE**	4	-	-	50	50	100	**3**
6	**20SCS16X**	**ELECTIVE – II**	**CSE**	4	-	-	50	50	100	**3**
7	20SCSL17	IoT Laboratory	**CSE**	-	-	3	50	50	100	**2**
8	20SCSS18	Technical Seminar	**CSE**	-	4	-	50	-	50	**2**
9	20SCSM19	Minor project	**CSE**	-	-	6	50	-	50	**2**
Total							**450**	**350**	**800**	**24**

Technical Seminar: Seminar on Advanced topics from refereed journals by each student.

ELECTIVE - I			ELECTIVE - II	
Sl .No	**Sub Code**	**Subject title**	**Subject Code**	**Subject title**
1	20SCS151	Advanced Operating System	20SCS161	Introduction to Blackchain Technology
2	20SCS152	Advances in Computer Network	20SCS162	Advanced Algorithms and Data structure
3	20SCS153	Artificial Intelligence and Prolog Programming	20SCS163	Cyber Security and Cyber Laws
4	20SCS154	Parallel Computing with GPU Architecture	20SCS164	Computational Intelligence

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Department of Telecommunication Engineering

SCHEME OF TEACHING AND EXAMINATION II SEMESTER (Autonomous) 2020-21, 2021-22

M. Tech in Computer Science & Engineering

II semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1	20SCS21	Managing Big Data	**CSE**	4	-	-	50	50	100	**3**
2	20SCS22	Advanced Database Systems	**CSE**	4	-	-	50	50	100	**3**
3	**20SCS23**	**Cryptography & Network Security**	**CSE**	4	-	-	50	50	100	**3**
4	**20SCS24**	**Data Science and Machine Learning Techniques**	**CSE**	4	-	-	50	50	100	**3**
5	**20SCS25X**	**ELECTIVE – III**	**CSE**	4	-	-	50	50	100	**3**
6	**20SCS26X**	**ELECTIVE – IV**	**CSE**	4	-	-	50	50	100	**3**
7	20RM27	Research Methodology	**CSE**	2	--	-	50	50	100	**2**
8	20SCSL28	Data Science and Machine Learning Laboratory	**CSE**	-	-	3	50	50	100	**2**
9	20SCSP29	Project Phase - I	**CSE**	-	-	6	50	-	50	**2**
Total							**450**	**400**	**850**	**24**

ELECTIVE - III			ELECTIVE - IV	
Sl .No	**Sub Code**	**Subject title**	**Subject Code**	**Subject title**
1	20SCS251	Natural Language Processing	20SCS261	Business Analytics
2	20SCS252	Industry Elective (TCS)	20SCS262	Deep Learning
3	20SCS253	Agile Methodologies	20SCS263	Storage Area Network
4	20SCS254	Wireless Networks & Mobile Computing	20SCS264	Intelligent Systems

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Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION III SEMESTER (Autonomous) 2020-21, 2021-22

M. Tech in Computer Science & Engineering

III semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
1	20SCS31	Self Study – Massive Open Online Course (MOOC)	**CSE**	--	8	--	50	50	100	**4**
2	20SCSI32	Internship	**CSE**	--	--	16	50	50	100	**8**
3	20SCSS33	Technical Seminar	**CSE**	-	4	-	50	-	50	**2**
4	20SCSP34	Evaluation of Project Work Phase I	**CSE**	-	-	12	50	50	100	**6**
Total							**200**	**150**	**350**	**20**

* List of MOOC course shall be decided in the Board of Studies meeting Students shall register for NPTEL-MOOC during 2nd semester and shall be completed before the last working day of the 3rd semester. The certificate and assignment and examination scores should be submitted to the examination section.

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

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Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION IV SEMESTER (Autonomous) 2020-21, 2021-22

M. Tech in Computer Science & Engineering

IV semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
1	20SCSP41	Project Phase – II Midterm Internal Evaluation	**CSE**	-	-	8	100	-	100	**2**
2	20SCSP42	Project Work Evaluation and Viva Voce	**CSE**	-	4	24	100	100	200	**18**
Total							**200**	**100**	**300**	**20**
Grand Total (I to IV Semester) : 2300 Marks ; 88 Credits										

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

Note:

1) Project Phase – I **:** 6 weeks duration shall be carried out during III Semester. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Project Phase – II **:** 16 weeks duration during IV Semester. Evaluation shall be taken during the IV Semester. Total Marks shall be 100.

3) Project Work Evaluation and viva-voce: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 200 (Phase –II Evaluation: 100 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, and 100 for viva-voce).

Marks of Evaluation of Project:

1. During Project Phase – I, finalise titles and submit synopsis to the Institute along with Project Work report at the end of the Semester.
2. During the final viva, students have to submit all the reports.
3. The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
   a) Head of the Department (Chairman)
   b) Internal examiner (Guide)
   c) External examiner proposed by the Chairman, BoE (PG)

SEMESTER -1

Dr. Ambedkar Institute of Technology

M.Tech Computer Science & Engineering

2021-2022

	Course Title: : PROBABILITY STATISTICS AND QUEUEING THEORY		
	Course Code: 20SCS11	**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. To develop analytical capability and to impart knowledge of Probability, Statistics and Queuing. **2.** The application of above concepts in Engineering and Technology. **3.** Students acquire knowledge of Hypothesis testing and Queueing methods and their applications so as to enable them to apply them for solving real world problems.

Unit No.	**Syllabus Content**	**No of Hours**
1	**Probability**: Axioms of Probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Engineering Application: Optical communication system.	**11**
2	**Standard Probability Distributions:** Discrete distributions: Binomial, Poisson , Geometric and their properties. Continuous distributions: Normal, exponential Weibull distributions and their properties. Two-dimensional Random variables, Joint pdf / cdf and their properties, Engineering Application: Entropy and Source coding.	**11**
3	**Testing Hypothesis:** Testing of Hypothesis: Formulation of Null hypothesis, critical 10 Hours region, level of significance, errors in testing, Test2s of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution.	**10**
4	**Random Processes:** Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Auto correlation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	**10**
5	**Queueing Theory:** Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffer	**10**

Course Outcomes	**Description**
CO1	Students will demonstrate knowledge & use of probability and will be able to characterize probability models using probability mass (density) functions & cumulative distribution functions.
CO2	Students will be introduced to the techniques of developing discrete & continuous probability distributions and its applications.
CO3	Students will be able to describe a random process in terms of its mean and correlation functions.

CO4	Students will be introduced to methods of Hypothesis testing for goodness of fit.
CO5	Students will be able to understand the terminology & nomenclature appropriate queuing theory and also demonstrate the knowledge and understand the various queuing models

CO-PO Mapping	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**2**	**3**	**3**									
CO2	**3**	**2**	**2**									
CO3	**3**	**2**	**3**									
CO4	**3**	**3**	**2**									
CO5	**2**	**3**	**2**									

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009. Published by PHI Learning, New Delhi (2009)

REFERENCE BOOKS:

1. Probability and Random Processes, Scott L.Miller and Donald Childers, Sixth indian reprint,2018
2. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India, 2004. ISBN: 978-0-471-33341-8.
3. Probability ,Queing theory and Engineering Reliability, Haribhaskaran, First Edition ,Laxmi Publication 2005.

COURSE COORDINATOR:	**Prof. Shiva Prasanna (Maths Dept)**

	Course Title: Cloud Computing		
	Course Code: 20SCS12	**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. To learn how to use Cloud Services. 2. To implement Virtualization 3. To implement Task Scheduling algorithms. 4. Apply Map-Reduce concept to applications. 5. To build Private Cloud. 6. Broadly educate to know the impact of engineering on legal and societal issues involved.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction:** Network centric computing and network centric content, Peer-to-peer systems, Cloud Computing: an old idea whose time has come, Cloud Computing delivery models & Services, Ethical issues, Cloud vulnerabilities, Challenges. **Cloud Infrastructure:** Amazon, Google, Azure & online services, open source private clouds. Storage diversity and vendor lock-in, intercloud, Energy use & ecological impact of data centers, service level and compliance level agreement, Responsibility sharing, user experience, Software licensing.	**10**
2	**Cloud Computing**: **Applications & Paradigms**, Challenges, existing and new application opportunities, Architectural styles of cloud applications, Workflows coordination of multiple activities, Coordination based on a state machine model -the Zoo Keeper, The Map Reduce programming model, Apache Hadoop, A case study: the GrepTheWeb application, High performance computing on a cloud, cloud for biological research, Social computing, digital content, and cloud computing. **Cloud Applications:** Scientific Applications, Business and consumer Application	**10**
3	**Cloud Resource Virtualization**: definition, merits and demerits, types and techniques, Layering and virtualization, Virtual machine monitors, Virtual machines Full virtualization and paravirtualization, Hardware support for virtualization Case study: Xen -a VMM based on paravirtualization, Optimization of network virtualization in Xen 2.0, vBlades -paravirtualization targeting a x86-64 Itanium processor, A performance comparison of virtual machines, The darker side of virtualization, Software fault isolation.	**11**

4	**Cloud Resource Management and Scheduling:** Policies and mechanisms for resource management, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, utility based model for cloud-based web services, Resource bundling, combinatorial auctions for cloud resources, fair queuing, Start time fair queuing, borrowed virtual time. **Python for Cloud:** Python for Amazon Web services, Python for Google Cloud platform, Python for Windows Azure, python for map Reduce **Self Study Component:**	**11**
5	**Cloud Security, Cloud Application Development, Storage systems**: Storage models, file systems, databases, DFS, General parallel File system, GFS, Apache Hadoop, Locks & Chubby, TPS & NOSQL databases, Bigdata, Mega store. **Cloud Security:** Risks, Security, Privacy, Trust, Security of OS, VM, VMM, Shared Image, Management OS, Xoar.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	**Analyze** the Cloud computing setup with it's vulnerabilities and applications using different architectures.	**L1, L3**
CO2	**Design** different workflows according to requirements and **Apply** map reduce programming model.	**L4,**
CO3	**Apply and Design** suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.	**L5**
CO4	**Create** combinatorial auctions for cloud resources and **Design** scheduling algorithms for computing clouds	**L6**
CO5	**Assess** cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application	**L2**
CO6	Broadly **Educate** to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.	**L1, L2**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**		**1**								
CO2	**2**	**1**	**2**									
CO3	**2**	**2**	**2**									
CO4	**2**	**2**	**1**		**1**							
CO5	**2**	**2**			**1**							
CO6	**2**	**1**				**2**				**1**		

Strong -3 Medium -2 Weak -1
TEXT BOOKS:
1. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013, 1st Edition, Print Book ISBN :9780124046276, eBook ISBN :9780124046412
REFERENCE BOOKS:
1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
SELF STUDY REFERENCES/WEBLINKS:
1. Cloud Computing : A hands on Approach, Arshdeep Bagha - Vijay Bagha Madisetti , 2013, ISBN/EAN13: 1494435144 / 9781494435141. 2. https://nptel.ac.in/content/syllabus_pdf/106104182.pdf 3. https://nptel.ac.in/content/syllabus_pdf/106105167.pdf

COURSE COORDINATOR:	Dr. SIDDARAJU

	Course Title: Internet Of Things		
	Course Code: 20SCS13	**No. of Credits: 3 = 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. Infer the concepts of Physical and Logical design in IoT to deploy applications at different levels. 2. Interpret the vision of IoT from a global context. 3. Understand the IoT Market perspective and discover the IoT architectural standards. 4. Identify the specifications involved in designing IoT applications. 5. Classify the Real-World Domain specific IoT applications.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction and 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, **IoT Levels and Deployment Templates:** IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6.	**11**
2	**M2M to IoT:** The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.	**10**
3	**M2M to IoT: A Market Perspective**- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. **M2M to IoT-An Architectural Overview:** Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	**10**
4	**IoT Architecture-State of the Art –** Introduction, State of the art, **SDN and NFV for IoT:** Software Defined Networking, Network Function Virtualization, **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 and Application Development.	**11**
5	**Domain Specific IoTs: Home Automation:** Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities:** Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment:** Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection,	**10**

	River Floods Detection, **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. **Self-Study**	

Course Outcomes	**Description**	**RBT Levels**
CO1	Examine the Physical design and Logical design required to enable IoT applications and employ technologies to deploy applications at different levels.	**L3**
CO2	Express the vision of M2M and IoT to satisfy the requirements of a global market.	**L2**
CO3	Determine the architectural principles and standards for structuring the IoT applications.	**L2**
CO4	Compare and Contrast the use of Devices, Gateways and Data Management in IoT.	**L3**
CO5	Articulate the need for SDN, NFV from IoT perspective and analyze the design methodologies involved in building the IoT applications.	**L3**
CO6	Illustrate the applications of IoT in different domains and identify Real World Design Constraints.	**L2**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	2	2	2	2	2	-	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-
CO6	3	3	3	3	3	-	-	-	-	-	-	-

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, **"Internet of Things: A Hands-on Approach",** 1st Edition, Orient Blackswan Private Limited, 2015. (ISBN-13: 978-8173719547)
2. Ian Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,
David Boyle, **"From Machine-to-Machine to the Internet of Things: Introduction**

to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846)

REFERENCE BOOKS:

1) Cuno Pfister, **"Make: Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud",** 1st Edition, O'Reilly Publishers, 2011. (ISBN-13: 978-9350234136)
2) Adrian Mcewen, Hakin Cassimally, **"Designing the Internet of Things",** 1st Edition, Wiley Publishers, 2015. (ISBN-13: 978-8126556861)
3) Raj Kamal, **"Internet of Things",** 1st Edition, McGraw Hill Education Publishers, 2017. (ISBN-13: 978-9352605224)
4) David Hanes, et al., **"IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things",** 1st Edition, Pearson Education, 2017. (ISBN-13: 978-9386873743)
5) Rahul Dubey, **"An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications",** 1st Edition, Cengage India Learning Pvt Ltd, 2019. (ISBN-13: 978-9353500931)

COURSE COORDINATOR :	**Dr.Gowrishankar S.**

	Course Title: Soft Computing		
	Course Code: 20SCS14	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :**
	Exam Duration : 3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours :**

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, linear separability, Hebb Network.	**11**
2	Supervised Learning: Perceptual Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network, Associative Memory Network: introduction, training algorithms for pattern association, associative memory network, hetero-associative memory network, bidirectional associative memory.	**10**
3	Classical sets and Fuzzy Sets – classical and Fuzzy Relations – Features of membership functions, Fuzzification and methods of membership value assignment. Defuzzification lambda cuts for fuzzy relations and fuzzy sets.	**10**
4	Fuzzy Decision Making: introduction, individual decision making, multiperson Decision making, multiobjective decision making, multiattribute decision making, fuzzy Bayesian decision making, Fuzzy logic control systems: introduction, control system design, architecture and operation of FLC systems, FLC system Models, Applications of FLC systems	**11**
5	**Self Study Component** Genetic algorithms: Introduction - Basic operations - Traditional optimization and search techniques. Genetic algorithms and search space, Operators of genetic algorithms – Genetic programming	**10**

Course Outcomes	Description	RBT Levels
CO1	Understand the basics of soft computing, ANN and Terminologies to relate and understand the real time problems	**R2 R3**
CO2	Solve the real-time problems using ANN representations	**R3 R4**
CO3	Analyze and adopt fuzzy logic in designing and implementing soft computing applications.	**R3 R4**
CO4	Analyze and apply genetic algorithms to solve the optimization problems	**R3 R4**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**									
CO2	**3**	**3**	**2**									
CO3	**3**	**3**	**3**									**2**
CO4	**3**	**3**	**3**	**2**	**2**							**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Principles of Soft computing, S N Sivanandam, and S N Deepa, Wiley India, 3rd edition ISBN 13: 978812658744-5, 2019

REFERENCE BOOKS:

1. Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012, ISBN 0-13-261066-3
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Third Edition

WEBLINKS:

1. **Introduction to Soft Computing by Prof. Debasis Samanta NPTEL course**
2. **L. A. Zadeh, "Fuzzy Algorithms", Information and Control, vol. 12, pp. 94-102, 1968. CrossRef Google Scholar**
3. **2. L. A. Zadeh, "A Rationale for Fuzzy Control", J.Dynamic Systems Measurement and Control, vol. 94, pp. 3-4, 1972. CrossRef Google Scholar**
4. **3. L. A. Zadeh, "Outline of a New Approach to the Analysis of Complex Systems and Decision Processes", IEEE Trans. Systems Man and Cybernetics, vol. SMC-3, pp. 28-44, 1973**

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

	Course Title: INTERNET OF THINGS LABORATORY		
	Course Code: 20SCSL17	**No. of Credits: 2 = 0 : 0 : 2 (L-T-P)**	**No. of Practical hours/week : 3**
	Exam Duration : 3 hours	**CIE + SEE = 50+50**	

Course Objectives:	**Description**
	1. Develop IoT applications using sensing devices, actuation, processing and communications through IoT development kits. 2. Illustrate the process of building, testing and working of IoT applications through prototyping and programming.

Unit No	**Syllabus Content**
1.	Write a Raspberry Pi based program to make eight LEDs to blink as flowing water.
2.	Illustrate the process of turning an LED ON or OFF using a button on a Raspberry Pi.
3.	Design and develop a heart monitoring system using Arduino/Raspberry Pi.
4.	Develop a home security system using Raspberry Pi/Arduino and PIR Sensor.
5.	Write Python program to monitor the environmental temperature using Arduino/Raspberry Pi.
6.	Devise a program to connect or disconnect a circuit using slide switch on a Raspberry Pi.
7.	Develop a Raspberry Pi based program to gradually increase or decrease the luminance of an LED with Pulse Width Modulation to simulate human breathing.
8.	Write a program using Arduino/Raspberry Pi to display the characters on a LCD module.

Course Outcomes	**Description**	**RBT Levels**
CO1	Examine the key components that make up an IoT system.	**L3**
CO2	Experiment with various sensor modules like environmental, health and security modules and examine how they fit in the overall development process of IoT applications.	**L3**
CO3	Develop hands-on skills by prototyping and building IoT applications.	**L3**
CO4	Determine how the IoT concept fits within the broader ICT industry.	**L3**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	3	3	3	2	3	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-

Strong -3 Medium -2 Weak -1

TEXT BOOKS:	
Conduct of Practical Examination ● All the laboratory programs are to be included for practical examination. ● The instructions and breakup of marks printed on the cover page of the answer script are to be strictly adhered by the examiners. ● Students are allowed to pick any one program randomly from the lot. ● Change of program is allowed only once and the marks will be deducted as per the Dr.AIT Autonomous/Examination rules and regulations.	
COURSE COORDINATOR :	**Dr.Gowrishankar S.**

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

Course Objectives:	**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, deadlock 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, UNIX SVR4 Process Management Text Book 2: Chapter 2 & 3	**10**
2	Threads, SMP, and Microkernel, Processes and Threads, Symmetric Multiprocessing (SMP), Microkernel, Solaris Thread and SMP Management, Virtual Memory: hardware and control structures, Operating System Software, UNIX and Solaris Memory Management. Text Book2: Chapter 4 & 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, Text Book 1: Chapter 10 Text Book 2: Chapter 16	**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 Text Book 1: Chapter 17 & 18	**11**
5	**Self-Study Component:**	**10**

	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	

NOTE:

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

2. Total number of COs is decided by concerned Course Coordinator

Course Outcomes	Description	RBT Levels
CO1	Understand the structure and components of OS and their working mechanism	**R1 R2 R3**
CO2	Analyze and design the applications to run in parallel using OS modules	**R3 R4**
CO3	Analyze and implement the mechanisms involved for sharing resources in distributed and timesharing environments	**R2 R4**
CO4	Conceptualize the components involved in designing a contemporary OS	**R3**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
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

TEXT BOOKS:

1. Avi Silberschatz, 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 edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948

REFERENCE BOOKS:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2012.
2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.

SELF STUDY REFERENCES/WEBLINKS:

1. **Operating System By Prof. Sorav Bansal, IIT Delhi, https://swayam.gov.in/nd1_noc20_cs04/preview** 2. **Linux Kernel Programming - IPC b/w Userspace and KernelSpace by udemy** https://www.udemy.com/course/netlinksockets/ 3. Introuction to Operating Systems from Udemy https://classroom.udacity.com/courses/ud923/lessons/3056258560/concepts/3306199014 0 923	
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 : 3 hours	**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	**Syllabus Content**	**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	**Internetworking I:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), Exercise Problems. What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless 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 Version 6 (IPv6).	**10**
4	**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), Endto- 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 Retransmit and 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**

Course Outcomes	**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	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**3**	**2**										
CO2	**3**	**2**			**1**							
CO3		**3**			**2**							
CO4			**3**	**2**	**1**							
CO5	**3**	**2**										

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition, Elsevier -2014
2. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

REFERENCE BOOKS:

1. Uyless Black, "Computer Networks Protocols , Standards and Inte rfaces" 2nd Edition -PHI.
2. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill

COURSE COORDINATOR:	**SHAMSHEKHAR PATIL**

	Course Title: Artificial Intelligence and Prolog Programming		
	Course Code: 20SCS153	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4 hrs**
	Exam Duration : 3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	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. (Text Book 1: Chapter 3, 4 & 5)	**10**
3	Symbolic Reasoning Under Uncertainty: Introduction to non-monotonic reasoning, Logic for non-monotonic reasoning, Implementation Issues, 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) **Self-Study Components:** Implement programs on agent building, knowledge representation and reasoning mechanisms in prolog	**11**

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

Course Outcomes	**Description**	**RBT Levels**
CO1	Acquire knowledge and understand AI agents with problem solving, reasoning, planning, decision making, and learning abilities	
CO2	Analyze the real time problems to represent it in AI framework and techniques	
CO3	Use prolog programming constructs to represent AI components	
CO4	Design and implement AI applications in prolog to solve real time problems	

CO-PO Mapping	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**

CO1	**3**	**3**	**2**									**2**
CO2	**3**	**3**	**3**	**2**								**3**
CO3	**3**	**3**	**3**	**3**	**3**							**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**						**3**

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:

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

SELF STUDY REFERENCES/WEBLINKS:

1. **An Introduction to Artificial Intelligence By Prof. Mausam , IIT Delhi https://swayam.gov.in/nd1_noc20_cs42/preview**
2. W3schools online tutorials https://www.tutorialspoint.com/prolog_in_artificial_intelligence/index.asp
3. https://lpn.swi-prolog.org/lpnpage.php?pageid=online

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

	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 : 3 hours	**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, OpenMP.

Unit No	**Syllabus Content**	**No of Hours**
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, Isoefficiency 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, Quicksort, Bucket and Sample Sort.	**10**
5.	**Self Study Components**: OpenMP, 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	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1**
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

TEXT BOOKS:

1. Introduction to Parallel Computing (2nd ed.), by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar.
2. High Performance Cluster Computing: Programming and Applications, Volume 2 By Buyya Raijkumar.
3. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs by shane cook.

REFERENCE BOOKS:

1. Introduction to High-Performance Scientific Computing, Victor Eijkhout, 2011. http://tacc web.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, David Walker, and Jack Dongarra, 1996. http://www.netlib.org/utk/papers/mpi-book/mpi-book.html
4. MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, David Walker, and Jack Dongarra, 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 Programming in C with MPI and OpenMP, Michael J. Quinn, McGraw-Hill.

COURSE COORDINATOR:	**Dr. Prabha R**

	Course Title: Introduction to Blockchain Technology		
	Course Code: 20SCS161	**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. To learn fundamentals of Blockchain Technology. 2. To apply the cryptographic primitives in making the Blockchain 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 Blockchain** What is Blockchain, Reality about Blockchain and How Block chain works, Blockchain Architecture and Platforms(BigChainDB, corda, Etherum etc.), Digital Ledger Technology, Peer–to-Peer Network, Centralized, Decentralized and Distributed Networks, Layers of Blockchain, why Blockchain is important, Smart Contracts, Block in a Blockchain, Transaction, Permission less and Permissioned Blockchain, Consortium Blockchain, The Chain and the Longest Chain, Distributed Consensus, Byzantine 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 cryptocurrency. **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), HashcashPoW, Attacks on PoW 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 Blockchain** Pseudo-anonymity vs. anonymity, Zcash and Zk-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 Blockchain 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	RBT Levels
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	PO7	PO8	PO9	PO10	PO11	PO12
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

TEXT BOOKS:

1. Arvind Narayanan, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press,July 19, 2016
2. "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.

REFERENCE BOOKS:

1. Andreas M. Antonopoulos, Mastering Bitcoin, O'Reilly, 2014
2. Melanie Swa, Blockchain: Blueprint for a new Economy, O'Reilly, 2015
3. Antony Lewis, The Basics of Bitcoin and Blockchain.
4. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain-A Beginner's Guide to Building Blockchain Solutions, APress, 2018

SELF STUDY REFERENCES/WEBLINKS:

1. Imran Bashir, Mastering Blockchain, Packt Publishing, Birmingham, UK 2016 2. https://swayam.gov.in/nd1_noc19_cs63/preview	
COURSE COORDINATOR:	**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 : 3 hours	**CIE + SEE = 50+50**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To learn implementing 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: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The Course substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods	11
2	**Graph Algorithms:** Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-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 heapsort 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. Include Self study component in any one of the Unit.

2. Total number of COs is decided by concerned Course Coordinator

Course Outcomes	**Description**	**RBT Levels**
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	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO12**
CO1	**3**	**3**	**3**									
CO2	**3**	**3**	**3**	**2**	**2**							
CO3	**3**	**3**	**3**	**3**	**3**							**3**
CO4	**3**	**3**	**3**	**3**	**3**							**3**

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. Ellis Horowitz, SartajSahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007, ISBN 8173716129, 9788173716126
2. Horowitz, Sahani, Dinesh Mehata, ―Fundamentals of Data Structures in C++‖, 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

SELF STUDY REFERENCES/WEBLINKS:

1. **Introduction to algorithms and analysis By Prof. Sourav Mukhopadhyay | IIT Kharagpur**
   https://swayam.gov.in/nd1_noc20_cs93/preview
2. **Khan Academy course on advanced algorithms and data structure**

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

	Course Title: 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 : 3 hours	**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, 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 Self Study component: **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.	**Self study component:** **Duplication and Preservation of Digital Evidence**	**10**

	Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image Verification and Authentication Special Needs of Evidential Authentication, Practical Considerations.	

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	P06	PO7	PO8	PO9	PO10	PO11	PO112
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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

TEXT BOOKS:

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

REFERENCE BOOKS:

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:	**Dr. Prabha R**

	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 : 3 hours	**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, 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.	**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, 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
CO1	To Work on state of art techniques in wireless communication.
CO2	Explore CDMA, GSM, Mobile IP, WiMax.
CO3	Explore on Different Mobile OS, 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	P06	PO7	PO8	PO9	PO10	PO11	PO12
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

TEXT BOOKS:

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:

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:	**DR. Prabha R**

SEMESTER-2

Dr. Ambedkar Institute of Technology

M.TECH Computer Science & Engineering

2021-2022

	Course Title: Big Data		
	Course Code: 20SCS21	**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. To Understand big data for business intelligence. 2. To Learn business case studies for big data analytics. 3. To Understand NoSQL big data management. 4. To understand map-reduce analytics using Hadoop and related tools.

Unit No	**Syllabus Content**	**No of Hours**
1.	**Understanding Big Data:** What is big data – why big data – Data!, Data Storage and Analysis, convergence of key trends unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data— big data and healthcare – big data in medicine – advertising and big data – big data technologies, Big Data Stack,Case study:weather data analysis.	10
2.	**NoSQL Data Management:** Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce – partitioning and combining – composing map-reduce calculations.	**10**
3.	**Basics Of Hadoop:** Data format – analysing data with Hadoop – scaling out – Hadoop streaming– Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.	**11**
4.	**MapReduce Applications:** MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic MapReduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.	**10**
5.	Self Study component **Hadoop Related Tools:** Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries. Illustrate HiveQL data manipulation commands for the following problem Consider an example of a Toy company selling Jigsaws. Consider a text file named jigsaw_puszzle_info.txt in /home/user director. The file is text field with four fields:Toy-category,toy-id,toy-name and Prize in US $ as follows: Puzzle_Garden 10725 fantasy 1.35 Puzzle-Jungle 31047 animals 2.85	**11**

	Puzzle-School 81049 Nursery 4.45 How will you use (i) LOAD (insert) (ii) ALTER (iii) DROP commands?	

Course Outcomes	Description
CO1	Analyze and interpret big data and few of its use cases from selected business domains, Health Care, Fraud Detection and Advertising.
CO2	Analyze and apply NoSQL in big data.
CO3	Apply map-reduce analytics using Hadoop.
CO4	Analyze and develop applications using Hadoop and its related tools.
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti Big, “Data Analytics: A Hands-On Approach”, 2019,ISBN: 978-1-949978-00-1.
2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
3. Alan Gates, "Programming Pig", O'Reilley, 2011.

REFERENCE BOOKS:

1. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Copyright © 2013 Pearson Education, Inc. 2012.

COURSE COORDINATOR:	**Dr. Prabha R**

	Course Title: Advanced Database Management Systems		
	Course Code: 20SCS22	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**Number of lecture hours/week: 4**
	Exam Duration : 3 hours	**CIE + SEE = 50+50**	**Total Number of Contact Hours: 52**

Course Objectives :	**Description**
	1. Design and implement advanced queries using Structured Query Language 2. To study the usage and applications of Object Oriented database 3. To acquire knowledge on variety of NoSQL databases 4. To attain inquisitive attitude towards research topics in NoSQL databases

Unit No	**Syllabus Content**	**No. of Hrs**
1	**Database System Concepts and Architecture:** Data Models, Schemes and Instances, Three-Schema Architecture and Data Independence, **The Relational Data Model and Relational Database Constraints**: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraints Violations. Basic Queries and Commands in SQL.	**11**
2	**PL/SQL Language Fundamentals**, Conditional and Sequential Control, Iterative Processing with Loops, String Datatypes, Working with Strings, Specifying String Constants, Using Nonprintable Characters, Concatenating Strings, Dealing with Case, Traditional Searching, Extracting, and Replacing, Date time Datatypes, Getting the Current Date and Time, Date time Conversions, From Strings to Date times, From Date times to Strings.	**11**
3	**NoSQL:** Motivations for Not Just/No SQL (NoSQL) Databases, Variety of NoSQL Databases, Data Management with Distributed Databases, ACID and BASE, Four Types of NoSQL Databases, **Introduction to Key-Value Databases:** From Arrays to Key-Value Databases, Essential Features of Key-Value Databases, Keys: More Than Meaningless Identifiers, Values: Storing Just About Any Data You Want. **Key-Value Database Terminology:** Key-Value Database Data Modeling Terms, Key-Value Architecture Terms, Key-Value Implementation Terms.	**10**
4	**Document Databases:** Introduction to Document Databases, What Is a Document? Avoid Explicit Schema Definitions, Basic Operations on Document Databases, **Document Database Terminology:** Document and Collection Terms, Types of Partitions, Data Modeling and Query Processing, **Introduction to Column Family Databases:** In the Beginning, There Was Google BigTable, Differences and Similarities to Key-Value and Document Databases, Architectures Used in Column Family Databases, Protocols When to Use Column Family Databases**, Column Family Database Terminology:** Basic Components of Column Family Databases, Structures and Processes: Implementing Column Family Databases, Processes and Protocols	**10**
5	**Introduction to Graph Databases:** What Is a Graph?, Graphs and Network Modeling, Advantages of Graph Databases, **Graph Database**	**10**

	Terminology: Elements of Graphs, Operations on Graphs, Properties of Graphs and Nodes, Types of Graphs. Choosing a NoSQL Database.	

Course Outcomes	**Description**
CO1	Acquiring the basics of SQL.
CO2	Construct queries using Pl/SQL efficiently for developing database applications.
CO3	Choosing appropriate NoSQL and Developing NoSQL application databases
CO4	Critically analyze and evaluate variety of NoSQL Databases.
CO5	Demonstrate the knowledge of Key-Value databases, Document based Databases, Column based Databases and Graph Databases.

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**										
CO2		**3**	**2**		**1**							
CO3	**3**	**2**										
CO4		**3**	**1**									
CO5			**3**	**1**								

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. Ramez Elmasri, Shamkant B Navathe,**" Database Systems: Models, Languages, Design and Application Programming",** 6th Edition, Pearson Education, 2013. **(ISBN-13:978-8131792476).**
2. Steven Feuerstein, **"Oracle PL/SQL Programming",** 6th Edition, O'Reilly Media, 2014. **(ISBN-13: 978-1449324452).**
3. Dan Sullivan, **"NoSQL for Mere Mortals",** 1st Edition, Pearson Education, 2015. **(ISBN-13: 978-9332557338).**

REFERENCE BOOKS:

1. Michael McLaughlin,**"Oracle Database 12c PL/SQL Programming",** 1st Edition, McGraw-Hill Education, 2014. **(ISBN-13: 978-0071812436).**
2. Pramod J. Sadalage, Martin Fowler,**"NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence",** 1st Edition, Pearson Education, 2012. **(ISBN-13: 978-8131775691).**

COURSE COORDINATOR:	**SHAMSHEKHAR PATIL**

	Course Title: Cryptography and Network Security		
	Course Code: 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, 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, 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, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(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 public keys, Publicly available directory, Public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure.	**10**
4	**User Authentication:** Remote user Authentication principles, Mutual Authentication, one way 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. **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**
CO1	Analyze the vulnerabilities in any computing system
CO2	Aware of various security algorithms used in Cryptography
CO3	Identify the security issues in the network and resolve it.
CO4	Able to Propose/ design a security solution.
CO5	Evaluate security mechanisms using rigorous approaches, including theoretical.

CO-PO Mapping	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**3**	**2**										
CO2	**3**	**2**										
CO3	**3**		**1**									
CO4			**3**		**2**							
CO5			**3**	**2**								

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, Pearson 6th edition.
2. V. K. Pachghare , Cryptography and information security PHI 2nd Edition.

REFERENCE BOOKS:

1. Behrozn A Forozen and Debdeep Mukhopadhyay, Cryptography and Network Securty. McGrawHill Education Indian Pvt Ltd
2. Bruuice Schmeier, Applied Cryptography 2nd Edition Wiley India Edition.

COURSE COORDINATOR:	**SHAMSHEKHAR PATIL**

	Course Title: Data Science and Machine Learning Techniques		
	Course Code: 20SCS24	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**Number of lecture hours/week: 4**
	Exam Duration : 3 hours	**CIE + SEE = 50+50**	**Total Number of Contact Hours: 52**

Course Objectives:	**Description**
	1. To understand the significance of data analytics 2. To analyze the real time data and come out with preprocessing techniques suitable for preparing correct data set 3. To analyze the real world data to implement a learning model 4. To design different learning models for real world problems to arrive at the solution 5. To implement and test different learning models to improve the accuracy

Unit No	**Syllabus Content**	**No of Hours**
1	**Learning** – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces – Find S, Candidate Elimination Algorithm (chapter 1&2 Textbook 3)	**10**
2	**Correlation and Simple Linear Regression** Introduction, Correlation, The Least-Squares Line, Uncertainties in the Least-Squares Coefficients. (chapter 6 textbook 2) **Multiple Regression** Introduction, The Multiple Regression Model, Confounding and Collinearity, Model Selection(chapter 7 textbook 2)	**10**
3	**Classification Model:** An Overview of Classification, Why Not Linear Regression? The Logistic Model, Estimating the Regression Coefficients, Making Predictions, Multiple Logistic Regression, Logistic Regression for >2 Response Classes, Linear Discriminant Analysis, Using Bayes' Theorem for Classification, Linear Discriminant Analysis for p = 1, Linear Discriminant Analysis for p >1, Quadratic Discriminant Analysis, A Comparison of Classification Methods (chapter 4 of textbook 1)	**11**
4	**Tree and Probabilistic Models:** **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **Probability and Learning**: Bayes Theorem, – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm –Naïve Bayes Classifier– Bayesian Belief Network (chapter 6 of Textbook 3)	**11**

5	**Self-Study Component: Dimensionality Reduction Models** Subset Selection, Best Subset Selection, stepwise Selection, Choosing the Optimal Model, Shrinkage Methods, Ridge Regression, The Lasso, Selecting the Tuning Parameter, Dimension Reduction Methods, Principal Components Regression, Partial Least Squares (chapter 6 of text book1) Cross-Validation, The Validation Set Approach, Leave-One-Out Cross-Validation, *k*-Fold Cross-Validatio (chapter 5 of text book 1)	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze and understand the correctness of data set collected using various mathematical models	R1, R2,R3
CO2	Apply various mathematical approaches to solve the learning problem	R4 and R5
CO3	Analyze and infer the strength and weakness of different machine learning models	R3
CO4	Implement suitable supervised and unsupervised machine learning algorithms for real time applications.	R5

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**										
CO2	**3**	**3**	**2**									
CO3	**3**	**3**		**2**	**2**							**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**					**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, ISSN 1431-875X,ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook), DOI 10.1007/978-1-4614-7138-7,2015,Springer Publication
2. Statistics for Engineers and Scientists, William Navidi.3 rd edition, McGraw Hil Education, India, 2013
3. Machine Learning, Tom M. Mitchell, Indian Edition, 2013, McGraw-Hill Education, ISBN:978-1-25-909695-2

REFERENCE BOOKS:

1. Ethem Alpaydin "Introduction To Machine Learning" 2nd Edition PHI Learning Pvt. Ltd-New Delhi. (6th Chapter)
2. Ian H. Witten & Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, 2nd Edition, Elsevier Morgan Kaufmann Publishers, 2005, ISBN: 0-12-088407-0

3. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 2nd Edition **ISBN**-10: 9781787125933.**ISBN**-13: 978-1787125933.
4. Nina Zumel and John Mount, Practical data science with R, Manning Publications, March 2014, ISBN 9781617291562
5. Pattern Recognition (An Introduction), V SusheelaDevi, M Narsimha Murthy, 2011, Universities Press, ISBN : 978-81-7371-725-3

EXTERNAL REFERENCES/WEBLINKS:

1. Data Science for Engineers By Prof. Ragunathan Rengasamy, Prof. Shankar Narasimhan IIT Madras https://swayam.gov.in/nd1_noc20_cs28/preview
2. https://www.coursera.org/professional-certificates/ibm-data-science?authMode=signup
3. Machine Learning course from coursera by Andrew Ng https://www.coursera.org/learn/machine-learning/home/welcome

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

	Course Title: Data Science and Machine Learning Lab		
	Course Code: 20SCSL27	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**Number of lecture hours/week :**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50**	**Total Number of Contact Hours :**

Course Objectives:	**Description**
	1. To give practical exposure to work on real time data sets **2. To enable them to analyze the data sets for its correctness** **3. To give exposure to machine learning models** **4. To enable them to analyze the data and arrive at appropriate learning models to improve the accuracy** **5. To enable them to build efficient learning models for real time problems**

	Part A **(Data Preprocessing)**	
1	Given a data set generate summary and do the following preprocessing: i. Print datatype of each column in dataset ii. Check the null values iii. Use appropriate method to populate null values iv. Describe the dataset and analyze	
2	Given a dataset write python code for statistical analysis to determine linearity of features with the target value? Write your analysis about what model is suitable.	
3	Given a data set plot the box-plot and histogram to analyze the data distribution	
4	Given a dataset determine if dimensionality reduction is necessary and also use Principal Component Analysis (PCA) to determine the first principle component	
5	Implement linear discriminants Analysis on a given data set.	
	Part B **(Machine Learning)**	
1	Given data set implement a linear regression model for prediction	
2	Given a dataset implement multiple linear regression	
3	Given a dataset implement logistic regression for classification	
4	Implement a non linear regression model for classification on a given data set.	
5	Implement any classification model for an image data set	
	Part C **(Mini Project)**	

	• A team of two students can be formed to implement a mini project on real time data set using any machine learning technique • Design an appropriate user interface for the project either using web interface or android app platform.	

NOTE:
The student has to execute one from Part A and one from Part B
Demonstrate the mini project and answer the viva-voce

Course Outcomes	Description	RBT Levels
CO1	**Able to analyze the dataset for its correctness using mathematical functions**	**R4**
CO2	**Demonstrate the ability to analyze the dataset by generating relations among the properties**	**R5**
CO3	**Design both linear and non-linear learning models based on the data set given**	**R5**
CO4	**Compare different learning models for a given data set**	**R5**
CO5	**Build real time applications using various machine learning techniques**	**R5**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							3
CO2	3	3	3	3	3							3
CO3	3	3	3	3	3							3
CO4	3	3	3	3	3	3			3	3	3	3

Strong -3 Medium -2 Weak -1

REFERENCE BOOKS:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, ISSN 1431-875X,ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook), DOI 10.1007/978-1-4614-7138-7,2015,Springer Publication

2. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 2nd Edition ISBN-10: 9781787125933.ISBN-13: 978-1787125933.

3. Data Analytics With Spark Using Python by Jeffrey Aven, PEARSON INDIA ISBN: 9789353068455

SELF STUDY REFERENCES/WEBLINKS:	
1. Data Science for Engineers By Prof. Ragunathan Rengasamy, Prof. Shankar Narasimhan | IIT Madras https://swayam.gov.in/nd1_noc20_cs28/preview 2. https://www.coursera.org/professional-certificates/ibm-data-science?authMode=signup 3. Machine Learning course from coursera by Andrew Ng https://www.coursera.org/learn/machine-learning/home/welcome	
COURSE COORDINATOR:	**Dr. K R Shylaja**

	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. 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:** 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 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. **Self-Study Component:** **A Case Study in Natural Language Based Web Search:** InFact System Overview, The GlobalSecurity.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, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and FiniteState Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving	11

	Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.	
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. Total number of COs is decided by concerned Course Coordinator

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

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**								
CO2	**3**	**3**	**3**	**3**								
CO3	**3**	**3**	**3**	**3**	**3**							**3**
CO4	**3**	**3**	**3**	**3**	**3**							**3**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

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 Language Processing and Text Mining”, Springer- Verlag London Limited 2007.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 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.

<table>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">SELF STUDY REFERENCES/WEBLINKS:</td></tr>
<tr><td colspan="2">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</td></tr>
<tr><td>COURSE COORDINATOR :</td><td>Dr. K R Shylaja</td></tr>
</table>

	Course Title: Agile Methodology		
	Course Code: 20SCS253	**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. 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**
5	**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **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**
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

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:	**Dr. Siddaraju**

	Course Title: Wireless and Mobile Computing		
	Course Code: 20SCS254	**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. 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.	**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, 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**

CO1	To Work on state of art techniques in wireless communication.
CO2	Explore CDMA, GSM, Mobile IP, WiMax.
CO3	Explore on Different Mobile OS, 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	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
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

TEXT BOOKS:

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:

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:	**DR. Prabha R**

	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 AnalyticsI concepts and core IT concepts. 2. Critique problems, issues, and trends using predictive analysis. 3. Perform predictive analytics and data science. 4. Instil a sense of ethical decision-making and a commitment to the long- 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. **Satstical Tools:** 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, Business Analytics 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, regrassion forecasting with casual variables, selecting appropriate Forecasting Models.	**10**
5.	**Decision Analysis:** Formulating Decision Problems, Decision Statergies with are without outcome, Probablities, decision trees, 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 forecasting models.
CO5	Formualte decision problems to slove buisness applications.

CO-PO Mapping	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO7**	**P O8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
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

TEXT BOOKS:

1. Business Analytics Principles, Concepts, and Applications FT Press Analytics, by Marc J. Schniederjans , Dara G. Schniederjans, Christopher M. Starkey, 1 st Edition 2014,ISBN-13:978-0133989403, ISBN-10: ISBN-12.
2. The value of Business Analytics: Identify the path to Profitability, Evan Stubs, John Wiley and sons, ISBN:9781118983881, 1 st Edition 2014.

REFERENCE BOOKS:

1. Business Analytics, James R. Evans, Pearson education 2nd Edition, ISBN-13:978-032199782, ISBN-10:0321.
2. Predictive Business Analytics Forward looking capabilities to improve Business, Gary Cokins and lawrence Maisel, wiley 1st Edition, 2014.

COURSE COORDINATOR:	**Dr. Prabha R**

	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. Students will acquire knowledge on different architectures of ANN 3. Enable students to analyze and solve real-time problems using deep learning techniques

Unit No	**Syllabus Content**	**No of Hours**
1	**Deep Feedforward 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 Parameter Sharing, 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 as an 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. Long short-term memory	**10**
4	**Autoencoders:** Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Auto encoders, Applications of Autoencoders	**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 tasks, Convolutional networks	**R3**
CO4	Evaluate and compare the solutions by various Neural Network approaches for a given problem	**R4**

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**2**							**3**
CO2	**3**	**3**	**3**	**2**	**2**							**3**
CO3	**3**	**3**	**3**	**3**	**2**							**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**						**3**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep learning: The MIT Press, 2016, 800 pp, ISBN: 0262035618.

REFERENCE BOOKS:

1. Neural Networks: Asystematic Introduction, Raúl Rojas 1996. Springer Publisher ISBN 978-3-642-61068-4
2. Pattern Recognition and machine Learning, Christopher Bishop 2007. Springer publisher, ISBN 978-0-387-31073-2
3. Neural Networks – A Comprehensive Foundation, Simon Haykin, Second Edition, PHI, 2005.
4. Introduction to Artificial Neural Networks, Gunjan Goswami, S.K. Kataria & Sons; 2012 Edition, ISBN-13: 978-9350142967.
5. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, Nikhil Buduma, by O'Reilly Publications, 2016 Edition, ISBN-13: 978-1491925614.

WEBLINKS:

1. Deep Learning Specialization. Master Deep Learning, and Break into AI from deeplearn.ai https://www.coursera.org/specializations/deep-learning? 2. Deep Learning - Part 1 By Prof. Sudarshan Iyengar, Prof. Padmavati , IIT Ropar https://swayam.gov.in/nd1_noc20_cs50/preview	
COURSE COORDINATOR:	**Dr. K R Shylaja**

	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 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 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, Hot Spares. 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, FC Topologies, Virtualization in SAN.IP SAN 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. Backup Archive 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, Management Activities, Management Challenges, Information Lifecycle Management, Storage Tiering.	**10**

Course Outcomes	**Description**	**RBT Levels**

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**	**PO5**	**P06**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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

TEXT BOOKS:

TEXT BOOKS:

1. EMC Education Services, edited by Somasundaram G., Alok Shrivastava “Information Storage and Management”; 2nd edition , Wiley India, 2012, ISBN 9788126537501.

REFERENCE BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, 1st Edition, Wiley India, 2012.
2. Robert Spalding: Storage Networks, The Complete Reference, 1stEdition, Tata McGraw Hill, 2011.

SELF STUDY
Unit 2: Data Protection

COURSE COORDINATOR:	**Suresha. D**

	Course Title: Intelligent Systems		
	Course Code: 20SCS264	**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. 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 implement a 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 Best-First 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, RuleBased Expert Systems, Model-Based, Case Based, and Hybrid Systems Planning: Introduction to Planning, Algorithms as State- Space Search, Planning graphs	**10**
4.	**Automated Reasoning:** Introduction to Weak Methods in Theorem Proving, The General Problem Solver and Difference Tables, Resolution Theorem Proving; Uncertain Knowledge and Reasoning: Introduction to Uncertainty, Inference using Full-Joint Distribution, Independence, Bayes' Rule and its use. Representing Knowledge in Uncertain Domain: Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Network, Approximate Inference in Bayesian Network	**10**
5.	**Self study component:** Introduction to Learning: Forms of Learning: Supervised learning, Unsupervised Learning, Semi-Supervised and Reinforcement Learning; Parametric Models & Non-Parametric Models, Classification and	**12**

	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;	

Course Outcomes	Description
CO1	Students are able to Explore various Artificial Intelligence problem solving techniques.
CO2	Students are able to Identify and describe the different AI approaches such as Knowledge representation, Search strategies, learning techniques to solve uncertain imprecise, stochastic and nondeterministic nature in AI problems.
CO3	Students are able to analyze Knowledge Representation Techniques: Semantic Networks, Conceptual Dependencies, Scripts and Frames, Conceptual Graphs.
CO4	Students are able to Apply the AI techniques to solve various AI problems.
CO5	Students are able to Analyze and compare the relative challenges pertaining to design of Intelligent Systems.

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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

TEXT BOOKS:

1. George F Luger, “Artificial Intelligence – Structures and Strategies for Complex problem Solving”, 6th Edition, Pearson Publication, 2009, ISBN-10: 0-321-54589-3, ISBN-13: 978- 0-321-54589-3
2. Stuart Russel, Peter Norvig, “Artificial Intelligence A Modern Approach”, 3rd Edition, Pearson Publication, 2015, ISBN-13: 978-93-325-4351-5.

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709, ISBN-13: 978-0070087705
2. Grosan, Crina, Abraham, Ajith, "Intelligent Systems-A Modern Approach", SpringerVerlag Berlin Heidelberg 2011, ISBN 9783642269394, 2011

COURSE COORDINATOR:	**Dr. Prabha R**

Dr. Ambedkar Institute of Technology

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Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION I SEMESTER (Autonomous) 2019-20

M. Tech (CSE)

I semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1.	18SCS11	Probability Statistics and Queueing Theory (Maths)	**MAT**	4	-	-	50	50	100	**3**
2.	18SCS12	Cloud Computing Theory and Practice	**CSE**	4	-	-	50	50	100	**3**
3.	18SCS13	Advances in Computer Network	**CSE**	4	-	-	50	50	100	**3**
4.	**18SCS14**	**Soft Computing**	**CSE**	4	-	-	50	50	100	**3**
5.	**18SCS15X**	**ELECTIVE – I**	**CSE**	4	-	-	50	50	100	**3**
6.	18SCSL16	Cloud Computing Lab	**CSE**	-	-	3	50	50	100	**2**
7.	18SCSS17	Technical Seminar	**CSE**	-	2	-	50	-	50	**2**
8.	18SCSM18	Mini project	**CSE**	-	-	6	50	-	50	**2**
Total							**400**	**300**	**700**	**21**

Technical Seminar: Seminar on Advanced topics from refereed journals by each student.

ELECTIVE I

Sl .No	Name of the Subject	Subject Code
1	Advances in Storage Area Networks	18SCS151
2	Software Quality Assurance, Testing and Metrics	18SCS152
3	Artificial Neural Networks	18SCS153
4	Multicore Architecture	18SCS154

Chairman-BOS

Dr. Ambedkar Institute of Technology

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Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION II SEMESTER (Autonomous) 2019-20

M. Tech (CSE)

II semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1.	18SCS21	Managing Big Data	**CSE**	4	-	-	50	50	100	**3**
2.	18SCS22	Advanced Database Systems	**CSE**	4	-	-	50	50	100	**3**
3.	**18SCS23**	**Artificial Intelligence and Prolog Programming**	**CSE**	4	-	-	50	50	100	**3**
4.	**18SCS24**	**Advanced Algorithms and Data structure**	**CSE**	4	-	-	50	50	100	**3**
5.	**18SCS25X**	**ELECTIVE – II**	**CSE**	4	-	-	50	50	100	**3**
6.	18SCSL26	Data structure and DBMS Lab	**CSE**	-	-	3	50	50	100	**2**
7.	18RM27	Research Methodology	**CSE**	-	2	-	50	50	100	**2**
8.	18SCSM28	Mini project/Research Institute Visit	**CSE**	-	-	6	50	-	50	**2**
Total							**400**	**350**	**750**	**21**

ELECTIVE-II

Sl .No	Name of the Subject	Subject Code
1	Digital Image Processing	18SCS251
2	Data Science with R-Programming	18SCS252
3	Cyber Security	18SCS253
4	Sensor Networks Infrastructure	18SCS254

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Department of Computer Science

SCHEME OF TEACHING AND EXAMINATION III SEMESTER (Autonomous) 2019-20

M. Tech (CSE)

III semester#: Internship

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
1.	**18SCS31**	**Machine Learning Techniques**	**CSE**	04	-	4	50	50	100	**3**
2.	**18SCS32X**	**Elective -III**	**CSE**	04	-	4	50	50	100	**3**
3.	**18SCS33X**	**Elective -IV**	**CSE**	04	-	4	50	50	100	**4**
4.	18SCS34	Internship Evaluation	**CSE**	-	-			50	50	**8**
5.	18SCSS35	MOOCS/SWAYAM/SWEBOK/ NPTEL	**CSE**	-	-	-	50		50	**2**
6.	18SCSP36	Project Phase -I	**CSE**	-	-	-	50	-	50	**2**
Total							**250**	**200**	**450**	**22**

ELECTIVE III

Sl .No	Name of the Subject	Subject Code
1	Internet of Things (IoT)	18SCS321
2	Agile Methodologies	18SCS322
3	Network Programming in UNIX	18SCS323
4	Mobile Computing and Wireless Network	18SCS324

ELECTIVE IV

Sl .No	Name of the Subject	Subject Code
1	Natural Language Processing and Text mining	18SCS331
2	Data ware house and Data mining	18SCS332
3	Cryptography and Network Security	18SCS333
4	Computational Intelligence	18SCS334

* The student should undergo internship training during the vacation between 2nd and 3rd semester for 8 weeks and for the same he must make a final presentation of the work carried out during Internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.
* Student must complete a certification under anyone online course as specified in the scheme for 18SCSS35

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

Chairman-BOS

Dr. Ambedkar Institute of Technology

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Department of Computer Science

SCHEME OF TEACHING AND EXAMINATION IV SEMESTER (Autonomous) 2019-20

M. Tech in CSE

IV semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
2.	18SCSP41	Evaluation of Project Work Phase II	**CSE**	-	-	6	50	-	50	**2**
3.	18SCSP42	Project Work Evaluation and Viva –Voce	**CSE**	-	-	-	100	100	200	**22**
Total							**200**	**100**	**250**	**24**
Grand Total (I to IV Semester) : 2150 Marks ; 88 Credits										

Chairman-BOS

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

Note:

1) Project Phase – I **:** 6 weeks duration shall be carried out during III Semester. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Project Phase – II **:** 16 weeks duration during IV Semester. Evaluation shall be taken during the IV Semester. Total Marks shall be 100.

3) Project Work Evaluation and viva-voce: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 200 (Phase –II Evaluation: 100 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, and 100 for viva-voce).

Marks of Evaluation of Project:

1. During Project Phase – I, finalise titles and submit synopsis to the Institute along with Project Work report at the end of the Semester.
2. During the final viva, students have to submit all the reports.
3. The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
   a) Head of the Department (Chairman)
   b) Internal examiner (Guide)
   c) External examiner proposed by the Chairman, BoE (PG)

	Course Title: Probability Statistics And Queuing Theory		
	Course Code: 18SCS11	**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 develop analytical capability and to impart knowledge of Probability, Statistics and Queuing. 2. The application of above concepts in Engineering and Technology. **3.** Students acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Unit No	**Syllabus Content**	**No of Hours**
1	Axioms of probability, Conditional probability, Total probability, Bayer's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	**10**
2	Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	**10**
3	Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical 10 Hours region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit, $\chi 2$ test for Independence	**11**
4	Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	**11**
5	Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	**10**

Course Outcomes	Description	RBT Levels
CO1	Demonstrate knowledge & use of probability and will be able to characterize probability models using probability mass (density) functions & cumulative distribution functions.	R1
CO2	Apply the techniques of developing discrete & continuous probability distributions and its applications.	R4 and R5
CO3	Describe a random process in terms of its mean and correlation functions.	R3
CO4	Apply the methods of Hypothesis testing for goodness of fit.	R4
CO5	Understand the terminology &nomenclature appropriate queuing theory and also demonstrate the knowledge and understand the various queuing models.	R2,R3

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009. Published by PHI Learning, New Delhi (2009) ISBN 10: 8120338448 ISBN 13: 9788120338449

REFERENCE BOOKS:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishore. S. Trivedi, Prentice Hall of India, 2004. ISBN: 978-0-471-33341-8
2. Pattern Recognition (An Introduction), V SusheelaDevi, M Narsimha Murthy, 2011, Universities Press, ISBN : 978-81-7371-725-3

COURSE COORDINATOR:	**Dr. Shivaprasana**

	Course Title: Cloud Computing Theory and Practice		
	Course Code: 18SCS12	**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 comprehensive view to different aspects of cloud computing like; service models, challenges & infrastructure with different Cloud Service providers in the market 2. To introduce to cloud virtualization, with different type of virtualization. To analyze and differentiate between cloud architectures and few standards followed in cloud computing 3. To understand how high throughput can be achieved with task computing on cloud environment. 4. To understand and demonstrate different features of cloud platforms used in Industry 5. To understand how energy efficiency achieved in cloud computing using green computing. To also understand technologies used for Cloud federation with cloud federation stack.

Unit No	**Syllabus Content**	**No of Hours**
1	Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 20, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force-com and Salesforcecom, Manjrasoft Aneka	10
2	**Virtualization** Introduction, Characteristics of virtualized environments, Increased security, Managed execution, Portability, Taxonomy of virtualization techniques, Execution virtualization, Other types of virtualization, Virtualization and cloud computing, Pros and cons of virtualization, Advantages of virtualization, The other side of the coin: disadvantages,	12

	Technology examples, Xen par virtualization, VMware: full virtualization, Microsoft Hyper-V **Cloud Computing Architecture** Introduction, The cloud reference model, Architecture, Infrastructure- and hardware-as-a-service Platform as a service, Software as a service, Types of clouds, Public clouds, Private clouds, Hybrid clouds Community clouds, Economics of the cloud, Open challenges, Cloud definition, Cloud interoperability and standards, Scalability and fault tolerance, Security, trust, and privacy, Organizational aspects	
3	**High-Throughput Computing** Task computing , Characterizing a task, Computing categories, Frameworks for task computing , Task-based application models , Embarrassingly parallel applications, Parameter sweep applications, MPI applications , Workflow applications with task dependencies ,Aneka task-based programming,Task programming model,Developing applications with the task model, Developing a parameter sweep application, Managing workflows	10
4	**Cloud Platforms in Industry**: Amazon web services: Compute services ,Storage services, Communication services ,Additional services. Google AppEngine : Architecture and core concepts, Application life cycle, Cost model Observations Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance , Observations	10
5	**Advanced topics** Energy efficiency in clouds , Energy-efficient and green cloud computing architecture, Market-based management of clouds ,Market-oriented cloud computing, A reference model for MOCC Technologies and initiatives supporting MOCC, Observations, Federated clouds/InterCloud Characterization and definition, Cloud federation stack , Aspects of interest, Technologies for cloud federations, Observations, Third-party cloud services , MetaCDN , SpotCloud	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Obtain knowledge on different aspects of cloud computing like; service models, challenges & infrastructure and different services provided by cloud service providers	R1, R2
CO2	Analyze the importance of virtualization and different features of Virtual Machine (VM) in cloud computing and understand cloud architectures and few standards followed in cloud computing.	R3 and R4

CO3	To able to understand task computing on cloud environment.	R5
CO4	Able to understand and demonstrate different features of cloud platforms used in Industry	R5
CO5	Able to understand technologies used for Cloud federation with cloud federation stack.	R5,R6

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1.Rajkumar Buyya, The University of Melbourne and Manjrasoft Pty Ltd, Australia, Christian Vecchiola, **Cloud computing theory and practice 2nd Edition**

REFERENCE BOOKS:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010.
3. Cloud Computing: Theory and Practice, Dan Marinescu, 1st edition, MK Publishers, 2013.

COURSE COORDINATOR:	**Dr. Prakash**

	Course Title: Advances in Computer Networks		
	Course Code: 18SCS13	**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 :**

Course Objectives:	**Description**
	1. Discuss with the basics of Computer Networks. 2. Compare various Network architectures. 3. Discuss fundamental protocols. Define and analyse network traffic, congestion, and controlling and resource allocation

Unit No	**Syllabus Content**	**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, Stop-and-Wait , Sliding Window protocol.	**08**
2	**Internetworking I:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP),	**09**
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 Version 6 (IPv6)	**08**
4	**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), Endto- 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 Retransmit and Fast Recovery	**09**
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)	**08**

Course Outcomes	**Description**	**RBT Levels**
CO1	Able to classify network services, protocols and architectures, explain why they are layered.	R3

CO2	Choose key Internet applications and their protocols, and apply to develop their own Applications (e.g. Client Server applications, Web Services) using the sockets API.	R4 and R6
CO3	Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.	R5
CO4	Interpret various congestion control techniques.	R3
CO5	Analyse Network traffic, congestion control and resource allocation	R4

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition, Elsevier -2014
2. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

REFERENCE BOOKS:

1. Uyless Black, "Computer Networks Protocols , Standards and Inte rfaces" 2nd Edition -PHI.
2. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill.

COURSE COORDINATOR:	**Dr. Shamshekhar patil**

	Course Title: Soft Computing		
	Course Code: 18SCS14	**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 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. 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, linear separability, Hebb Network.	**11**
2	Supervised Learning: Perceptual Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network, Associative Memory Network: introduction, training algorithms for pattern association, associative memory network, hetero-associative memory network, bidirectional associative memory.	**11**
3	Classical sets and Fuzzy Sets – classical and Fuzzy Relations – Features of membership functions, Fuzzification and methods of membership value assignment. Defuzzification lambda cuts for fuzzy relations and fuzzy sets.	**10**
4	Fuzzy Decision Making: introduction, individual decision making, multi person Decision making, multi objective decision making, multi attribute decision making, fuzzy Bayesian decision making, Fuzzy logic control systems: introduction, control system design, architecture and operation of FLC systems, FLC system Models, Applications of FLC systems	**10**
5	Genetic algorithms: Introduction - Basic operations - Traditional optimization and search techniques. Genetic algorithms and search space, Operators of genetic algorithms – Genetic programming	**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

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, S N Sivanandam, and S N Deepa, Wiley India, 3rd edition ISBN 13: 978812658744-5, 2019

REFERENCE BOOKS:

1. Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012, ISBN 0-13-261066-3
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition

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

	Course Title: Cloud Computing Laboratory		
	Course Code: 18SCSL27	**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 : 16**

Course Objectives:	**Description**
	1. To Install and understand Virtual Box by deploying web application 2. To get Hands on with Different Cloud services: Amazon, Google apps and Salesforce and VMware 3. To Create and provision VMs on any Cloud Simulation environments, and execute different polices to understand the VM features

	Part A	
1	Using Given Data set apply Find-s and Candidate Elimination algorithm to find most specific and Most generic Hypothesis.	
2	Using Boston Data Set implement Linear regression to predict Mean House Value	
3	Using Boston Data Set implement Multiple Linear regression to predict Mean House Value	
4	Using Stock Market Data, implement logistic regression to recognize stock market trends. Implement LDA for the same data set and give a comparison with logistic regression	
5	Using Boston data set implement regression tree and fit the regression tree to predict the Mean house data.	
	Part B **(Mini Project)**	
	• A team of two students can be formed to implement a mini project on real time data set using any machine learning technique • Design an appropriate user interface for the project either using web interface or android app platform.	

NOTE:
The student has to execute one from Part A and Demonstrate the mini project and answer the viva-voce

Course Outcomes	**Description**	**RBT Levels**
CO1	Learn about Amazon EC2. Amazon Cloud computing platform, Amazon Web Services.	**R2**
CO2	Salesforce cloud computing platform, deploying and managing applications and services	**R1**

CO3	Google Apps: Google Drive, Google Docs and Google Slides	**R4**
CO4	To create and run VMs on any Virtualization Hypervisors and understanding Cloud Sim	**R3**

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Cloud Computing: Theory and Practice, Dan Marinescu, 1st edition, MK Publishers, 2013.

REFERENCES:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010.
3. Case studies: AWS, Google app engine, Salesforce Trailhead

COURSE COORDINATOR:	**Prof Shamhekar patil**

	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 + 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.	**10**

	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,	
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
CO2	Analyze the parallel programming techniques and design issues to solve the issues related to multiprocessing.	R3, 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	R4

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: **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 + 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 file level; 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
CO2	Apply the techniques used for data maintenance.	R4
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	-	-	**3**	**2**	**2**
CO2	-	-	**3**	**2**	**2**
CO3	-	**1**	**3**	**2**	**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:	**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 + 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 Quality Definitions 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.	R3, R4
CO2	Able apply SQA and SOA function for testing of frameworks.	R3
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	R1, 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**	**2**	**2**
CO2	-	-	**3**	**2**	-
CO3	-	**2**	**3**	**2**	-
CO4	-	**2**	**3**	**2**	**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	R4,R6
CO3	Able to learn multi-layer perceptions using different techniques for critical thinking and to design common goals	R2, R
CO4	**A**ble to solve Engineering problems using various ANN tools and Design techniques for real time applications.	R4, R6

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

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: Managing Big data		
	Course Code: 18SCS21	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 4**
	Exam Duration : 3 hours	**CIE + SEE = 30+50=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	1. To Understand big data for business intelligence 2. To Learn business case studies for big data analytics 3. To Understand NoSQL big data management **4.** To understand map-reduce analytics using Hadoop and related tools

Unit No	**Syllabus Content**	**No of Hours**
1	**Understanding Big Data:** What is big data – why big data – Data!, Data Storage and Analysis, convergence of key trends unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data— big data and healthcare – big data in medicine – advertising and big data – big data technologies – Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics	**10**
2	**NoSQL Data Management:** Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce – partitioning and combining – composing map-reduce calculations	**10**
3	**Basics Of Hadoop:** Data format – analysing data with Hadoop – scaling out – Hadoop streaming– Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures **Exercise 1 --- HDFS** Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the hadoop fs command when interacting with HDFS. 1. Review the commands available for the Hadoop Distributed File System: 2. Copy file foo.txt from local disk to the user's directory in HDFS 3. Get a directory listing of the user's home directory in HDFS 4. Get a directory listing of the HDFS root directory 5. Display the contents of the HDFS file user/fred/bar.txt 6. Move that file to the local disk, named as baz.txt 7. Create a directory called input under the user's home directory 8. Delete the directory input old and all its contents	**11**

	9. Verify the copy by listing the directory contents in HDFS	
4	**MapReduce Applications:** MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic MapReduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats **Exercise 2 --- MapReduce** 1. Create a JOB and submit to cluster 2. Track the job information 3. Terminate the job 4. Counters in MR Jobs with example 5. Map only Jobs and generic map examples 6. Distributed cache example 7. Combiners, Secondary sorting and Job chain examples	**10**
5	**Hadoop Related Tools:** Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries. **Exercise 3 – Extract facts using Hive** Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database. The moveapp_log_json table contains an activity column. Activity states are as follows: 1. RATE_MOVIE 2. COMPLETED_MOVIE 3. PAUSE_MOVIE 4. START_MOVIE 5. BROWSE_MOVIE 6. LIST_MOVIE 7. SEARCH_MOVIE 8. LOGIN 9. LOGOUT 10. INCOMPLETE_MOVIE hive> SELECT * FROM movieapp_log_json LIMIT 5; hive> drop table movieapp_log_json; hive> CREATE EXTERNAL TABLE movieapp_log_json (movieId INT, genreId INT, time STRING,	**11**

recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE
'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';
hive> SELECT * FROM movieapp_log_json LIMIT 20;
hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json
1. PURCHASE_MOVIE
Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.
1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.
3. Load the results of the previous two queries into a staging table. First, create the staging table:
4. Next, load the results of the queries into the staging table.

Exercise 4 -- Extract sessions using Pig
While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.
In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.
1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are

	assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement. 2. Group the log sample by movie and dump the resulting bag. 3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.	

Course Outcomes	**Description**	**RBT Levels**
CO1	Learn, analyze and interpret big data and few of its use cases from selected business domains, Health Care, Fraud Detection and Advertising.	R1,r2
CO2	Analyze and apply NoSQL in big data applications.	R3,R4
CO3	Apply map-reduce analytics using Hadoop.	R1,r5
CO4	Analyze and develop applications using Hadoop and its related tools.	R4

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Copyright © 2013 Pearson Education, Inc. 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

REFERENCE BOOKS

1. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
3. Alan Gates, "Programming Pig", O'Reilley, 2011.

Course Coordinator: Dr. Siddaraju

	Course Title: **Advanced Database Systems**		
	Course Code: **18SCS22**	**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**
	Course objectives: 1. Design and implement advanced queries using Structured Query Language 2. To study the usage and applications of Object Oriented database 3. To acquire knowledge on variety of NoSQL databases 4. To attain inquisitive attitude towards research topics in NoSQL databases

Unit No	**Syllabus Content**	**No of Hours**
1.	**Database System Concepts and Architecture:** Data Models, Schemes and Instances, Three-Schema Architecture and Data Independence, **The Relational Data Model and Relational Database Constraints**: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraints Violations. Basic Queries and Commands in SQL.	**10**
2.	**PL/SQL Language Fundamentals**, Conditional and Sequential Control, Iterative Processing with Loops, String Datatypes, Working with Strings, Specifying String Constants, Using Nonprintable Characters, Concatenating Strings, Dealing with Case, Traditional Searching, Extracting, and Replacing, Date time Datatypes, Getting the Current Date and Time, Date time Conversions, From Strings to Date times, From Date times to Strings.	**11**
3.	**NoSQL:** Motivations for Not Just/No SQL (NoSQL) Databases, Variety of NoSQL Databases, Introduction to Key-Value Databases, Key-Value Database Terminology.	**10**
4.	Introduction to Document Databases, Document Database Terminology Introduction to Column Family Databases, Column Family Database Terminology	**11**
5.	Introduction to Graph Databases, Graph Database Terminology,	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Acquiring the basic knowledge of ER-Diagram, Relational Database and SQL.	R1
CO2	Construct queries using Pl/SQL efficiently for developing database applications.	R4,r5
CO3	Critically analyze and evaluate variety of NoSQL databases.	R4

CO4	Demonstrate the knowledge of Key-Value databases, Document based Databases, Column based Databases and Graph Databases.	R2,r3

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

Ramez Elmasri, Shamkant B Navathe,"Database Systems: Models,Languages,Design and Application Programming", 6th Edition, Pearson Education, 2013.(ISBN-13:978-8131792476)

1) Steven Feuerstein, "Oracle PL/SQL Programming", 6th Edition, O'Reilly Media, 2014. (ISBN-13: 978-1449324452)
2) Dan Sullivan,"NoSQL for Mere Mortals",1st Edition, Pearson Education, 2015. (ISBN-13: 978-9332557338)

REFERENCE BOOKS / WEBLINKS:

1) Michael McLaughlin,"Oracle Database 12c PL/SQL Programming", 1st Edition, McGraw-Hill Education, 2014. (ISBN-13: 978-0071812436)
2) Pramod J. Sadalage, Martin Fowler,"NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Pearson Education, 2012. (ISBN-13: 978-8131775691)

COURSE COORDINATOR:	**Prof. ShamshekarPatil**

	Course Title:	**Artificial Intelligence and Prolog Programming**	
	Course Code: **18SCS23**	**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 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 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. (Text Book 1: Chapter 3, 4 & 5)	**10**
3	Symbolic Reasoning Under Uncertainty: Introduction to non-monotonic reasoning, Logic for non-monotonic reasoning, Implementation Issues,	**10**

	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	
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**

Course Outcomes	**Description**	**RBT Levels**
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.	R5,R6
CO2	Apply AI technique on current applications.	R4
CO3	Problem solving, knowledge representation, reasoning, and learning.	R1,R2
CO4	Demonstrating how to write a programs for Artificial Intelligence	R2,r3
CO5	Solving recursive programs in Prolog	R5
CO6	Analyzing and Solving Artificial Intelligence programs by using Backtracking methods	R4,R5

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

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: Advanced Algorithms and Data Structure		
	Course Code: 18SCS24	**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 learn implementing 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 To understand the application of hashing technique

Unit No	**Syllabus Content**	**No of Hours**
1	**Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The Course substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods	**11**
2	**Graph Algorithms:** Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-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 heapsort algorithm, Priority queues	**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	**B-Trees**, Definition of B-trees, Basic operations on B-trees , Deleting a key from a B-tree, Structure of Fibonacci heaps	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze, Design and apply iterative and recursive algorithms	R3,R4,R6
CO2	Interpret the logic and determine the suitable data structures for a real-time applications	R2,R5

CO3	To apply graph algorithms to find optimal solutions for real time applications	R3,R4
CO4	Use Advanced data structures like Binary search trees and tree rotations in real time applications	R4
CO5	**U**se hashing technique to optimize retrieval process in real-time applications.	R4,R5

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

TEXT BOOK:

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/WEBLINKS:

1. Ellis Horowitz, SartajSahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007, ISBN 8173716129, 9788173716126
2. Horowitz, Sahani, Dinesh Mehata, ―Fundamentals of Data Structures in C++‖, 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

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

	Course Title : Digital Image Processing		
	Course Code: **18SCS251**	**No. of Credits: 4 : 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 Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	11
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.	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
1.	Understand image formation and the role human visual system plays in perception of gray and color image data.	R1,R5
2.	Apply image processing techniques in both the spatial and frequency (Fourier) domains	R3
3.	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.	R6
4.	Conduct independent study and analysis of feature extraction techniques.	R2
5.	Understand the concepts of image registration and image fusion.	R5
6.	Analyze the constraints in image processing when dealing with image data sets and to apply image algorithms in practical applications	R4,R3

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	**-**	**-**	**3**	**2**	**1**
CO2	**-**	**-**	**3**	**2**	**2**
CO3	**-**	**-**	**3**	**2**	**2**
CO4	**-**	**-**	**3**	**2**	**-**
CO5	**-**	**2**	**3**	**2**	**-**
CO6	**-**	**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: Prof. Shamshekar S. Patil

	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	R3
CO2	Apply the construction of R Programming to design real time applications	R3,R4
CO3	Apply Linear Regression for Regression problems in real time	R3
CO4	Understand and Apply parametric and non-parametric classification	R2,R3
CO5	Understand and Apply text mining techniques	R3,R4

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. 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** **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, 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.	R4
CO2	Describe the types of computer forensics technology.	R2,R3
CO3	Analyze various computer forensics systems.	R3
CO4	Illustrate the methods for data recovery, evidence collection and data seizure.	R4,R3
CO5	Summarize duplication and preservation of digital evidence.	R6

CO-PO Mapping	PO 1	PO 2	PO3	PO4	PO5
CO1	-	-	3	2	-
CO2	-	-	3	2	1
CO3	-	-	3	3	2
CO4	-	-	3	2	2
CO5	-	-	3	2	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**
	1. Understand of Wireless Sensor Networks and its applications. 2. Understanding of Basic Wireless Sensor Technology. 3. Discuss Wireless Transmission Technology and Protocols. 4.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	R2,R3
2.	Explain Basic technologies for WSN.	R2
3.	Different types of Protocols for WSN.	R5,R6
4.	Understand different types of Operating system for WSN.	R2

5	To understand different types operating system design	R1,R2

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	3	3
CO2	-	-	3	3	3
CO3	-	-	3	3	3
CO4	-	-	3	2	1
CO5	-	1	-	1	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:	**Data structures and DBMS LAB**	
	Course Code: **18SCSL26**	**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 : 16**

Course Objectives:	**Description**
	1. To understand usage of advanced data structure in real time applications 2. To acquire inquisitive attitude towards research topics in databases. 3. To acquire practical knowledge on advanced databases and its applications. 4. To implement the shell of Operating System. To implement distributed operating system concepts.

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

Part A: ADBMS LABORATORY WORK

Note: The following experiments may be implemented on MySQL/ORACLE/PostgreSQL or any other suitable RDBMS with support for Object features

1. **Develop a database application to demonstrate storing and retrieving of BLOB andCLOB objects.**

   a) Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter.

   b) Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.

2. **Develop a database application to demonstrate the representation of multi valuedattributes, and the use of nested tables to represent complex objects. Write suitablequeries to demonstrate their use.**

   Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach.

   a) Show how to implement the schema -- Implementing the Application under the Relational Model -- using only MySQL/PostgreSQL/Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views.

3. **Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each subject for which he/she has enrolled and Internal Assessment Using TRIGGERS, write active rules to do the following:**

   a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.

b) Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

Use the following guidelines when designing triggers:

- Use triggers to guarantee that when a specific operation is performed, related actions are performed.
- Use database triggers only for centralized, global operations that should be fired for the triggering statement, regardless of which user or database application issues the statement.
- Do not define triggers that duplicate the functionality already available in any database (Oracle/MySQL/PostgreSQL, etc.). For example, do not define triggers to enforce data integrity rules that can be easily enforced using declarative integrity constraints.
- Limit the size of triggers (60 lines or fewer is a good guideline). If the logic for your trigger requires much more than 60 lines of PL/SQL code, it is better to include most of the code in a stored procedure, and call the procedure from the trigger.
- Be careful not to create recursive triggers. For example, creating an AFTER UPDATE statement trigger on the EMP table that itself issues an UPDATE statement on EMP causes the trigger to fire recursively until it has run out of memory.

4. Design, develop, and execute a program to implement specific Apriori algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk".

Part B: Algorithms and Data structure Laboratory

1 Implement Binary search tree for some real time application and demonstrate the operations on binary search tree

2 Implement Red-Back tree rotations on some real time applications with insertion, deletion and searching

3 Implement all the functions of a dictionary (ADT) using hashing. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique Standard Operations: Insert(key, value), Find(key), Delete(key)

4 To create ADT that implements the SET concept.

a. Add (newElement) -Place a value into the set
b. Remove (element) Remove the value
c. Contains (element) Return true if element is in collection
d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection
e. Intersection of two sets,
f. Union of two sets,
g. Difference between two sets,
h. Subset

Course Outcomes	Description	RBT Levels
1.	Model and represent the real world data using object oriented database.	R1,R2

2.	Embed the rule set in the database to implement data warehousing of mining.	R2,R6
3.	Choose and design database for recent applications database for better interoperability	R6,R5
4.	Use Binary search trees in any real time problem domains where appropriate.	R5,R3
5.	Use Red –black trees for real time problems for optimization purpose.	R4
6.	Use hashing technique for searching in any real time applications.	R3

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	2	3
CO2	1	2	3	2	3
CO3	2	2	3	2	3
CO4	-	2	3	3	3
CO5	1	2	3	3	3
CO6	1	2	3	3	3

Course Coordinator: Prof. Shamshekar Patil & K.R. Shylaja

	Course Title : Research Methodology		
	Course Code: 18RM27	**No. of Credits: 2 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 2**
	Exam Duration : 3 hours	**CIE + SEE = 50+50=100**	**Total No. of Contact Hours : 26**

Course Objectives:	**Description**
	1. Have a basic understanding of the underlying principles of quantitative and qualitative research **2. Identify the overall process of designing a research study from its inception to its report.** **3. Choose the most appropriate research method to address a particular research question** **4. Gain a overview of a range of quantitative and qualitative approaches to data analysis**

Unit No	**Syllabus Content**	**No of Hours**
1.	Unit – I, Overview of Research Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules.	08
2.	Unit – II, Sampling Methods Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions	06
3.	Unit – III, Processing and analysis of Data Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t and Chi Square).	06
4.	Unit-IV, Essential of Report writing and Ethical issues: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Ethical issues related to Research, Plagiarism and self- Plagiarism, Publishing.	06

Course Outcomes	**Description**	**RBT Levels**
1.	Describe a range of quantitative and qualitative research designs and identify the advantages and disadvantages associated with these designs	R3,R4
2.	Choose appropriate quantitative or qualitative method to collect data	R6

3.	Analyse and test the given data using appropriate methods	R3,R4
4.	Design an appropriate mixed-method research study to answer a research question	R5

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

Course Coordinator: Dr. Chandrakant poojari

	Course Title: Machine Learning Techniques		
	Course Code: 18SC31	**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 basic concepts of learning and decision trees. 2. Compare and contrast neural networks and genetic algorithms 3. Apply the Bayesian techniques and instant based learning 4. Examine analytical learning and reinforced learning

Unit No	**Syllabus Content**	**No of Hours**
1	INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias –Decision Tree learning – Representation – Algorithm – Heuristic Space Search	**11**
2	NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search –Genetic Programming – Models of Evolution and Learning.	**10**
3	BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**10**
4	INSTANT BASED LEARNING AND LEARNING SET OF RULES: K-Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –CaseBased Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction– Inverting Resolution	**11**
5	ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Choose the right learning techniques for designing an application with the basic knowledge of ML techniques.	R6

CO2	Apply effectively neural networks and genetic algorithms for appropriate applications.	R4,R5
CO3	Apply bayesian techniques and derive effectively learning rules.	R4
CO4	Choose and differentiate reinforcement and analytical learning techniques	R5,R6

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

Strong -3 Medium -2 Weak -1

TEXT BOOK:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCE BOOKS / WEBLINKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.

2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

Course Coordinator: Dr. K R Shylaja

	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, Smart Appliances,, Intrusion Detection, Smoke/Gas Detectors. **Cities:** Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response. **Environment:** Weather Monitoring, Air Pollution Monitoring, Noise Pollution 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.	**11**

	Health & Lifestyle: Health & Fitness Monitoring, Wearable Electronics.	
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
CO2	Analyze different Technologies used in IoT	R3
CO3	Interpret different domain specific IoT diagrams and illustrations	R6
CO4	Analyze specification document for Environment Monitoring using IoT	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 :**

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	R2
CO2	Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests	R3,R4
CO3	Implement Concepts to Eliminate Waste	R3

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	2	2
CO2	-	-	3	2	2
CO3	-	2	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	R3
CO2	Design programs for network communications	R6
CO3	Interpret the network protocol stacks in UNIX	R2
CO4	Use commands to understand the network configure	R4

CO-PO Mapping	Po1	PO2	Po3	PO4	PO5	
CO1	-	-	3	2	-	
CO2	-	-	3	2	-	
CO3	-	-	3	2	2	
CO4	-	-	3	2	2	
CO5	-	2	3	2	2	

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	R5,r6
CO2	Explore CDMA, GSM, Mobile IP, WiMax.	R2,r3
CO3	Work on Different Mobile OS, Develop program for CLDC, MIDP let model and security concerns	R1

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

Course Outcomes	Description	RBT Levels
CO1	Analyze the natural language text.	R3
CO2	Generate the natural language.	R5
CO3	Demonstrate Text mining.	R2
CO4	Apply information retrieval techniques	R1

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

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	R2
CO2	Apply the association rules for mining the data	R3
CO3	Design and deploy appropriate classification techniques	R5

CO4	Cluster the high dimensional data for better organization of the data	R4
CO5	Discover the knowledge imbibed in the high dimensional system	R1

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	3	2	2
CO2	-	-	3	2	2
CO3	-	-	3	2	2
CO4	-	2	3	2	2
CO5	-	2	3	2	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,	10

	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.	
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	Understand cryptography basics, algorithms and mathematical background for cryptography.	R6
CO2	Understand the various cryptographic algorithms.	R3
CO3	Ability to analyses the key management and Discuss the authentication applications.	R2,R3
CO4	Understand security issues in Wireless LAN and web.	R6
CO5	Analyse the important security protocols and theirapplications.	R4

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

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 RBT: L1, L2, L3	**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 RBT: L1, L2, L3	**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, RBT: L1, L2, L3	**10**
4	Using Uncertain Knowledge ,Introduction , Probability , Independence Assumptions , Making Decisions Under Uncertainty RBT: L1, L2, L3	**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 RBT: L1, L2, L3	**10**

Course Outcomes	Description	RBT Levels
CO1	Identify different types of AI agents	R1,R2
CO2	Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	R3,R4
CO3	Exhibit the fundamental usage of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	R5
CO4	Build simple knowledge-based systems	R1
CO5	Express working knowledge of reasoning in the presence of incomplete and/or uncertain information	R2
CO6	Apply knowledge representation, reasoning, and machine learning techniques to real-world problems	R3,R4

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	-	-	3	2	-
CO2	-	-	3	2	-
CO3	-	-	3	2	2
CO4	-	-	3	-	2
CO5	-	1	3	2	2
CO6	-	2	3	2	2

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

Dr. Ambedkar Institute of Technology

(An Autonomous Institute, Affiliated to VTU, Accredited by NAAC with 'A' grade)

Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION I SEMESTER (Autonomous) 2018-2020

M. Tech (CSE)

I semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1.	18SCS11	Probability Statistics and Queueing Theory (Maths)	**MAT**	4	-	-	50	50	100	**3**
2.	18SCS12	Cloud Computing	**CSE**	4	-	-	50	50	100	**3**
3.	18SCS13	Advanced Database Systems	**CSE**	4	-	-	50	50	100	**3**
4.	**18SCS14**	**Soft Computing**	**CSE**	4	-	-	50	50	100	**3**
5.	**18SCS15X**	**ELECTIVE – I**	**CSE**	4	-	-	50	50	100	**3**
6.	18SCSL16	Cloud Computing Lab	**CSE**	-	-	3	50	50	100	**2**
7.	18SCSS17	Technical Seminar	**CSE**	-	2	-	50	-	50	**2**
8.	18SCSM18	Mini project	**CSE**	-	-	6	50	-	50	**2**
Total							**400**	**300**	**700**	**21**

Technical Seminar: Seminar on Advanced topics from refereed journals by each student.

ELECTIVE I

Sl .No	Name of the Subject	Subject Code
1	Advances in Storage Area Networks	18SCS151
2	Software Quality Assurance, Testing and Metrics	18SCS152
3	Artificial Neural Networks	18SCS153
4	Multicore Architecture	18SCS154

Chairman-BOS

Dr. Ambedkar Institute of Technology

(An Autonomous Institute, Affiliated to VTU, Accredited by NAAC with 'A' grade)

Department of Computer Science & Engineering

SCHEME OF TEACHING AND EXAMINATION II SEMESTER (Autonomous) 2018-2020

M. Tech (CSE)

II semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Project	CIE	SEE	Total	
1.	18SCS21	Managing Big Data	**CSE**	4	-	-	50	50	100	**3**
2.	**18SCS22**	**Advances in Computer Networks**	**CSE**	4	-	-	50	50	100	**3**
3.	**18SCS23**	**Artificial Intelligence and Prolog Programming**	**CSE**	4	-	-	50	50	100	**3**
4.	**18SCS24**	**Advanced Algorithms and Data structure**	**CSE**	4	-	-	50	50	100	**3**
5.	**18SCS25X**	**ELECTIVE – II**	**CSE**	4	-	-	50	50	100	**3**
6.	18SCSL26	Data structure and Computer Network Lab	**CSE**	-	-	3	50	50	100	**2**
7.	18RM27	Research Methodology	**CSE**	-	2	-	50	50	100	**2**
8.	18SCSM28	Mini project/Research Institute Visit	**CSE**	-	-	6	50	-	50	**2**
Total							**400**	**350**	**750**	**21**

ELECTIVE-II

Sl .No	Name of the Subject	Subject Code
1	**Data Center Virtualization**	**18SCS251**
2	**Data Science with R-Programming**	**18SCS252**
3	**Cyber Security**	**18SCS253**
4	**Sensor Networks Infrastructure**	**18SCS254**

Dr. Ambedkar Institute of Technology

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Department of Computer Science

SCHEME OF TEACHING AND EXAMINATION III SEMESTER (Autonomous) 2018-2020

M. Tech (CSE)

III semester# : Internship

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
1.	18SCS31	Midterm Presentation on Internship(After 8 weeks from the date of commencement)*	**CSE**	-	-	-	25	-	25	**2**
2.	18SCS32	Report on Internship (After 16 weeks from the date of commencement)	**CSE**	-	-	-	25	-	25	**13**
3.	18SCS33	Evaluation and Viva-voce on Internship	**CSE**	-	-	-	-	50	50	**5**
4.	18SCSP34	Project phase - I	**CSE**	-	-	-	-	-	-	**2**
Total							**50**	**50**	**100**	**22**

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

Dr. Ambedkar Institute of Technology

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Department of Computer Science

SCHEME OF TEACHING AND EXAMINATION IV SEMESTER (Autonomous) 2018-2020

M. Tech in CSE

IV semester

Sl. No.	Sub Code	Subject Title	Teaching Department	Teaching hours per week			Maximum Marks allotted			Examination Credits
				Lecture	Tutorial/ Seminar/ Assignment	Practical / Field Work	CIE	SEE	Total	
1.	**18SCS41**	**Internet of Things (Dr. Prakash)**	**CSE**	04	-	4	50	50	100	**3**
2.	**18SCS42X**	**ELECTIVE – III**	**CSE**	04	-	4	50	50	100	**3**
2.	18SCSP43	Evaluation of Project Work Phase II	**CSE**	-	-	6	100	-	100	**2**
3.	18SCSP44	Project Work Evaluation and Viva –Voce	**CSE**	-	-	-	-	200	200	**16**
Total							**200**	**300**	**500**	**24**
Grand Total (I to IV Semester) : 2050 Marks ; 88 Credits										

ELECTIVE III

Sl .No	Name of the Subject	Subject Code
1	Machine Learning with Python Programming	18SCS421
2	Agile Methodologies	18SCS422
3	Programmatic development using APEX and VISUALFORCE	18SCS423
4	Mobile Computing and Wireless Network	18SCS424

Chairman-BOS

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the Institute.

Note:

1) Project Phase – I **:** 6 weeks duration shall be carried out during III Semester. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Project Phase – II **:** 16 weeks duration during IV Semester. Evaluation shall be taken during the IV Semester. Total Marks shall be 100.

3) Project Work Evaluation and viva-voce: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 200 (Phase –II Evaluation: 100 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, and 100 for viva-voce).

Marks of Evaluation of Project:

1. During Project Phase – I, finalise titles and submit synopsis to the Institute along with Project Work report at the end of the Semester.
2. During the final viva, students have to submit all the reports.
3. The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
   a) Head of the Department (Chairman)
   b) Internal examiner (Guide)
   c) External examiner proposed by the Chairman, BoE (PG)

	Course Title: Probability Statistics And Queuing Theory		
	Course Code: 18SCS11	**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 develop analytical capability and to impart knowledge of Probability, Statistics and Queuing. 2. The application of above concepts in Engineering and Technology. 3. Students acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Unit No	**Syllabus Content**	**No of Hours**
1	Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	**10**
2	Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	**10**
3	Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical 10 Hours region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit, $\chi 2$ test for Independence	**11**
4	Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	**11**
5	Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	**10**

Course Outcomes	Description	RBT Levels
CO1	Demonstrate knowledge & use of probability and will be able to characterize probability models using probability mass (density) functions & cumulative distribution functions.	R1, R2,R3
CO2	Apply the techniques of developing discrete & continuous probability distributions and its applications.	R4 and R5
CO3	Describe a random process in terms of its mean and correlation functions.	R3
CO4	Apply the methods of Hypothesis testing for goodness of fit.	R5
CO5	Understand the terminology &nomenclature appropriate queuing theory and also demonstrate the knowledge and understand the various queuing models.	

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009. Published by PHI Learning, New Delhi (2009) ISBN 10: 8120338448 ISBN 13: 9788120338449

REFERENCE BOOKS:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishore. S. Trivedi, Prentice Hall of India, 2004. ISBN: 978-0-471-33341-8
2. Pattern Recognition (An Introduction), V SusheelaDevi, M Narsimha Murthy, 2011, Universities Press, ISBN : 978-81-7371-725-3

COURSE COORDINATOR:	**Dr.Shiva Prasanna**

	Course Title: Cloud Computing Theory and Practice		
	Course Code: 18SCS12	**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 comprehensive view to different aspects of cloud computing like; service models, challenges & infrastructure with different Cloud Service providers in the market 2. To introduce to cloud virtualization, with different type of virtualization. To analyze and differentiate between cloud architectures and few standards followed in cloud computing 3. To understand how high throughput can be achieved with task computing on cloud environment. 4. To understand and demonstrate different features of cloud platforms used in Industry 5. To understand how energy efficiency achieved in cloud computing using green computing. To also understand technologies used for Cloud federation with cloud federation stack.

Unit No	**Syllabus Content**	**No of Hours**
1	Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 20, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force-com and Salesforcecom, Manjrasoft Aneka	10
2	**Virtualization** Introduction, Characteristics of virtualized environments, Increased security, Managed execution, Portability, Taxonomy of virtualization techniques, Execution virtualization, Other types of virtualization, Virtualization and cloud computing, Pros and cons of virtualization, Advantages of virtualization, The other side of the coin: disadvantages,	12

	Technology examples, Xen par virtualization, VMware: full virtualization, Microsoft Hyper-V **Cloud Computing Architecture** Introduction, The cloud reference model, Architecture, Infrastructure- and hardware-as-a-service Platform as a service, Software as a service, Types of clouds, Public clouds, Private clouds, Hybrid clouds Community clouds, Economics of the cloud, Open challenges, Cloud definition, Cloud interoperability and standards, Scalability and fault tolerance, Security, trust, and privacy, Organizational aspects	
3	**High-Throughput Computing** Task computing , Characterizing a task, Computing categories, Frameworks for task computing , Task-based application models , Embarrassingly parallel applications, Parameter sweep applications, MPI applications , Workflow applications with task dependencies ,Aneka task-based programming,Task programming model,Developing applications with the task model, Developing a parameter sweep application, Managing workflows	10
4	**Cloud Platforms in Industry**: Amazon web services: Compute services ,Storage services, Communication services ,Additional services. Google AppEngine : Architecture and core concepts, Application life cycle, Cost model Observations Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance , Observations	10
5	**Advanced topics** Energy efficiency in clouds , Energy-efficient and green cloud computing architecture, Market-based management of clouds ,Market-oriented cloud computing, A reference model for MOCC Technologies and initiatives supporting MOCC, Observations, Federated clouds/InterCloud Characterization and definition, Cloud federation stack , Aspects of interest, Technologies for cloud federations, Observations, Third-party cloud services , MetaCDN , SpotCloud	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Obtain knowledge on different aspects of cloud computing like; service models, challenges & infrastructure and different services provided by cloud service providers.	R1, R2,R3
CO2	Analyze the importance of virtualization and different features of Virtual Machine (VM) in cloud computing and understand cloud architectures and few standards followed in cloud computing.	R4 and R5

CO3	To able to understand task computing on cloud environment.	R3
CO4	Able to understand and demonstrate different features of cloud platforms used in Industry.	R5
CO5	Able to understand technologies used for Cloud federation with cloud federation stack.	

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1.Rajkumar Buyya, The University of Melbourne and Manjrasoft Pty Ltd, Australia, Christian Vecchiola, **Cloud computing theory and practice 2nd Edition**

REFERENCE BOOKS:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010.
3. Cloud Computing: Theory and Practice, Dan Marinescu, 1st edition, MK Publishers, 2013.

COURSE COORDINATOR:	**Dr. Prakash**

	Course Title: Advances in Computer Networks		
	Course Code: 18SCS13	**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. Discuss with the basics of Computer Networks. 2. Compare various Network architectures. 3. Discuss fundamental protocols. 4. Define and analyse network traffic, congestion, and controlling and resource allocation

Unit No	**Syllabus Content**	**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, Stop-and-Wait , Sliding Window protocol.	**08**
2	**Internetworking I:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP),	**09**
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 Version 6 (IPv6)	**08**
4	**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), Endto- 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 Retransmit and Fast Recovery	**09**
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)	**08**

Course Outcomes	**Description**	**RBT Levels**
CO1	Able to classify network services, protocols and architectures, explain why they are layered.	R1, R2,R3

CO2	Choose key Internet applications and their protocols, and apply to develop their own Applications.	R4 and R5
CO3	Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.	R3
CO4	Ability to analyse different transmission protocols and Interpret various congestion control techniques.	R5
CO5	Analyse Network traffic, resource allocation and need of different protocols for different applications.	

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition, Elsevier -2014
2. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

REFERENCE BOOKS:

1. Uyless Black, "Computer Networks Protocols , Standards and Inte rfaces" 2nd Edition -PHI.
2. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill.

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

	Course Title: Soft Computing		
	Course Code: 18SCS14	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week :**
	Exam Duration : 3 hours	**CIE+SEE = 50+50=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. 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, linear separability, Hebb Network.	**11**
2	Supervised Learning: Perceptual Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network, Associative Memory Network: introduction, training algorithms for pattern association, associative memory network, hetero-associative memory network, bidirectional associative memory.	**11**
3	Classical sets and Fuzzy Sets – classical and Fuzzy Relations – Features of membership functions, Fuzzification and methods of membership value assignment. Defuzzification lambda cuts for fuzzy relations and fuzzy sets.	**10**
4	Fuzzy Decision Making: introduction, individual decision making, multiperson Decision making, multiobjective decision making, multiattribute decision making, fuzzy Bayesian decision making, Fuzzy logic control systems: introduction, control system design, architecture and operation of FLC systems, FLC system Models, Applications of FLC systems	**10**
5	Genetic algorithms: Introduction - Basic operations - Traditional optimization and search techniques. Genetic algorithms and search space, Operators of genetic algorithms – Genetic programming	**10**

Course Outcomes	**Description**	**RBT Levels**

CO1	Analyze the basics of soft computing, ANN and Terminologies to relate and understand the real time problems	R1, R2,R3
CO2	Apply supervised and unsupervised learning representations for analyzing real time problems	R4 and R5
CO3	Analyze and adopt fuzzy logic in implementing soft computing applications.	R3
CO4	Analyze and apply genetic algorithms to solve the optimization problems	R5

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, S N Sivanandam, and S N Deepa, Wiley India, 3rd edition ISBN 13: 978812658744-5, 2019

REFERENCE BOOKS:

1. Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012, ISBN 0-13-261066-3
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition

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

	Course Title: Cloud Computing Laboratory		
	Course Code: 18SCSL16	**No. of Credits: 3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 16**

Course Objectives:	**Description**
	1. To Install and understand Virtual Box by deploying web application 2. To get Hands on with Different Cloud services: Amazon, Google apps and Salesforce and VMware 3. To Create and provision VMs on any Cloud Simulation environments, and execute different polices to understand the VM features

	Part A	
1	Using Given Data set apply Find-s and Candidate Elimination algorithm to find most specific and Most generic Hypothesis.	
2	Using Boston Data Set implement Linear regression to predict Mean House Value	
3	Using Boston Data Set implement Multiple Linear regression to predict Mean House Value	
4	Using Stock Market Data, implement logistic regression to recognize stock market trends. Implement LDA for the same data set and give a comparison with logistic regression	
5	Using Boston data set implement regression tree and fit the regression tree to predict the Mean house data.	
	Part B **(Mini Project)**	
	• A team of two students can be formed to implement a mini project on real time data set using any machine learning technique • Design an appropriate user interface for the project either using web interface or android app platform.	

NOTE:
The student has to execute one from Part A and Demonstrate the mini project and answer the viva-voce

Course Outcomes	**Description**	**RBT Levels**
CO1	Learn about Amazon EC2. Amazon Cloud computing platform, Amazon Web Services.	**R4**
CO2	Salesforce cloud computing platform, deploying and managing applications and services	**R5**

CO3	Google Apps: Google Drive, Google Docs and Google Slides	**R5**
CO4	To create and run VMs on any Virtualization Hypervisors and understanding Cloud Sim	**R5**

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Cloud Computing: Theory and Practice, Dan Marinescu, 1st edition, MK Publishers, 2013.

REFERENCES:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010.
3. Case studies: AWS, Google app engine, Salesforce Trailhead

COURSE COORDINATOR:	**Dr. Prakash**

	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.	**10**

	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,	
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: **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 file level; 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 Quality Definitions 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	**10**

	simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps.	
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: Managing Big data		
	Course Code: 18SCS21	**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 big data for business intelligence 2. To Learn business case studies for big data analytics 3. To Understand NoSQL big data management 4. To understand map-reduce analytics using Hadoop and related tools

Unit No	**Syllabus Content**	**No of Hours**
1	**Understanding Big Data:** What is big data – why big data – Data!, Data Storage and Analysis, convergence of key trends unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data— big data and healthcare – big data in medicine – advertising and big data – big data technologies – Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics	**10**
2	**NoSQL Data Management:** Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce – partitioning and combining – composing map-reduce calculations	**10**
3	**Basics Of Hadoop:** Data format – analysing data with Hadoop – scaling out – Hadoop streaming– Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures **Exercise 1 --- HDFS** Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the hadoop fs command when interacting with HDFS. 1. Review the commands available for the Hadoop Distributed File System: 2. Copy file foo.txt from local disk to the user's directory in HDFS 3. Get a directory listing of the user's home directory in HDFS	**11**

	4. Get a directory listing of the HDFS root directory 5. Display the contents of the HDFS file user/fred/bar.txt 6. Move that file to the local disk, named as baz.txt 7. Create a directory called input under the user's home directory 8. Delete the directory input old and all its contents 9. Verify the copy by listing the directory contents in HDFS	
4	**MapReduce Applications:** MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic MapReduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats **Exercise 2 --- MapReduce** 1. Create a JOB and submit to cluster 2. Track the job information 3. Terminate the job 4. Counters in MR Jobs with example 5. Map only Jobs and generic map examples 6. Distributed cache example 7. Combiners, Secondary sorting and Job chain examples	**10**
5	**Hadoop Related Tools:** Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries. **Exercise 3 – Extract facts using Hive** Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database. The moveapp_log_json table contains an activity column. Activity states are as follows: 1. RATE_MOVIE 2. COMPLETED_MOVIE	**11**

3. PAUSE_MOVIE

4. START_MOVIE

5. BROWSE_MOVIE

6. LIST_MOVIE

7. SEARCH_MOVIE

8. LOGIN

9. LOGOUT

10. INCOMPLETE_MOVIE

hive> SELECT * FROM movieapp_log_json LIMIT 5;

hive> drop table movieapp_log_json;

hive> CREATE EXTERNAL TABLE movieapp_log_json (

movieId INT,

genreId INT,

time STRING,

recommended STRING,

activity INT,

rating INT,

price FLOAT

)

ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'

LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the

	RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows. 2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie. 3. Load the results of the previous two queries into a staging table. First, create the staging table: 4. Next, load the results of the queries into the staging table. **Exercise 4 -- Extract sessions using Pig** While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan. In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples. 1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement. 2. Group the log sample by movie and dump the resulting bag. 3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.	

Course Outcomes	Description	RBT Levels
CO1	Learn, analyze and interpret big data and few of its use cases from selected business domains, Health Care, Fraud Detection and Advertising.	R2,R3,R4

CO2	Analyze and apply NoSQL in big data applications.	R3,R4
CO3	Apply map-reduce analytics using Hadoop.	R3
CO4	Analyze and develop applications using Hadoop and its related tools.	R4,R5

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Copyright © 2013 Pearson Education, Inc. 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

REFERENCE BOOKS

1. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
3. Alan Gates, "Programming Pig", O'Reilley, 2011.

Course Coordinator: Dr. Siddaraju

	Course Title: Advanced Database Systems		
	Course Code: 18SCS22	**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**
	Course objectives: 1. Design and implement advanced queries using Structured Query Language 2. To study the usage and applications of Object Oriented database 3. To acquire knowledge on variety of NoSQL databases 4. To attain inquisitive attitude towards research topics in NoSQL databases

Unit No	**Syllabus Content**	**No of Hours**
1.	**Database System Concepts and Architecture:** Data Models, Schemes and Instances, Three-Schema Architecture and Data Independence, **The Relational Data Model and Relational Database Constraints**: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraints Violations. Basic Queries and Commands in SQL.	**10**
2.	**PL/SQL Language Fundamentals**, Conditional and Sequential Control, Iterative Processing with Loops, String Datatypes, Working with Strings, Specifying String Constants, Using Nonprintable Characters, Concatenating Strings, Dealing with Case, Traditional Searching, Extracting, and Replacing, Date time Datatypes, Getting the Current Date and Time, Date time Conversions, From Strings to Date times, From Date times to Strings.	**11**
3.	**NoSQL:** Motivations for Not Just/No SQL (NoSQL) Databases, Variety of NoSQL Databases, Introduction to Key-Value Databases, Key-Value Database Terminology.	**10**
4.	Introduction to Document Databases, Document Database Terminology Introduction to Column Family Databases, Column Family Database Terminology	**11**
5.	Introduction to Graph Databases, Graph Database Terminology,	**10**

Course Outcomes	**Description**	**RBT Levels**

CO1	Acquiring the basic knowledge of ER-Diagram, Relational Database and SQL.	R1,R2
CO2	Construct queries using Pl/SQL efficiently for developing database applications.	R3,R4
CO3	Critically analyze and evaluate variety of NoSQL databases.	R4
CO4	Demonstrate the knowledge of Key-Value databases, Document based Databases, Column based Databases and Graph Databases.	R1,R4

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

Ramez Elmasri, Shamkant B Navathe,"Database Systems: Models,Languages,Design and Application Programming", 6thEdition, Pearson Education, 2013.(ISBN-13:978-8131792476)

1) Steven Feuerstein, "Oracle PL/SQL Programming", 6thEdition, O'Reilly Media, 2014. (ISBN-13: 978-1449324452)
2) Dan Sullivan,"NoSQL for Mere Mortals",1stEdition, Pearson Education, 2015. (ISBN-13: 978-9332557338)

REFERENCE BOOKS / WEBLINKS:

1) Michael McLaughlin,"Oracle Database 12c PL/SQL Programming", 1stEdition, McGraw-Hill Education, 2014. (ISBN-13: 978-0071812436)
2) Pramod J. Sadalage, Martin Fowler,"NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1stEdition, Pearson Education, 2012. (ISBN-13: 978-8131775691)

COURSE COORDINATOR:	**Prof. Shamshekar Patil**

	Course Title: Artificial Intelligence and Prolog Programming		
	Course Code: 18SCS23	**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 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 IntelligenceAnalyzing 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. (Text Book 1: Chapter 3, 4 & 5)	**10**

3	Symbolic Reasoning Under Uncertainty: Introduction to non-monotonic reasoning, Logic for non-monotonic reasoning, Implementation Issues, 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**

Course Outcomes	**Description**	**RBT Levels**
CO1	Acquire knowledge and understand AI agents with problem solving, reasoning, planning, decision making, and learning abilities	R1,R5
CO2	Analyze the real time problems to represent it in AI framework and techniques	R4
CO3	Use prolog programming constructs to represent AI components	R3
CO4	Design and implement AI applications in prolog to solve real time problems	R5

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

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

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: Advanced Algorithms and Data structure		
	Course Code: 18SCS24	**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 learn implementing 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 To understand the application of hashing technique

Unit No	**Syllabus Content**	**No of Hours**
1	**Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The Course substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods	**11**
2	**Graph Algorithms:** Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-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 heapsort algorithm, Priority queues	**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	**B-Trees**, Definition of B-trees, Basic operations on B-trees , Deleting a key from a B-tree, Structure of Fibonacci heaps	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze and design iterative and recursive algorithms	R4,R5

CO2	Interpret the logic and determine the suitable data structures for a real-time applications	R3,R4
CO3	To Analyze and apply graph algorithms to find optimal solutions for real time applications.	R4,R3,R5
CO4	Apply the operations on tree based data structures to find optimal solutions using for real time applications.	R3
CO5	Apply suitable hashing technique to optimize retrieval process in real-time applications.	R3

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

TEXT BOOK:

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/WEBLINKS:

1. Ellis Horowitz, SartajSahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007, ISBN 8173716129, 9788173716126
2. Horowitz, Sahani, Dinesh Mehata, ―Fundamentals of Data Structures in C++‖, 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

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

	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,	**11**

	Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering.	
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.	11

	Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems ,Identity Theft , Biometric Security Systems, Homeland Security Systems	
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: Data structures and DBMS LAB		
	Course Code: **18SCSL26**	**No. of Credits: 3 : 0 : 0** **(L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE+ SEE = 50+50=100**	**Total No. of Contact Hours : 36**

Course Objectives:	**Description**
	1. To understand usage of advanced data structure in real time applications 2. To acquire inquisitive attitude towards research topics in databases. 3. To acquire practical knowledge on advanced databases and its applications. 4. To implement the shell of Operating System. To implement distributed operating system concepts.

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

Part A: ADBMS LABORATORY WORK

Note: The following experiments may be implemented on MySQL/ORACLE/PostgreSQL or any other suitable RDBMS with support for Object features

1. **Develop a database application to demonstrate storing and retrieving of BLOB andCLOB objects.**

   a) Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter.

   b) Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.

2. **Develop a database application to demonstrate the representation of multi valuedattributes, and the use of nested tables to represent complex objects. Write suitablequeries to demonstrate their use.**

   Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach.

   a) Show how to implement the schema -- Implementing the Application under the Relational Model -- using only MySQL/PostgreSQL/Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views.

3. **Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each subject for which he/she has enrolled and Internal Assessment Using TRIGGERS, write active rules to do the following:**

   a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.

b) Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

Use the following guidelines when designing triggers:

- Use triggers to guarantee that when a specific operation is performed, related actions are performed.
- Use database triggers only for centralized, global operations that should be fired for the triggering statement, regardless of which user or database application issues the statement.
- Do not define triggers that duplicate the functionality already available in any database (Oracle/MySQL/PostgreSQL, etc.). For example, do not define triggers to enforce data integrity rules that can be easily enforced using declarative integrity constraints.
- Limit the size of triggers (60 lines or fewer is a good guideline). If the logic for your trigger requires much more than 60 lines of PL/SQL code, it is better to include most of the code in a stored procedure, and call the procedure from the trigger.
- Be careful not to create recursive triggers. For example, creating an AFTER UPDATE statement trigger on the EMP table that itself issues an UPDATE statement on EMP causes the trigger to fire recursively until it has run out of memory.

4. Design, develop, and execute a program to implement specific Apriori algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk".

Part B: Algorithms and Data structure Laboratory

1 Implement Binary search tree for some real time application and demonstrate the operations on binary search tree

2 Implement Red-Back tree rotations on some real time applications with insertion, deletion and searching

3 Implement all the functions of a dictionary (ADT) using hashing. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique Standard Operations: Insert(key, value), Find(key), Delete(key)

4 To create ADT that implements the SET concept.

a. Add (newElement) -Place a value into the set
b. Remove (element) Remove the value
c. Contains (element) Return true if element is in collection
d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection
e. Intersection of two sets,
f. Union of two sets,
g. Difference between two sets,
h. Subset

Course Outcomes	Description	RBT Levels
1.	Model and represent the real world data using object oriented database.	

2.	Embed the rule set in the database to implement data warehousing of mining.	
3.	Choose and design database for recent applications database for better interoperability	
4.	Use Binary search trees in any real time problem domains where appropriate.	
5.	Use Red –black trees for real time problems for optimization purpose.	
6.	Use hashing technique for searching in any real time applications.	

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	2	3
CO2	1	2	3	2	3
CO3	2	2	3	2	3
CO4	-	2	3	3	3
CO5	1	2	3	3	3
CO6	1	2	3	3	3

Course Coordinator: Prof. Shamshekar Patil & K.R. Shylaja

	Course Title :Research Methodology		
	Course Code: **18RM27**	**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 : 26**

Course Objectives:	**Description**
	1. Have a basic understanding of the underlying principles of quantitative and qualitative research 2. Identify the overall process of designing a research study from its inception to its report. 3. Choose the most appropriate research method to address a particular research question **4.** Gain a overview of a range of quantitative and qualitative approaches to data analysis

Unit No	**Syllabus Content**	**No of Hours**
1.	**Unit – I, Overview of Research** Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules.	**08 Hrs**
2.	**Unit – II, Sampling Methods** Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions	**06 Hrs**
3.	**Unit – III, Processing and analysis of Data** Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t and Chi Square).	**06 Hrs**
4.	**Unit-IV,** **Essential of Report writing and Ethical issues**: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Ethical issues related to Research, Plagiarism and self- Plagiarism, Publishing.	**06 Hrs**

Course Outcomes	**Description**	**RBT Levels**
1.	Describe a range of quantitative and qualitative research designs and identify the advantages and disadvantages associated with these designs	

2.	Choose appropriate quantitative or qualitative method to collect data	
3.	Analyse and test the given data using appropriate methods	
4.	Design an appropriate mixed-method research study to answer a research question	

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

Course Coordinator:

	Course Title: Machine Learning Techniques		
	Course Code: 18SC31	**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 basic concepts of learning and decision trees. 2. Compare and contrast neural networks and genetic algorithms 3. Apply the Bayesian techniques and instant based learning 4. Examine analytical learning and reinforced learning

Unit No	**Syllabus Content**	**No of Hours**
1	INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias –Decision Tree learning – Representation – Algorithm – Heuristic Space Search	**11**
2	NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search –Genetic Programming – Models of Evolution and Learning.	**10**
3	BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**10**
4	INSTANT BASED LEARNING AND LEARNING SET OF RULES: K-Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –CaseBased Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction– Inverting Resolution	**11**
5	ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Choose the right learning techniques for designing an application with the basic knowledge of ML techniques.	R6

CO2	Apply effectively neural networks and genetic algorithms for appropriate applications.	R3
CO3	Apply bayesian techniques and derive effectively learning rules.	R3
CO4	Choose and differentiate reinforcement and analytical learning techniques	R6

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

Strong -3 Medium -2 Weak -1

TEXT BOOK:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCE BOOKS / WEBLINKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.

2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

Course Coordinator: Dr. K R Shylaja

	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, Smart Appliances,, Intrusion Detection, Smoke/Gas Detectors. **Cities:** Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response. **Environment:** Weather Monitoring, Air Pollution Monitoring, Noise Pollution 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 Tests	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 NLPLanguage 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 FiniteState Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a	**11**

	Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.	
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	10

	Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication.	
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

Dr. Ambedkar Institute of Technology, Bangalore-560056
An Autonomous Institution, Affiliated to VTU
Department of CSE, M.Tech Programme

Autonomous Syllabus for M.Tech 2017-2018 Batch

M.Tech (CSE) First Semester

Total Credits: 26

			CREDIT BASED				
Sub Code	**Subject Name**	**Lecture Hrs/week**	**Duration of exam in Hrs**	**Marks for**			**Total credits**
				CIE	**SEE**	**Total**	
SCS11	Advances in Operating System	4	3	30	70	100	4
SCS12	Cloud Computing	4	3	30	70	100	4
SCS13	Advanced DBMS	4	3	30	70	100	4
SCS14	Probability Statistics and Queuing Theory	4	3	30	70	100	4
SCS15X	**Elective I**	4	3	30	70	100	4
SCS16L	OS and ADBMS lab	3	3	30	70	100	2
SCSS17	Seminar		-	50		50	2
SCSM18	Mini Project		-	50		50	2
Total		**23**	**18**	**280**	**420**	**700**	**26**

Elective Group - I

1. Artificial Intelligence and Prolog Programming (SCS151)
2. Digital Image Processing(SCS152)
3. Advances in Storage Area Network (SCS153)

M.Tech (CSE) Second Semester

Total Credits: 26

			CREDIT BASED				
Sub Code	**Subject Name**	**Lecture Hrs/week**	**Duration of exam in Hrs**	**Marks for**			**Total Credits**
				CIE	**SEE**	**Total**	
SCS21	Managing Big Data	4	3	30	70	100	4
SCS22	**Advanced Computer Networks**	4	3	30	70	100	4
SCS23	**Advanced Algorithms**	4	3	30	70	100	4
SCS24X	**Elective II**	4	3	30	70	100	4
SCS25X	**Elective III**	4	3	30	70	100	4
SCS26L	Network/ Algorithms Lab	3	3	30	70	100	2
SCS27	Research Methodologies	3	3	30	70	100	2
SCSM28	Mini project		-	50		50	2
Total		**23**	**18**	**260**	**490**	**750**	**26**

Elective Group II	**Elective Group III**
1. Machine Learning Techniques(SCS241) 2. Computer Vision (SCS242) 3. Cyber Security(SCS243)	1. Information and Network Security(SCS251) 2. Soft Computing (SCS252) 3. Neural Networks (SCS253)

M.Tech (CSE). Third Semester

Total Credits: 24

			CREDIT BASED				
Sub Code	**Subject Name**	**Lecture Hrs/week**	**Duration of exam in Hrs**	**Marks for**			**Total Credits**
				CIE	**SEE**	**Total**	
SCS31	Internship	-	-	50	50	100	20
SCSP32	Project Phase -I	-	-	50	-	50	2
SCSS33	Seminar	-	-	50	-	50	2
Total				**150**	**50**	**200**	**24**

M.Tech (CSE). Fourth Semester

Total Credits: 24

		CREDIT BASED					
Sub Code	**Subject Name**	**Lecture Hrs/week**	**Duration of exam in Hrs**	**Marks for**			**Total Credits**
				CIE	**SEE**	**Total**	
SCS41	**Internet of Things**	4	3	30	70	100	4
SCS42X	**Elective-IV**	4	3	50	50	100	4
SCSP41	Project Phase II	-	-	50	100	150	16
Total				**130**	**220**	**350**	**24**

Elective Group - IV

1. Wireless networks and Mobile Computing (SCS421)
2. Advanced Data Structures (SCS422)
3. Agile Methodologies (SCS423)

	Course Title: Advances In Operating Systems		
	Course Code: SCS11	**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 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, deadlock 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, UNIX SVR4 Process Management Text Book 2: Chapter 2 & 3	10
2	**Threads, SMP, and Microkernel,** Processes and Threads, Symmetric Multiprocessing (SMP), Microkernel, Solaris Thread and SMP Management, Virtual Memory: hardware and control structures, Operating System Software, UNIX and Solaris Memory Management. Text Book2: Chapter 4 & 8	10
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, Text Book 1: Chapter 10 Text Book 2: Chapter 16	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	11

	Text Book 1: Chapter 17 & 18	
5	**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	11

Course Outcomes	Description	RBT Levels
CO1	Analyze the structure of OS and basic architectural components involved in OS design	R4
CO2	Analyze and design the applications to run in parallel either using process or thread models of different OS	R4 & R5
CO3	Analyze the various device and resource management techniques for timesharing and distributed systems	R4
CO4	Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system	R1, R2
CO5	Interpret the mechanisms adopted for file sharing in distributed Applications	R3
CO6	Conceptualize the components involved in designing a contempary OS	R4,R5,R6

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5
CO1	-	-	3	3	-
CO2	-	-	3	3	1
CO3	-	-	3	3	2
CO4	1	-	3	2	2
CO5	1	-	3	3	2
CO6	1	-	3	3	2

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. AviSilberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 8th Edition, John wiley& Sons, Inc. ISBN 978-1-118-06333-0, 2012

2. William Stallings, Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948

REFERENCE BOOKS:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2012.
2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.

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

	Course Title: Cloud Computing		
	Course Code: SCS12	**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 how to use Cloud Services. 2. To implement Virtualization 3. To implement Task Scheduling algorithms. 4. Apply Map-Reduce concept to applications. 5. To build Private Cloud. **6.** Broadly educate to know the impact of engineering on legal and societal issues involved.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction, Cloud Infrastructure:** Network centric computing and network centric content, Peer-to-peer systems, Cloud Computing: an old idea whose time has come, Cloud Computing delivery models & Services, Ethical issues, Cloud vulnerabilities, Challenges, **Cloud Infrastructure:** Amazon, Google, Azure & online services, open source private clouds. Storage diversity and vendor lock-in, inter-cloud, Energy use & ecological impact of data centers, service level and compliance level agreement, Responsibility sharing, user experience, Software licensing.	**10**
2	**Cloud Computing: Application Paradigms.:** Challenges, existing and new application opportunities, Architectural styles of cloud applications: single , multi ,hybrid cloud site, redundant, non redundant , 3 tier, multi tier architectures, Workflows coordination of multiple activities, Coordination based on a state machine model -the Zoo Keeper, The Map Reduce programming model, Apache Hadoop, A case study: the Grep, The Web application, **Applications**: Healthcare, Energy systems, transportation, manufacturing, Education, Government, mobile communication, application development.	**10**
3	**Cloud Resource Virtualization:** Definition, merits and demerits, types & Techniques, Layering, Virtual machine monitors, Hardware support for virtualization Case study: *Xen* -a VMM based on para-virtualization, Optimization of network virtualization in *Xen* 2.0, *vBlades* - paravirtualization targeting a *x86-64* Itanium processor, A performance comparison of virtual machines, The darker side of virtualization, Software fault isolation.	**11**
4	**Cloud Resource Management and Scheduling:** Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized	**11**

	autonomic performance managers, A utility-based model for cloud-based web services, Resource bundling, combinatorial auctions, fair queuing, Start time fair queuing, borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling mapreduce applications subject to deadlines, Resource management and application scaling	
5	**Cloud Security, Cloud Application Development: Storage systems:** Evolution, Storage models, file systems, databases, DFS, General parallel File system, GFS, Hadoop, Locks & Chubby, TPS, NOSQL, Big Table, Mega store. **Cloud security:** Risks, Security, privacy, Trust. Security of OS, VM, VMM, shared image, management OS, Xoar.	**10**

Course Outcomes	**Description**	**RBT Levels**
CO1	Obtain knowledge on different aspects of cloud computing like; service models, challenges & infrastructure and different services provided by cloud service providers.	R1, R2,R3
CO2	Analyze the importance of virtualization and different features of Virtual Machine (VM) in cloud computing and understand cloud architectures and few standards followed in cloud computing.	R4 and R5
CO3	To able to understand task computing on cloud environment.	R3
CO4	Able to understand and demonstrate different features of cloud platforms used in Industry.	R3, R5
CO5	Able to understand technologies used for Cloud federation with cloud federation stack.	R5

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013, 1st Edition, Print Book ISBN :9780124046276, eBook ISBN :9780124046412
Chapter 1 - Introduction*Pages 1-19*, Chapter 2 - Parallel and Distributed Systems*Pages 21-65*, Chapter 3 - Cloud Infrastructure*Pages 67-98*, Chapter 4 - Cloud Computing: Applications and Paradigms*Pages 99-130*, Chapter 5 - Cloud Resource Virtualization*Pages 131-161*, Chapter 6 - Cloud Resource Management and Scheduling*Pages 163-203*, Chapter 8 - Storage Systems*Pages 241-271*, Chapter 9 - Cloud Security*Pages 273-300*,, Chapter 11 - Cloud Application Development *Pages 317-359*

2. Cloud Computing : A hands on Approach, Arshdeep Bagha - Vijay Bagha Madisetti , 2013, ISBN/EAN13: 1494435144 / 9781494435141, web links: www.cloudcomputingbook.info.
Chapter 1-1-19 pages, Chapter 4-64-93 pages, Chapter 5- 94-113 pages, Case studies and examples.

REFERENCE BOOKS:

1.Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, 1st edition, 2014, Morgan Kaufmann Publishers, Inc., San Francisco. ISBN-13: 978-0124166752, ISBN-10: 012416675X
2. T. Erl, R. Puttini, and Z. Mahmood, Cloud Computing: Concepts, Technology & Architecture • ISBN-10: 0133387526 • ISBN-13: 9780133387520 ©2013 • Prentice Hall • Cloth, 528 pp
3. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. ISBN: 978-0-470-88799-8
4. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra and Geoffrey Fox, Morgan Kaufmann, 2011. ISBN-10: 0123858801 ISBN-13: 978-0123858801
5. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010 ISBN 10: 0070683514 ISBN 13: 9780070683518

COURSE COORDINATOR:	**Dr. Siddaraju**

	Course Title: Advanced DBMS		
	Course Code: SCS13	**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. Design and implement advanced queries using Structured Query Language 2. To study the usage and applications of Object Oriented database 3. To acquire knowledge on variety of NoSQL databases **4.** To attain inquisitive attitude towards research topics in NoSQL databases

Unit No	**Syllabus Content**	**No of Hours**
1	Database System Concepts and Architecture, The Relational Data Model and Relational Database Constraints, Language Fundamentals, Conditional and Sequential Control, Iterative Processing with Loops, String Datatypes, Working with Strings, Specifying String Constants, Using Nonprintable Characters, Concatenating Strings, Dealing with Case, Traditional Searching, Extracting, and Replacing, Datetime Datatypes, Getting the Current Date and Time, Datetime Conversions, From Strings to Datetimes, From Datetimes to Strings, Collection Methods, Introduction to Oracle's Object Features, Object Types by Example.	11
2	Motivations for Not Just/No SQL (NoSQL) Databases, Variety of NoSQL Databases, Introductionto Key-Value Databases, Key-Value Database Terminology	11
3	Introduction to Document Databases, Document Database Terminology	10
4	Introduction to Column Family Databases, Column Family Database Terminology	10
5	Introduction to Graph Databases, Graph Database Terminology, Choosing a database for your application.	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Acquiring the basic knowledge of ER-Diagram, Relational Database and SQL.	R1, R2,R3
CO2	Construct queries using Pl/SQL efficiently for developing database applications.	R4 and R5
CO3	Critically analyze and evaluate variety of NoSQL databases.	R3
CO4	Demonstrate the knowledge of Key-Value databases, Document based Databases, Column based Databases and Graph Databases.	R5

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1) RamezElmasri, Shamkant B Navathe,"Database Systems: Models,Languages,Design and Application Programming", 6th Edition, Pearson Education, 2013.(ISBN-13:978-8131792476)
2) Steven Feuerstein, "Oracle PL/SQL Programming", 6th Edition, O'Reilly Media, 2014. (ISBN-13: 978-1449324452)
3) Dan Sullivan,"NoSQL for Mere Mortals",1st Edition, Pearson Education, 2015. (ISBN-13: 978-9332557338)

REFERENCE BOOKS:

1) Michael McLaughlin,"Oracle Database 12c PL/SQL Programming", 1st Edition, McGraw-Hill Education, 2014. (ISBN-13: 978-0071812436)
2) Pramod J. Sadalage, Martin Fowler,"NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Pearson Education, 2012. (ISBN-13: 978-8131775691)

COURSE COORDINATOR:	**Shamshekhar patil**

	Course Title: Probability Statistics And Queuing Theory		
	Course Code: SCS14	**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 develop analytical capability and to impart knowledge of Probability, Statistics and Queuing. 2. The application of above concepts in Engineering and Technology. **3.** Students acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Unit No	**Syllabus Content**	**No of Hours**
1	Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	10
2	Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	10
3	Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical 10 Hours region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit, $\chi 2$ test for Independence	11
4	Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	11
5	Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	10

Course Outcomes	Description	RBT Levels
CO1	Demonstrate knowledge & use of probability and will be able to characterize probability models using probability mass (density) functions & cumulative distribution functions.	R1, R2,R3
CO2	Apply the techniques of developing discrete & continuous probability distributions and its applications.	R3 and R5
CO3	Describe a random process in terms of its mean and correlation functions.	R2
CO4	Apply the methods of Hypothesis testing for goodness of fit.	R3
CO5	Understand the terminology &nomenclature appropriate queuing theory and also demonstrate the knowledge and understand the various queuing models.	R4,R5

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern EconomyEdition, PHI Learning Pvt. Ltd, 2009. Published by PHI Learning, New Delhi (2009) ISBN 10: 8120338448 ISBN 13: 9788120338449

REFERENCE BOOKS:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Editionby Kishor. S. Trivedi , Prentice Hall of India ,2004.ISBN: 978-0-471-33341-8

COURSE COORDINATOR:	**Dr. ShivaPrasana**

	Course Title: ADBMS and OS Laboratory		
	Course Code: SCS16L	**No. of Credits: 0 : 0 : 2 (L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 16**

Course Objectives:	**Description**
	1. To understand the basic concepts and applications of Object Oriented database. 2. To understand and work on areas like Storage, Retrieval, Multi valued attributes, Triggers and other complex objects 3. To acquire inquisitive attitude towards research topics in databases. 4. To acquire practical knowledge on advanced databases and its applications. 5. To implement the shell of Operating System. 6. To implement distributed operating system concepts.

Part A: ADBMS LABORATORY WORK

Note: The following experiments may be implemented on MySQL/ORACLE/PostgreSQL or any other suitable RDBMS with support for Object features

1. **Develop a database application to demonstrate storing and retrieving of BLOB andCLOB objects.**
   a) Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter.
   b) Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.
2. **Develop a database application to demonstrate the representation of multi valuedattributes, and the use of nested tables to represent complex objects. Write suitablequeries to demonstrate their use.**
   Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach.
   a) Show how to implement the schema -- Implementing the Application under the Relational Model -- using only MySQL/PostgreSQL/Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views.
3. **Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each**

subject for which he/she has enrolled and Internal Assessment Using TRIGGERS, write active rules to do the following:

a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
b) Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

Use the following guidelines when designing triggers:

- Use triggers to guarantee that when a specific operation is performed, related actions are performed.
- Use database triggers only for centralized, global operations that should be fired for the triggering statement, regardless of which user or database application issues the statement.
- Do not define triggers that duplicate the functionality already available in any database (Oracle/MySQL/PostgreSQL, etc.). For example, do not define triggers to enforce data integrity rules that can be easily enforced using declarative integrity constraints.
- Limit the size of triggers (60 lines or fewer is a good guideline). If the logic for your trigger requires much more than 60 lines of PL/SQL code, it is better to include most of the code in a stored procedure, and call the procedure from the trigger.
- Be careful not to create recursive triggers. For example, creating an AFTER UPDATE statement trigger on the EMP table that itself issues an UPDATE statement on EMP causes the trigger to fire recursively until it has run out of memory.

4. Design, develop, and execute a program to implement specific Apriori algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk".

Part B : OPERATING SYSTEM LABORATORY

1. Design and Develop a UNIX/LINUX shell program that should support at least 10 commands(Assume suitable application). OR Design a front-end application upon click of a button corresponding shell command should be executed.
2. Design and develop a program to implement lazy buddy system algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Create two process and demonstrate the usage of Shared segment by the above processes (use shmget, signal, fork etc. to simulate the working environment of the program).

Course Outcomes	Description	RBT Levels
CO1	Model and represent the real world data using object oriented database.	R1, R2,R3

CO2	Embed the rule set in the database to implement data warehousing of mining.	R4
CO3	Choose and design database for recent applications database for better interoperability	R5,R6
CO4	Use Binary search trees in any real time problem domains where appropriate.	R3
CO5	Use Red –black trees for real time problems for optimization purpose.	R3
CO6	Use hashing technique for searching in any real time applications.	R3

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	2	3
CO2	1	2	3	2	3
CO3	2	2	3	2	3
CO4	-	2	3	3	3
CO5	1	2	3	3	3
CO6	1	2	3	3	3

Strong -3 Medium -2 Weak -1

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

	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=100**	**Total No. of Contact Hours : 52**

Course Objectives:	**Description**
	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-	10

	based systems, Bayesian Networks Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13	
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

Course Outcomes	**Description**	**RBT Levels**
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.	R3, R4,R5,R6
CO2	Apply AI technique on current applications	R3
CO3	Problem solving, knowledge representation, reasoning, and learning.	R4,R5
CO4	Demonstrating how to write a programs for Artificial Intelligence	R3
CO5	Solving recursive programs in Prolog	R4
CO6	Analyzing and Solving Artificial Intelligence programs by using Backtracking methods	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. 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 BratkoProlog 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: 1. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

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

	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	**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.	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: Managing Big Data		
	Course Code: SCS21	**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 big data for business intelligence 2. To Learn business case studies for big data analytics 3. To understand the big data technologies and security issues. 4. To manage Big data without SQL **5.** To understanding map-reduce analytics using Hadoop and related tools

Unit No	**Syllabus Content**	**No of Hours**
1	**Understanding Big Data:** What is big data – why is it important? – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data— big data and healthcare – big data in medicine – advertising and big data	10
2	**Big data Technologies and Data Privacy and Ethics:** Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics - Big Data Technology Terms- Data Size. Data Privacy and Ethics .	10
3	**Basics Of Hadoop:** Data format – analyzing data with Hadoop – scaling out – Hadoop streaming– Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures **Exercise 1 --- HDFS** Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the hadoop fs command when interacting with HDFS. 1. Review the commands available for the Hadoop Distributed File System: 2. Copy file foo.txt from local disk to the user's directory in HDFS 3. Get a directory listing of the user's home directory in HDFS 4. Get a directory listing of the HDFS root directory 5. Display the contents of the HDFS file user/fred/bar.txt 6. Move that file to the local disk, named as baz.txt 7. Create a directory called input under the user's home directory 8. Delete the directory input old and all its contents 9. Verify the copy by listing the directory contents in HDFS	**11**
4	**Mapreduce Applications:** MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Mapreduce and YARN – job scheduling	10

	– shuffle and sort – task execution – MapReduce types – input formats – output formats **Exercise 2 --- MapReduce** 1. Create a JOB and submit to cluster 2. Track the job information 3. Terminate the job 4. Counters in MR Jobs with example 5. Map only Jobs and generic map examples 6. Distributed cache example 7. Combiners, Secondary sorting and Job chain examples	
5	**Hadoop Related Tools:** Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. ZooKeeper – ZooKeeper Service. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries. **Exercise 3 – Extract facts using Hive** Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database. The moveapp_log_json table contains an activity column. Activity states are as follows: 1. RATE_MOVIE 2. COMPLETED_MOVIE 3. PAUSE_MOVIE 4. START_MOVIE 5. BROWSE_MOVIE 6. LIST_MOVIE 7. SEARCH_MOVIE 8. LOGIN 9. LOGOUT 10. INCOMPLETE_MOVIE hive> SELECT * FROM movieapp_log_json LIMIT 5; hive> drop table movieapp_log_json; hive> CREATE EXTERNAL TABLE movieapp_log_json (movieId INT, genreId INT, time STRING, recommended STRING, activity INT, rating INT, price FLOAT) ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde' LOCATION '/user/oracle/moviework/applog/'; hive> SELECT * FROM movieapp_log_json LIMIT 20; hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json 1. PURCHASE_MOVIE	**11**

	Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table. 1. Write a query to select only those clicks which correspond to starting, browsing, completing, or Purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows. 2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie. 3. Load the results of the previous two queries into a staging table. First, create the staging table: 4. Next, load the results of the queries into the staging table. **Exercise 4 Extract sessions using Pig** While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan. In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples. 1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement. 2. Group the log sample by movie and dump the resulting bag. 3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.	

Course Outcomes	Description	RBT Levels
CO1	Learn, analyze and interpret big data and few of its use cases from selected business domains, Health Care, Fraud Detection and Advertising.	R2,R3,R4
CO2	Analyze and apply NoSQL in big dataapplications.	R3 and R4
CO3	Apply map-reduce analytics using Hadoop.	R3

CO4	Analyze and develop applications using Hadoop and its related tools.	R4, R5
CO5	Broadly educate students to know the impact of engineering on legal and societal issues involved.	R5

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. ISBN: 978-1-449-31152-0. 1327616795. (Chapter 2, 3, 4- Unit3, Chapter 5,6,7 – Unit 4, Chapter 11, 12, 13, 14 – Unit 5)
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.(Chapter 1, 2– Unit 1, Chapter 3, 7 – Unit 2)

REFERENCE BOOKS:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Alan Gates, "Programming Pig", O'Reilley, 2011
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012. ISBN-10: 1449327052; ISBN-13: 978-1449327057
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

COURSE COORDINATOR:	**Dr. Siddaraju**

	Course Title: Advanced Computer Networks		
	Course Code: SCS22	**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 become familiar with different Computer Networks and it's Layering. 2. To understand various end to end Network architectures. 3. Analyse of Concepts of fundamental protocols **4.** To understand the network traffic, congestion, controlling and resource allocation

Unit No	**Syllabus Content**	**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, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window,	11
2	Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.	10
3	Internetworking- II: Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP),	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 Retransmit and Fast Recovery.	11
5	Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms,DEC bit, Random Early Detection(RED), SourceBased Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Able to classify network services, protocols and architectures, explain why they are layered.	R3 , R4

CO2	Choose key Internet applications and their protocols, and apply to develop their own Applications (e.g. Client Server applications, Web Services) using the sockets API.	R3 and R6
CO3	Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.	R5
CO4	Interpret various congestion control techniques.	R3
CO5	Analyse Network traffic, congestion control and resource allocation	R4

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

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition Elsevier -2014 (ISBN -13 978-0123850591)

REFERENCE BOOKS:

1) Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI – 2014 (ISBN - 9780131876712)
2) Uyless Black "Computer Networks, Protocols , Standards and Interfaces" 2nd Edition – PHI (ISBN - 9780130908612)
3) Behrouz A Forouzan "TCP/IP Protocol Suite" 3th Edition – Tata McGraw-Hill. (ISBN –13 – 978-0-07-060004 – I)

COURSE COORDINATOR:	**Proff Shamshekhar Patil**

	Course Title: Advanced Algorithms		
	Course Code: SCS23	**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 implementing iterative and recursive optimized solutions 2. To learn the graph search algorithms. 3. To study network flow and linear programming problems. 4. To learn the hill climbing and dynamic programming design techniques. 5. To develop recursive backtracking algorithms. To get an awareness of NP completeness and randomized algorithms

Unit No	**Syllabus Content**	**No of Hours**
1	**Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The Course substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods	11
2	**Graph Algorithms:** Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.	11
3	**Number -Theoretic Algorithms**: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem;	10
4	**String-Matching Algorithms:** Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms	10
5	**Probabilistic and Randomized Algorithms:** Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms;	10

Course Outcomes	**Description**	**RBT Levels**
CO1	Analyze, Design and apply iterative and recursive algorithms	R3, R4,R5

CO2	Design and implement optimized algorithms for real time applications.	R4 and R5
CO3	Design and implement security algorithms	R4, R5
CO4	To apply graph algorithms to find optimal solutions for real time applications	R2, R3
CO5	Design and implement text based search engines	R4,R5

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

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. 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: Computer Networks And Algorithms Laboratory		
	Course Code: SCS26L	**No. of Credits: 0 : 0 : 2 (L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE+ SEE = 30+70=100**	**Total No. of Contact Hours : 16**

Course Objectives:	**Description**
	1. To become familiar with the basics of Computer Networks 2. To understand concepts of fundamental protocols. 3. To understand the concepts of networks using simulation tool. 4. To understand the network traffic, congestion, controlling and resource allocation.

Part A: Computer Networking Laboratory	
1	Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2	Write a program to implement Link State Routing (Dijkstra Algorithm)
3	Write a program for implementing the error detection technique while data transfer in Unreliable network code using CRC (16-bits) Technique.
4	Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
5	Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1- >n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

Part B: Algorithms Laboratory	
1	Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2	Design, develop, and write a program to implement a Monte Carlo algorithm to test the primality of a given integer and determine its performance.
3	Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4	Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.

5	Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes	**Description**	**RBT Levels**
CO1	Classify network services, protocols and architectures, explain why they are layered.	R4, R5
CO2	Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.	R3 and R6
CO3	Understand the network using Simulations tool.	R3
CO4	Understand various congestion control techniques.	R5
CO5	Design and apply graph search algorithms.	R3 & R5

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

Strong -3 Medium -2 Weak -1

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

	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,	11

	Inference on a chain Trees, Factor graphs, The sum-product algorithm ,The max-sum algorithm.	

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,	10

	public key authority, public keys certificates, X-509 certificates.	
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	R4

	applications.	
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: Research Methodology		
	Course Code: RM27	**No. of Credits: 2 : 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 : 26**

Course Objectives:	**Description**
	1. Have a basic understanding of the underlying principles of quantitative and qualitative research 2. Identify the overall process of designing a research study from its inception to its report. 3. Choose the most appropriate research method to address a particular research question **4.** Gain a overview of a range of quantitative and qualitative approaches to data analysis

Unit No	**Syllabus Content**	**No of Hours**
1	**Unit – I, Overview of Research** Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules.	08
2	**Unit – II, Sampling Methods** Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions	06
3	**Unit – III, Processing and analysis of Data** Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t and Chi Square).	06
4	**Unit-IV,** **Essential of Report writing and Ethical issues**: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Ethical issues related to Research, Plagiarism and self-Plagiarism, Publishing.	06

Course Outcomes	**Description**	**RBT Levels**
CO1	Describe a range of quantitative and qualitative research designs and identify the advantages and disadvantages associated with these designs	R1, R2

CO2	Choose appropriate quantitative or qualitative method to collect data	R6
CO3	Analyse and test the given data using appropriate methods	R4
CO4	Design an appropriate mixed-method research study to answer a research question	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

REFERENCE BOOKS:

1. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Pearson Education: New Delhi.
2. Kothari C.R., Research Methodology Methods and techniques by, New Age International Publishers, 2nd edition
3. Levin, R.I. and Rubin, D.S., Statistics for Management, 7th Edition, Pearson Education: New Delhi.

COURSE COORDINATOR:	**Dr. Chandrakanth poojari**

	Course Title: Internet of Things		
	Course Code: SCS41	**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 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, Smart Appliances,, Intrusion Detection, Smoke/Gas Detectors. **Cities:** Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response. **Environment:** Weather Monitoring, Air Pollution Monitoring, Noise Pollution 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	10

	Virtualization.	
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.	R3, R4 &R5
CO2	Analyze different Technologies used in IoT	R3 and R6
CO3	Interpret different domain specific IoT diagrams and illustrations	R2 & R3
CO4	Analyze specification document for Environment Monitoring using IoT	R4

CO-PO Mapping	PO1	PO2	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, ArshdeepBahga "Internet of things, A hands-on-approach" 2014
2. Jean-Philippe Vasseur & Adam Dunkels "Interconnecting smart objects with IP", Morgan Kaufmann Publishers, 2010

REFERENCE BOOKS:

CunoPfister, "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: 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, EnterAgility, **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-MinuteBuild, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, ReleasePlanning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	11
4	**Mastering AgilityValues 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 EffectiveRelationships, 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**