# SEMESTER -1

# Dr. Ambedkar Institute of Technology



Aided By Govt. of Karnataka

# M.Tech Computer Science & Engineering

# 2020-2021

| | 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 | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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+ Assignment + SEE = 50+50=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:** 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.<br>**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.<br>**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=100** | **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+ Assignment + SEE = 45+5+50=100** | | **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, 3$^{rd}$ 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:** 18SCSL17 | **No. of Credits: 2 = 0 : 0 : 2 (L-T-P)** | **No. of Practical hours/week : 3** |
| | **Exam Duration : 3 hours** | **CIE+ SEE = 50+50=100** | |

| 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** |
| <ul><li>All the laboratory programs are to be included for practical examination.</li><li>The instructions and breakup of marks printed on the cover page of the answer script are to be strictly adhered by the examiners.</li><li>Students are allowed to pick any one program randomly from the lot.</li><li>Change of program is allowed only once and the marks will be deducted as per the Dr.AIT Autonomous/Examination rules and regulations.</li></ul> |

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

| | **Course Title: Advanced Operating System** | | |
|---|---|---|---|
|  | **Course Code:** <br> **20SCS151** | **No. of Credits: 3 : 0 : 0** <br> **(L-T-P)** | **No. of lecture hours/week :** |
| | **Exam Duration :** <br> **3 hours** | **CIE+ SEE = 50+50=100** | **Total No. of Contact Hours :** |

| **Course Objectives:** | **Description** |
|---|---|
| | 1. To learn the fundamentals of Operating Systems. <br> 2. To learn the mechanisms of OS to handle processes and threads and their communication <br> 3. To learn the mechanisms involved in memory management in contemporary OS <br> 4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols <br> 5. To know the components and management aspects of concurrency management <br> **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 <br> 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. <br><br> 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, <br> 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 <br><br> 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/33061990140 923 |
|---|---|
| **COURSE COORDINATOR:** | **Dr. K R Shylaja** |

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

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

| Unit<br>No | Syllabus Content | No of<br>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<br>Outcome<br>s | Description |
|---|---|
| CO1 | List and classify network services, protocols and architectures, explain why they are layered. |
| CO2 | Compare various network architectures |
| CO3 | Analyze various Network protocols and their applications |
| CO4 | Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery etc. |

| CO5 | Define and analyze network traffic, congestion control and resource allocation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| CO-PO Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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+ Assignment + 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 |
| | 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.<br><br>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<br><br>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.<br><br>(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.<br><br>(Text Book 3: Chapter 3, 4 ,5 & 6)<br><br>**Self-Study Components:**<br><br>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 | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | 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.<br>2: Decomposition strategies of problem.<br>3: Knowledge about the measure the performance of parallel algorithm.<br>4. Study applications of parallel computing.<br>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**:<br>OpenMP, MPI, CUDA/OpenCL, Chapel, etc. Thread basics, Work Sharing constructs, Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers,<br>The MPI Programming Model, MPI Basics, Global Operations, Asynchronous Communication, Modularity, Other MPI Features Basic of GPGPU, CUDA Programming model, CUDA memory type Performance Issues. | 12 |

| Course Outcomes | Description |
|---|---|
| **CO1** | Students are able to describe principles of parallel algorithm design. |
| **CO2** | Students are able to analyze analytical modeling of parallel programs, programming models for shared- and distributed-memory systems. |
| **CO3** | Students are able to  analyze  performance evaluation of  Prallel algorithms. |
| **CO4** | Students are able to design parallel algorithms for matrix, graph and sorting operations. |

| CO5 | Students are able to explore how to use a GPU as a general proceesing device. | | | | | | | | | | | |

| CO-PO Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | 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+ Assignment + SEE = 50+50=100** | **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** <br> 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** <br> **Cryptographic** Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency. <br> **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** <br> 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** <br> 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<br><br>**DECENTRALIZED APPLICATIONS (DAPPS)**<br>**Applications -** Applications of Blockchain in Healthcare, egovernance, anomaly detections, use cases, trends on blockchains, serverless blocks, scalability issues, blockchain on clouds.<br>**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<br>2. https://swayam.gov.in/nd1_noc19_cs63/preview | |

| | |
|---|---|
| **COURSE COORDINATOR:** | **Dr. SIDDARAJU** |

| | Course Title: Advance Algorithms and Data Structure | | |
|---|---|---|---|
| | **Course Code:**<br>20SCS162 | **No. of Credits: 3 : 0 : 0**<br>(L-T-P) | **No. of lecture hours/week :**<br>04 |
| | **Exam Duration :**<br>3 hours | **CIE+ Assignment + SEE**<br>= 50+50=100 | **Total No. of Contact Hours :**<br>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 | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | 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:**<br>**20SCS163** | **No. of Credits: 3 : 0 : 0**<br>**(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<br>2. To analyze various computer forensics technologies<br>3. To provide computer forensics systems<br>4. To identify methods for data recovery.<br>5. To apply the methods for preservation of digital evidence |

| Unit No | Syllabus Content | No of Hours |
|---|---|---|
| **1.** | **Computer Forensics Fundamentals**<br>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**<br>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.<br>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**<br>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.<br>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**<br>Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data<br>Self Study component:<br>**Evidence Collection and Data Seizure**<br>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:**<br>**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 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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

## 2020-2021

| | 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. <br> 2. To Learn business case studies for big data analytics. <br> 3. To Understand NoSQL big data management. <br> **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 <br> **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 <br> 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: <br> Puzzle_Garden 10725 fantasy 1.35 <br> 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:**<br>20SCS22 | **No. of Credits: 3 : 0 : 0**<br>**(L-T-P)** | **Number of lecture**<br>**hours/week :   4** |
| | **Exam Duration :**<br>**3 hours** | **CIE + SEE = 50+50** | **Total  Number of**<br>**Contact Hours :  52** |

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

| Unit<br>No | Syllabus Content | No. of<br>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 | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 2<sup>nd</sup> 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) | **No. of lecture hours/week :** |
| | **Exam Duration : 3 hours** | **CIE+ Assignment  + SEE = 45+5+50=100** | **Total  No. of Contact Hours :** |

| 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 – Linear Discriminants – Perceptron – Linear Separability – Linear Regression. | 10 |
| 2 | **Correlation and Simple Linear Regression** Introduction , Correlation, The Least-Squares Line, Uncertainties in the Least-Squares Coefficients ,Checking Assumptions and Transforming Data: **Multiple Regression** Introduction, The Multiple Regression Model, Confounding and Collinearity, Model Selection | 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 | 11 |
| 4 | **Tree and Probabilistic Models** Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –Vector Quantization – Self Organizing Feature Map. | 11 |
| 5 | **Self-Study Component: Dimensionality Reduction Models** Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Least Squares Optimization Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process. | 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 | PO7 | 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. 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. Machine Learning, Tom M. Mitchell, Indian Edition, 2013, McGraw-Hill Education, ISBN:978-1-25-909695-2
4. Ethem Alpaydin "Introduction To Machine Learning" 2nd Edition PHI Learning Pvt. Ltd-New Delhi.

**REFERENCE BOOKS:**

1. 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
2. Nina Zumel and John Mount, Practical data science with R, Manning Publications, March 2014, ISBN 9781617291562
3. 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 <br> 2. https://www.coursera.org/professional-certificates/ibm-data-science?authMode=signup <br> **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:**<br>**18SCSL27** | **No. of Credits: 3 : 0 : 0**<br>**(L-T-P)** | **No. of lecture hours/week :** |
| | **Exam Duration :**<br>**3 hours** | **CIE+ Assignment + SEE**<br>**= 45+5+50=100** | **Total No. of Contact Hours :** |

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

| | **Part A**<br>**(Data Preprocessing)** | |
|---|---|---|
| 1 | Given a data set generate summary and analyze the correlation among parameters by generating appropriate graphs. Write summary on the analysis made for learning model | |
| 2 | Implement dimensionality reduction using Principal Component Analysis (PCA) | |
| 3 | Implement a mathematical model to handle null values in a given data set having columns with time series data and categorical data. | |
| 4 | Given a data set plot the box-plot and histogram to analyze the data distribution | |
| 5 | Implement linear discriminants Analysis on a given data set. | |
| | **Part B**<br>**(Machine Learning)** | |
| 1 | Given data set implement a linear regression model for prediction | |
| 2 | Given a dataset implement logistic regression for classification | |
| 3 | Implement multi class classification technique to predict class labels | |
| 4 | Implement a non linear regression model for classification on a given data set. | |
| 5 | Implement any classification model for a image data set | |
| | **Part C**<br>**(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. | |
|---|---|---|

| 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 | PO7 | 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<br><br>2.  https://www.coursera.org/professional-certificates/ibm-data-science?authMode=signup<br><br>3. Machine Learning course from coursera  by Andrew Ng https://www.coursera.org/learn/machine-learning/home/welcome | |
| **COURSE COORDINAT OR:** | **Dr. K R Shylaja** |

| | **Course Title:** Natural Language Processing and Text Mining | | |
|---|---|---|---|
| | **Course Code:** 20SCS251 | **No. of Credits: 3 : 0 : 0 (L-T-P)** | **No. of lecture hours/week : 04** |
| | **Exam Duration : 3 hours** | **CIE+ Assignment + SEE = 45+5+50=100** | **Total No. of Contact Hours : 52** |

| Course Objectives: | Description |
|---|---|
| | 1. Learn the techniques in natural language processing. <br> 2. Be familiar with the natural language generation. <br> 3. Be exposed to Text Mining. <br> 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. <br><br> **Self-Study Component:** <br><br> **A Case Study in Natural Language Based Web Search:** InFact System Overview, The GlobalSecurity.org Experience. <br><br> 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 |

| 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 | PO6 | 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.

| | 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. |

| **SELF STUDY REFERENCES/WEBLINKS:** |
| --- |
| 1. **Natural Language Processing from coursera** <br> https://www.coursera.org/learn/language-processing |
| 2. **Any relevant course from top international universities on NLP can be referred to implement** |

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

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

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

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

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

| Unit No | Syllabus Content | No of Hours |
|---|---|---|
| 1 | Computational Intelligence and Knowledge: What Is Computational Intelligence? Agents in the World, Representation and Reasoning Applications, Overview, A Representation and Reasoning System :Introduction, Representation and Reasoning Systems ,Simplifying Assumptions of the Initial RRS , Data log, Semantics , Questions and Answers , Proofs , Extending the Language with Function Symbols | 11 |
| 2 | Using Definite Knowledge :Introduction, Case Study: House Wiring , Databases and Recursion, Verification and Limitations, Case Study: Representing Abstract Concepts, Case Study: Representing Regulatory Knowledge, Applications in Natural Language Processing ; Representing Knowledge : Introduction, Defining a Solution, Choosing a Representation Language, Mapping from Problem to Representation, Choosing an Inference Procedure | 10 |
| 3 | Knowledge Engineering , Introduction, Knowledge-Based System Architecture, Meta- Interpreters, Querying the User, Explanation, Debugging Knowledge Bases, A Meta-Interpreter with Search, Unification, Beyond Definite Knowledge :Introduction, Equality ,Integrity Constraints ,Complete Knowledge Assumption , Disjunctive Knowledge, Explicit Quantification , First-Order Predicate Calculus, Modal Logic | 10 |
| 4 | Using Uncertain Knowledge ,Introduction , Probability , Independence Assumptions , Making Decisions Under Uncertainty | 11 |
| 5 | **Self-Study Component:** Introduction , Learning as Choosing the Best Representation , Case-Based Reasoning , Learning as Refining the Hypothesis Space , Learning Under Uncertainty , Explanation-Based Learning | 10 |

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

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

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation, by James M. Keller, Derong Liu, David B. Fogel ISBN: 978-1-119-21434-2

**SELF STUDY REFERENCES/WEBLINKS:**

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

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

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

| Course<br>Objectives: | Description |
|---|---|
| | 1. Assess Advanced Business AnalyticsI concepts and core IT concepts.<br>2. Critique problems, issues, and trends using predictive analysis.<br>3. Perform predictive analytics and data science.<br>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<br>No | Syllabus Content | No of<br>Hours |
|---|---|---|
| **1.** | Business Analytics:<br>Overview of Business Analytics, Scope of Business Analytics, Business Analytics Process, relationship of Buisness Analytics process and organization,Competative advantages of Business Analytics.<br>Satstical Tools: Satstical Notation, Desvrptive Stastical methods, review of probability distribution and data modelling. | 10 |
| **2.** | Trendiness and Regression Analysis:<br>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**<br>Organization Structures of Business Anlytics:<br>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:<br>Qualitative and Judgemental Forecasting, Stastical forecasting Models, Forecasting Models for Time series with linear trend.<br>Forecasting Time series with seasonality, regrassion forecasting with casual variables, selecting appropriate Forecasting Models. | 10 |
| **5.** | Decision Analysis:<br>Formulating Decision Problems, Decision Statergies with are without outcome, Probablities, decision trees, The value of Information, Utility and Decision Making. | 10 |

| Course<br>Outcome<br>s | 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 | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 Techniques** | | |
|---|---|---|---|
|  | **Course Code:** 20SCS262 | **No. of Credits: 3 : 0 : 0** (L-T-P) | **No. of lecture hours/week : 4 hrs** |
| | **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:** 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 Regression problems Artificial Neural Networks: ANN Structures, Single Layer feed-forward neural networks, Multi-Layer feed-forward neural networks, Learning in multilayer networks, networks. Artificial Intelligence Current Trends : The Science of Intelligent Systems, AI: Current Challenges and Future Directions; | 12 |

| Course Outcomes | Description |
|---|---|
| CO1 | Students are able to Explore various Artificial Intelligence problem 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 | P06 | 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 |
|---|---|