RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2023 – 2024

COMPUTER SCIENCE AND ENGINEERING

I - IV Semester M. Tech (CSE)

(Batch of 2023 – 2025)

COMPUTER SCIENCE AND ENGINEERING

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore –560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A+' grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems & Schneider Centre of Excellence. M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), by MoE, Govt. of India. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 65th rank among 1143 top Engineering institutions of India for the year 2021 and is 1st amongst the Engineering colleges affiliated to VTU, Karnataka.

About the Department:

Year of Establishment	1984
Names of the Programmes offered	1. B.E.in Computer Science and Engineering 2. M.Tech.in Computer Science and Engineering 3. M.Tech.in Computer Network and Engineering 4. Ph.D. (under VTU research Center) 5. Ph.D. (Ramaiah Doctoral Fellowship) 6. M.Sc. (Engg.) by Research . (under VTU research Center)

The Department of Computer Science and Engineering (CSE) has eminent emeritus professor, 19 faculty with the doctorate degree and 9 pursuing the doctoral studies. . Faculties are involved in institutional level activities and actively involved in interdisciplinary research activities. Deaprtment has 196 inernational journal papers, 152 international conference papers, 51 book chapters, 9 published patents and one granted patent on the credit during last three years. There are seven funded projects and many faculty-mentered student funded projects are currently active at the deparment. Faculty received 21 awards whereas student received 66 awards during last three years. There are many consultancy projects executed at the depatment from the MoUs with the industry like SAP, IBM, HP etc. The department has state of the art laboratories like SAP, IBM Centre of Excellence and CUDA learning center. The department is accredited by Nation Board of Accreditation (NBA).

Technical seminars, workshops and hackathons are conducted regularly for UG & PG students. The department conducts subjects with more of hands-on sessions and encourages students to take up MOOC based online courses in NPTEL, IITBombayX, Coursera, Udacity and edX. More than 850 MOOC certifications completed. The department encourages the students to conduct and participate in extra-curricular/sports activities. There are six professional clubs where professional and engineering events are conducted. The department also conducts vocational courses and proficiency courses on fundamental and new programming languages and computer science concepts. These courses are conducted beyond college hours/summer semester by the faculty of the department. The alumni network is very active and regular meeting are conducted by the department.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

M S Ramaiah Institute of Technology shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology, Bangalore strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISION OF THE DEPARTMENT

To build a strong learning and research environment in the field of Computer Science and Engineering that promotes innovation towards betterment of the society.

MISSION OF THE DEPARTMENT

1. To produce Computer Science post graduates who, trained in design and implementation of computational systems through competitive curriculum and research in collaboration with industry and research organizations.
2. To educate students in technology competencies by providing professionally committed faculty and staff.
3. To inculcate strong ethical values, leadership abilities and research capabilities in the minds of students so as to work towards the progress of the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

A M.Tech. (Computer Science & Engineering) graduate of M S Ramaiah Institute of Technology should, within three to five years of graduation,

PEO1: Pursue a successful career in the field of Computer Science & Engineering or a related field utilizing his/her education and contribute to the profession as an excellent employee, or as an entrepreneur.

PEO2: Be aware of the developments in the field of Computer Science & Engineering, continuously enhance their knowledge informally or by pursuing doctoral studies and engage in research and inquiry leading to new innovations and products.

PEO3: Be able to work effectively in multidisciplinary and multicultural environments and be responsible members and leaders of their communities.

PEO4: Understand the human, social and environmental context of their profession and contribute positively to the needs of individuals and society at large.

PROGRAM OUTCOMES (POs)

PO1: An ability to independently carry out research / investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report / document.

PO3: Students should be able to demonstrate a degree of mastery over Computer Science and Engineering. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Acquire professional and intellectual integrity to stress upon the impact of computer engineering applications with respect to economic and environmental aspects.

PO5: Acquire methods of engaging in life-long learning not only to predict and plan the projects of the future but also to groom others in the group.

PG Curriculum Course Credits
2023-25

Scheme Structure of M. Tech. Program from the Academic year 2023-24

Semester	Professional Core Courses (PCC)	Professional Core Courses Lab (PCL)	Professional Courses - Electives (PEC)	Mandatory Credit course (MCC)	Project Work / Seminar (PW)	Internship (INT)	Total semester credits
First	8	2	11	3	-	-	22
Second	8	2	12	-	-	-	22
Third	4	-	4	-	4	4	16
Fourth	-	-	-	-	20	-	20
Total	18	4	27	3	24	4	80

M. Tech. Computer Science and Engineering Scheme of Teaching and Examination 2023-24									
I SEMESTER									
Sl. No.	**Subject Code**	**Subject**	**Teaching Department**	**Category**	**Credits**				**Total contact hours / week**
					L	**T**	**P**	**Total**	
1	MCS11	Advanced Engineering Mathematics	Mathematics	PCC	2	1	0	3	4
2	MCS12	Advanced Database Management Systems	CSE	PCC	3	0	0	3	3
3	MCSE13x	Professional Elective Course I	CSE	PEC	3	0	0	3	3
4	MCSE14x	Professional Elective Course II	CSE	PEC	4	0	0	4	4
5	MCSE15x	Professional Elective Course III	CSE	PEC	4	0	0	4	4
6	RMI16	Research Methodology & IPR	CSE	MCC	3	0	0	3	3
7	MCSL17	Advanced Database Laboratory	CSE	PCCL	0	0	1	1	2
8	MCSL18	Real time Application development using Python Programming Laboratory	CSE	PCCL	0	0	1	1	2
Total					**19**	**1**	**2**	**22**	**25**

Where x=1,2,3…L –Lecture, T – Tutorial, P- Practical

Professional Elective Course I		**Professional Elective Course II**		**Professional Elective Course III**	
Subject Code	Subject	Subject Code	Subject	Subject Code	Subject
MCSE131	Information Retrieval	MCSE141	Artificial Intelligence and Machine Learning	MCSE151	Quantum Computing
MCSE132	Applied Cryptography	MCSE142	Distributed Systems	MCSE152	Soft and Evolutionary Computing
MCSE133	Virtual Reality	MCSE143	Computer System Performance Analysis	MCSE153	Image Processing and Machine Vision
MCSE134	Advances in Computer Networks	MCSE144	Pattern Recognition	MCSE154	IoT Technology and Applications

M.Tech. Computer Science and Engineering Scheme of Teaching and Examination 2023-24									
II SEMESTER									
Sl. No.	**Subject Code**	**Subject**	**Teaching Department**	**Category**	**Credits**				**Total contact hours /week**
					L	**T**	**P**	**Total**	
1	MCS21	Cloud Computing and Big Data	CSE	PCC	3	1	0	4	5
2	MCS22	Advanced Operating System	CSE	PCC	4	0	0	4	4
3	MCSE23x	Professional Elective Course IV	CSE	PEC	4	0	0	4	4
4	MCSE24x	Professional Elective Course V	CSE	PEC	4	0	0	4	4
5	MCSE25x	Professional Elective Course VI	CSE	PEC	4	0	0	4	4
6	MCSL26	Cloud Computing and Big data Laboratory	CSE	PCCL	0	0	1	1	2
7	MCSL27	System Programming Laboratory	CSE	PCCL	0	0	1	1	2
Total					**19**	**1**	**2**	**22**	**25**

Where x=1,2,3…L –Lecture, T – Tutorial, P- Practical

Professional Elective Course IV		**Professional Elective Course V**		**Professional Elective Course VI**	
Subject Code	Subject	Subject Code	Subject	Subject Code	Subject
MCSE231	Advanced Software Engineering	MCSE241	Wireless Networks and Mobile Computing	MCSE251	Block Chain Essentials & Dapps
MCSE232	Natural Language Processing	MCSE242	Advanced Algorithms	MCSE252	Web Technologies
MCSE233	Fog and Edge Computing	MCSE243	Digital Forensic and Cyber Crime	MCSE253	Future Skills & Start-up Engineering
MCSE234	Game Theory	MCSE244	Semantic Web and Social Networks	MCSE254	Network Security and Ethical Hacking

M.Tech. Computer Science and Engineering Scheme of Teaching and Examination 2023-24									
III SEMESTER									
Sl. No.	**Subject Code**	**Subject**	**Teaching Department**	**Category**	**Credits**				**Total contact hours / week**
					L	**T**	**P**	**Total**	
1	MCS31	Multicore Architecture and Programming	CSE	PCC	3	1	0	4	5
2	MCSE33x	Professional Elective Course VII	CSE	PEC	4	0	0	4	4
3	MCSI33	Internship/Industrial Training	CSE	INT	0	0	4	4	4
4	MCSP34	Project Work - I	CSE	PW	0	0	4	4	4
Total					**7**	**1**	**8**	**16**	**17**

Where x=1,2,3…L –Lecture, T – Tutorial, P- Practical

Professional Elective Course VII	
MCSE331	Deep Learning
MCSE332	Business Intelligence and its Applications
MCSE333	Robotics Process Automation
MCSE334	Software Project Management and Professional Ethics

M.Tech. Computer Science and Engineering Scheme of Teaching and Examination 2023-24									
IVSEMESTER									
Sl. No.	**Subject Code**	**Subject**	**Teaching Department**	**Category**	**Credits**				**Total contact hours /week**
					L	**T**	**P**	**Total**	
1	MCSP41	Project Work - II	CSE	PW	0	0	20	20	20
Total					**0**	**0**	**20**	**20**	**20**

L –Lecture, T – Tutorial, P- Practical

Advanced Engineering Mathematics

Course Code: MCS11 **Credits: 2:1:0**
Prerequisites: Engineering Mathematics I- IV **Contact Hours: 28+28**
Course Coordinator/s: Dr. A. Sreevallabha Reddy
Course Contents:

Unit I

Linear Algebra – I Vectors and Linear Combinations, Vector Spaces, The Null space of A, Solving Ax = 0. The Complete Solution to Ax = b, Independence, Basis and Dimension, Dimensions of the Four Subspaces, Orthogonality of the Four Subspaces, Projections. Orthonormal Bases and Gram-Schmidt Method, Factorization into A = QR, Least Squares Approximations.

Unit II

Linear Algebra – II: Linear Transformation: Fundamentals, The Matrices of a linear Transformation., Change of basis. Introduction to Eigenvalues and Eigenvectors, Similarity and Diagonalization. Symmetric Matrices, The singular value decomposition (SVD).

Unit III

Random Variables: Review of Random Variables, Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Exponential distribution and Uniform distribution.

Unit IV

Joint Probability Distributions and Stochastic Process Joint probability distribution: Joint probability distribution (both discrete and continuous). Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation.

Unit V

Markov Process, Introduction to Queuing and Applications: Introduction, Markov chain and Transition probabilities, Continuous Parameter Markov Chain, M/M/1: ∞/FIFO, K/FIFO, M/G/1 Queuing system characteristics, Case studies.

Text Books:

1. Gilbert Strang: Linear Algebra and its Applications, 5th Edition (2016).
2. David C Lay: Linear Algebra and its Applications, 5th Edition (2015).
3. Sheldon M. Ross : Probability models for Computer Science, Academic

Press, 2009.
4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th edition, 2007.
5. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye: Probability and Statistics for Engineers and Scientists, Pearson Education, Delhi, 8th edition, 2007.

Reference Books:

1. Murray R Spiegel, John Schiller & R. Alu Srinivasan: Probability and Statistics, Schaum's Outlines, 2nd edition.
2. Kishor S. Trivedi: Probability & Statistics with Reliability, Queuing and Computer Science Applications, PHI, 2nd edition, 2002.
3. Garreth Williams: Linear Algebra with Applications, Jones and Bartlett Press, 4th edition, 2001.
4. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India,10th edition, 2015.

Course Outcomes(COs):

At the end of the course, students should be able to:

1. Solve the system of equations AX=B. (PO 1, 3)
2. Find SVD and PCA of the given matrix. (PO 1, 3)
3. Express the probability distribution arising in the study of engineering problems and their applications. (PO 1, 3)
4. Apply the Markov Chain in prediction of future events. (PO 1, 3)
5. Apply and calculate the various parameters of the queuing models. (PO 1, 3)

Advanced Database Management Systems

Course Code: MCS12 **Credits: 3:0:0**

Prerequisites: DBMS **Contact Hours: 42**

Course Coordinator/s: Dr. Ganeshayya Shidaganti

Course Contents:

UNIT I

Introduction to Database Models: Overview of relational data model: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Database Design using ER model. **The Enhanced Entity-Relationship (EER) Model:** Subclasses, Super classes, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization Hierarchies, Modeling of UNION Types Using Categories, A Sample UNIVERSITY EER Schema, Design Choices, and Formal Definitions

UNIT II

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL.

UNIT III

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions **Query Optimization:** Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

UNIT IV

Parallel Databases: I/O Parallelism, Inter-query Parallelism, Intra-query Parallelism, Intra-operation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multi-Core Processors **Distributed Databases:** Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems

UNIT V

Enhanced Data Models: Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases. **Variety of NoSQL Databases:** Data Management with Distributed Databases, The CAP Theorem, ACID and BASE. Four Types of NoSQL Databases: Key-value pair databases, Document databases, Column family store databases, Graph databases

Text Books:

1. Ramez Elmasri, Shamkant B. Navathe, **Fundamentals of Database Systems**, Six Edition, Pearson Publications.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, **Database System Concepts**, Sixth Edition, McGraw Hill Education, 2013
3. **NoSQL for Mere Mortals** by Released April 2015, Publisher(s): Addison-Wesley Professional ,ISBN: 9780134029894

Reference books:

1. Raghu Ramakrishnan, Johanners Gehrke, **Database Management Systems**, Second Edition. McGraw-Hill Education.
2. Guy Harrison, **Next Generation Databases: NoSQLand Big Data**, Apress Berkeley, CA, 2015. https://doi.org/10.1007/978-1-4842-1329-2
3. M. Tamer Özsu, Patrick Valduriez, **Principles of Distributed Database Systems**, Springer Cham, 2020. https://doi.org/10.1007/978-3-030-26253-2
4. Sadalage, P. & Fowler, **NoSQL Distilled**: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Apply the relational model and EER model to design databases (PO1,2, 3, 4)
2. Discuss the concepts of indexing and hashing as applied to data storage and querying (PO 1, 2, 3, 4)
3. Explain how queries are processed and optimized (PO 1, 2, 3, 4)
4. Describe the processing of the queries in distributed and parallel databases. (PO1, 2, 3,4)
5. Elucidate the enhanced data models and NoSQL databases. (PO1,2, 3, 4, 5)

Research Methodology and IPR

Course Code: RMI16 **Credits:** 3:0:0
Prerequisites: Nil **Contact Hours**: 42
Course Coordinator: A M Nagabhushan
Course Contents:

Unit I

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Unit II

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.

Unit III

Building Intellectual Property Rights, Law of Patents, Fundamentals of Patent Law - Evolution of the patent system, Patentability Requirements; Patentable Subject Matter; Industrial Applicability/Utility; Novelty; Anticipation by publication; Anticipation by public knowledge and public use; Anticipation by public display; Anticipation by sale; Inventive Step/Non-Obviousness; Novelty Assessment; Inventive Step Assessment; Specification, Drafting of A Patent Specification - Introduction Patent Specification; Provisional Specification Complete Specification, Parts of the complete specification; Patent Procedure in India - PATENT PROCEDURE; Registration and Renewal fee payment; Patent Infringement - Infringement of a patent; Literal Infringement; Equivalence Infringement; Indirect Infringement; Defenses - Experiment - Research or Education - Bolar Exemption- Government use- Patent ExhaustionPatent Misuse- Inequitable Conduct - Remedies- Injunction- Account of profits- Costs; International Patent Regimes - International Instruments; Paris Convention; TRIPS AGREEMENT; PCT; BUDAPEST

TREATY, Patenting Biotechnology Inventions - Unique nature of Biotechnology; Patentability Requirements and Biotechnology Inventions; Patentable Subject Matter- USA- Europe- India; Patentability of Software Inventions - Patentability of Software Inventions in USA; Patentability of software inventions in Europe; Patentability of Software Inventions in India.

Unit IV

Law of Copyright and Designs, Understanding Copyright Law - Historical Overview – Justification For Copyright Law - The Natural Law Justification - The Economic Rationale of Copyright Clause, Basic Concepts Underlying copyright Law - Idea – Expression Dichotomy Originality / Creativity – Fixation Email dated 09082022 HB Term of Protection, Subject - Matter of Copyright - Literary Works - Dramatic Works - Musical Work - Artistic Works - Cinematograph Films and Sound recordings, Acquisition of Copyright in India, Rights of the Copyright Owner - Economic Rights - Moral Right or Droid Moral Right of Authorship or Paternity Rights - Rights against Distortion or Mutilation of the Original Works or Integrity Rights - Limitations - Limitations set under International Regime – Berne Convention - Rome Convention - Trips Agreement - Three Step Test, Infringement of Copyright - Transfer of copyright - License and Assignment - License and consent - Duration of a License Form and Content - Disputes in Respect of License - Types of Licenses - Exclusive and Non-Exclusive Licenses.

Unit V

Basic Principles of Design Rights - Justification for Protecting Designs - Historical Perspective - Features of Shape, configuration, Pattern or Ornament - or Composition of lines or colour - New or Original - Applied to an Article, Excluded Subject - Matter - Method or Principle of Construction - Features Dictated Solely by Function - Mechanical Device - Trademark, or Property Mark, or Artistic Work - immoral Designs and Designs Contrary to Public order–Rights of the Owner of Designs and Tests for Infringement. Assignment of Design Rights, Infringement of Designs. Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent, Case study of Apple Inc. v. Samsung Electronics Co., Ltd.

Text Book:

1. Dipankar Deb • Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868- 4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13- 2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0

Reference Book:

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488- 4

Course Outcomes (COs):

At the end of the course,students should be able to:

CO1. To know the meaning of engineering research.

CO2. To know the procedure o f Literature Review and Technical Reading.

CO3. To know the fundamentals of patent laws and drafting procedure.

CO4. Understanding the copyright laws and subject matters of copyrights and designs

CO5. Understanding the basic principles of design rights.

Advanced Database Laboratory

Course Code: MCSL17 **Credits:** 0:0:1
Prerequisites: SQL and NoSQL / Python and Java Programming **Contact Hours:** 28
Course Coordinator/s: Dr. Ganeshayya Shidaganti

List of problems for which student should develop program and execute in the Laboratory

1. Introduction to Entity-Relationship (ER) Model
2. Design an Enhanced Entity-Relationship (EER) Model
3. Implement SQL Queries using DDL, DML and DCL Statements
4. Overview of PL/SQL Environment and Block Structure.
5. Build an Applications in Oracle DB using SQL and PL/SQL
6. Introduction NoSQL Databases: Mongo DB
7. Implement NoSQL Queries using CRUD Operations.
8. Building Modern Applications in Mongo DB using NoSQL.
9. Introduction to Graph Databases: Neo4j
10. Building a Modern Application with Neo4j
11. Introduction to Data Structures and Algorithms in DBMS
12. Implement Operations on B/B+ Tree using Java or Python Programming.

References:

1. Raghu Ramakrishnan, Johanners Gehrke, Database Management Systems, Second Edition. McGraw-Hill Education.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Publications.
3. Abraham Silberschatz, Henry F. Korth, Database System Concepts, Sixth Edition, McGraw Hill Education.
4. NoSQL for Mere Mortals by Released April 2015, Publisher(s): Addison-Wesley Professional ,ISBN: 9780134029894
5. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
6. Ian Robinson, Jim Webber, Emil Eifrem, Graph Databases, 2nd Edition by Released June 2015 O'Reilly Media, Inc. ISBN: 9781491930892

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Apply SQL and NOSQL queries to different database models. (PO1,2,3,4,5)
2. Apply DDL and DML for storing, managing and interrogating complex data and the background processes involved in query processing. (PO1,2,3,4,5)
3. Demonstrate and implement the operations related to B/B+ trees. (PO1,2,3,4,5)

Real time Application Development using Python Programming Laboratory

Course Code: MCSL18 **Credits:** 0:0:1
Prerequisites: Nil **Contact Hours:** 28
Course Coordinator/s: Dr. Sangeetha J

Course Contents:

There shall be a minimum of 2 exercises conducted on each of the following topics.

1. Python Basics and Control Structures
2. Functions
3. Strings, lists, list comprehensions
4. Tuples and dictionaries
5. Lambdas and Regular Expression
6. Objects and classes
7. Files and Exception Handling
8. Singly Linked List
9. Doubly Linked List
10. Numerical Programming with Numpy
11. Numerical Programming with Pandas
12. Data Visualization using matplotlib
13. GUI Programming
14. Manipulation of images using PIL/Pillow

Reference Book:

1. Campbell, J., Gries, P., Montojo, J., & Wilson, G. "Practical programming: An Introduction to Computer Science using Python". Pragmatic Bookshelf, Second Edition, 2016.

Course Outcomes:

At the end of the course, students should be able to:

1. Design and implement python programs utilizing control structures, functions, strings and built-in data structures in Python. (PO1,2,3,4,5)
2. Employ object-oriented programming, files and exception handling and Linked List for solving problems using Python. (PO1,2,3,4,5)
3. Design and implement the concepts of numerical programming, Data Visualization and GUI programming using Python. (PO1,2,3,4,5)

Information Retrieval

Course Code: MCSE131 **Credits: 3:0:0**

Prerequisites: Nil **Contact Hours: 42**

Course Coordinator/s: Dr. Jayalakshmi D S

Course Contents:

Unit I

Introduction: Overview, History of IR, Text Operations: Document preprocessing, Document Clustering, Text Compression, Indexing: Inverted files, **Mathematics for IR**: Set Theory, Mathematical Logic, Probability and Linear algebra, **Classic IR Models**: Boolean Model, Vector space model: tf-idf weighing, Probabilistic Model. Language models for IR: The language model and the query likelihood model.

Unit II

Evaluation Measures: Precision, Recall, Alternative Measures, Reference Collections: TREC, Relevance Feedback and Query Expansion, **Text Classification:** The text classification problem, Flat clustering: Clustering in information retrieval, Problem Statement, Hierarchical clustering Hierarchical agglomerative clustering, Single-link and Complete-link clustering.

Unit III

String Matching algorithms: Knuth Morris Pratt and Rabin Karp, stemming algorithm: Porter, Map reduce algorithms: tf- idf calculation and indexing, **Classification:** Naive Bayes algorithm, clustering k-means algorithm. Machine learning Algorithms: Machine-learned scoring, Result ranking by machine learning

Unit IV

Web search basics: Background and history, Web characteristics, Advertising as the economic model, the search user experience, Index size and estimation, Near-duplicates and shingling, **Web Crawling and Indexing**: Overview, Crawling, Distributing Indexes, Connectivity Servers

Unit V

Link analysis: Web as a graph, PageRank, Hubs and Authorities. **Introduction to Semantic Web**: Purpose, Semantic Web Stack, RDF, RDFS, Ontology, Web ontology language (OWL) and ontology tools.

Text Books:

1. Berthier Ribeiro-Neto, Ricardo Baeza-Yates, Modern Information Retrieval, Pearson Education, 2010.

2. C.D. Manning, P. Raghavan, H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.

Reference Books:

1. Clarke, C. L. A., Büttcher, Stefan., Cormack, Gordon V.: Information Retrieval: Implementing and Evaluating Search Engines. MIT Press, 2016.
2. Latha K, Experiment and Evaluation in Information Retrieval Models, CRC Press, 2018
3. David A Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2e, Springer,2004
4. Alimohammadi, Dariush:, "Mathematics for Classical Information Retrieval" *Zea E-Books Collection*. 3, 2010. https://digitalcommons.unl.edu/zeabook/3

Course Outcomes(COs):

At the end of the course, the students will be able to:

1. Explain the mathematical foundations and different models of classical information retrieval. (PO 1, 3)
2. Assess the evaluation measures for IR and text classification. (PO 1, 2, 3 ,5)
3. Implement different algorithms for string matching and query processing. (PO1,3,4)
4. Appraise the web research basics and indexing. (PO1,3,4)
5. Discuss the concepts of link analysis and semantic web. (PO1,3,4,5)

Applied Cryptography

Course Code: MCSE132 **Credits: 3:0:0**
Prerequisites: Basic Cryptography methods **Contact Hours: 42**

Course Coordinator/s: Dr. Sangeetha V
Course Contents:

Unit I

OSI security architecture: Classical encryption techniques, Cipher principles, Data encryption standard, Block cipher design principles and modes of operation, Evaluation criteria for AES, AES cipher, Triple DES, Placement of encryption function, Traffic confidentiality

Unit II

Key management: Diffie Hellman key exchange, Elliptic curve architecture and cryptography, Introduction to number theory, Confidentiality using symmetric encryption, Public key cryptography and RSA.

Unit III

Authentication requirements: Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MACS, MD5 Message Digest algorithm, Secure hash algorithm, Ripened, HMAC digital signatures, Authentication protocols

Unit IV

Quantum Cryptography and Quantum Teleportation: Heisenberg uncertainty principle, polarization states of photons, quantum cryptography using polarized photons, locals. non local interactions, entanglements, EPR paradox, Bell‟s theorem, Bell basis, teleportation of a single Qubit theory and experiments.

Unit V

Future trends: Review of recent experimental achievements, study on technological feasibility of a quantum computer candidate physical systems and limitations imposed by noise.

Text Books:

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, 7 Edition, Prentice Hall of India, 2017.
2. Atul Kahate, “Cryptography and Network Security”, Tata McGraw - Hill,2019.
3. William Stallings, “Network Security Essentials: Applications and Standards”, 4th edition, Pearson Education Asia,2018.

Reference Books:

1. R. P. Feynman, "Feynman lectures on computation", 1st edition, CRC Press, 2019.
2. Gennady P. Berman, Gary D. Doolen, Ronnie Mainiri & ValdmisItri Frinovich, "Introduction to quantum computers", World Scientific, Singapore,1998.
3. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography" Principles and Protocols", CRC Press,2014

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Analyze the various Symmetric encryption techniques and algorithms. (PO1,3,4,5)
2. Apply modern algebra and number theory to understand cryptographic algorithms. (PO1,3,4,5)
3. Illustrate the working of authentication and hash algorithms. (PO1,3,4,5)
4. Identify the fundamental ideas of quantum cryptography. (PO1,3,4,5)
5. Appraise the role of a quantum computer candidate physical systems. (PO1,3,4,5)

Virtual Reality

Course Code: MCE133 **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator/s: Dr. Jayalakshmi D S
Course Contents:

Unit I

Definition of VR, modern experiences, historical perspective. Hardware, sensors, displays, software, virtual world generator, game engines, human senses, perceptual psychology, psychophysics. Geometric modeling, transforming rigid bodies, yaw, pitch, roll, axis-angle representation, quaternions, 3D rotation inverses and conversions, homogeneous transforms, transforms to displays, look-at and eye transforms, canonical view and perspective transforms, viewport transforms.

Unit II

Light propagation, lenses and images, diopters, spherical aberrations, optical distortion; more lens aberrations; spectral properties; the eye as an optical system; cameras; visual displays. Parts of the human eye, photoreceptors and densities, scotopic and photopic vision, display resolution requiments, eye movements, neural vision structures, sufficient display resolution, other implications of physiology on VR. Depth perception, motion perception, vection, stroboscopic apparent motion, color perception, combining information from multiple cues and senses, implications of perception on VR.

Unit III

Graphical rendering, ray tracing, shading, BRDFs, rasterization, barycentric coordinates, VR rendering problems, anti-aliasing, distortion shading, image warping (time warp), panoramic rendering. Velocities, acceleration, vestibular system, virtual world physics, simulation, collision detection, avatar motion, vection

Unit IV

Tracking systems, estimating rotation, IMU integration, drift errors, tilt and yaw correction, estimating position, camera-feature detection model, perspective n-point problem, sensor fusion, lighthouse approach, attached bodies, eye tracking, inverse kinematics, map building, SLAM. Remapping, locomotion, manipulation, social interaction, specialized interaction mechanisms.

Unit V

Sound propagation, ear physiology, auditory perception, auditory localization; Fourier analysis; acoustic modeling, HRTFs, rendering, auralization.

Perceptual training, recommendations for developers, best practices, VR sickness, experimental methods that involve human subjects Touch, haptics, taste, smell, robotic interfaces, telepresence, brain-machine interfaces.

Text book

1. Steven M. LaValle. 'Virtual Reality' Steven M. LaValle. Cambridge University Press 2016

Reference Books:

1. Ralf Doerner, Wolfgang Broll, Paul Grimm, Bernhard Jung, Virtual and Augmented Reality (VR/AR), Springer Cham, 2022.
2. Jesse Glover, Jonathan Linowes, Complete Virtual Reality and Augmented Reality Development with Unity, Packt Publishing Limited, 2019.

Course outcomes:

At the end of the course the student will be able to:

1. Describe fundamental concepts of virtual reality systems including geometric modeling and transformations. (PO 1, 3, 4)
2. Appraise the role of optics and human vision on perception in VR. (PO 1, 3, 4)
3. Identify the various virtual world physics issues related to graphical rendering. (PO 1, 3, 4)
4. Recognize the issues related to tracking VR systems. (PO 1, 3, 4)
5. Describe the role of human auditory system and other human interfaces in creating an experiential VR system. (PO 1, 3, 4, 5)

Advances in Computer Networks

CourseCode: MCSE134 **Credits:3:0:0**
Prerequisites: Computer Networks **Contact Hours: 42**

Course Coordinator: Dr.Shilpa S. Chaudhari

Course Contents:

Unit 1

Foundation: Building a Network, Applications, Requirements, Architecture, Software Performance, Packets: Packet Delay, Variability, Packet Size, Error Detection. IP Version 4, IP version 6-IPv6 Header, IPv6 addresses, IPv6 Host Address Assignment, ICMPv6.

Unit 2

Routing-Update Algorithms: Distance-Vector Routing-Update Algorithm, Distance-Vector Slow-Convergence Problem, Loop-Free Distance Vector Algorithms: DSDV, AODV, Link-State Routing-Update Algorithm: Shortest-Path-First Algorithm, Classless Internet Domain Routing: CIDR, Provider-Based Routing, User Datagram Protocol: UDP, QUIC, DCCP.

Unit 3

TCP transport, TCP Header, TCP Connection Establishment, TCP Offloading, TCP Sliding Windows, TCP Delayed ACKs, Nagle Algorithm, TCP Flow Control, Silly Window Syndrome, TCP Timeout and Retransmission, TCP Reno and Congestion Management: Slow Start, TCP Reno Per-ACK Responses, Threshold Slow Start, TCP Tahoe and Fast Retransmit, TCP Reno and Fast Recovery, TCP NewReno, TCP and Bottleneck Link Utilization- TCP Queue Sizes.

Dynamics of TCP: Bottleneck Links with Competition-Example 1: linear bottleneck, Example 2: router competition, Example 3: competition and queue utilization, TCP Fairness with Synchronized Losses: Example: Faster additive increase, Longer RTT.

Unit 4

Queuing and Scheduling: Fair Queuing: Bit-by-bit Round Robin Weighted Fair Queuing, The GPS Model, Deficit Round Robin Stochastic Fair Queuing, Hierarchical Weighted Fair Queuing: A Hierarchical Weighted Fair Queuing Algorithm.

Quality of Service: Real-time Traffic, Integrated Services / RSVP, Global IP Multicast, RSVP, Differentiated Services, Real-time Transport Protocol (RTP)

Unit 5

Wireless and Mobile Networks: Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs, Cellular Networks: 4G and 5G, Mobility Management: Principles, Mobility Management in Practice.
Security in Computer Networks: Securing Wireless LANs and 4G/5G Cellular Networks, Securing Wireless LANs and 4G/5G Cellular Network.

Text Books:

1. Peter L Dordal, "An Introduction to Computer Networks", Release 1.9.21 2020.
2. Larry L. Peterson, Bruce S Davie," Computer Networks: A Systems Approach", Release Version 6.1 2019, Fifth Edition.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8 th edition, Addison-Wesley, 2021.

Reference Book:

1. Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP protocol Suite", McGraw Hill Education, 6th edition, 2022.
2. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Pearson 5th edition

Course Outcome:

1. Analyze the fundamental concepts in networks and addressing mechanism using IPv4 and IPv6 (PO-1,2,3)
2. Illustrate routing using various routing protocols and algorithms. (PO-1,2,3)
3. Identify various congestion control mechanism and bottlenecks in TCP(PO-1,2,3)
4. Illustrate Queuing and Scheduling mechanism and analyze the performance of applications using QOS (PO-1,2,3)
5. Identify issues related to mobility in Internet and cellular networks and security in computer network. (PO-1,2,3)

Artificial Intelligence and Machine Learning

Course Code: MCSE141 **Credits: 4:0:0**

Prerequisites: Knowledge of Algorithms, Elementary Discrete Mathematics and Probability theory **Contact Hours: 56**

Course Coordinator/s: Dr.Annapurna P Patil / Dr.Sangeetha V

Course Contents:

Unit I

Introduction: What is AI? Foundation and History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Rationality, The Nature of Environments, The Structure of Agents.

Problem-solving by search: Problem Solving Agents, Example Problems, Searching for Solution, Uniformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Unit II

Logical Agents: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, reasoning patterns in propositional Logic, Agents Based on Propositional Logic.

First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

Interference in First-order Logic: Propositional vs. First-Order Inference, Unification and Lifting, forward chaining, Backward chaining, Resolution.

Unit III

Introduction to Machine Learning: What is Machine Learning, Key Terminology, Key tasks of machine learning, well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Introduction, A Concept Learning Task, Concept Learning as Search, Find-S, Version Spaces and the Candidate-Elimination Algorithm.

Decision Tree - Decision Tree Representation, Appropriate Problems for Decision Tree Learning, Basic Decision Tree Learning Algorithm, Issues in Decision Tree Learning.

Unit IV

Artificial Neural Networks - Introduction, Neural Network Representation, Appropriate problems for Neural Network Learning, Perceptrons, Multilayer

Networks and the Backpropagation algorithm.

Bayesian Learning - Introduction, Bayes theorem, Naive Bayes Classifier, The EM Algorithm.

Unit V

Instance Based Learning - Introduction, k-nearest neighbor learning, Locally Weighted Regression, radial basis function, Case-based reasoning

Genetic Algorithms – Representing hypotheses, Genetic Operators, Fitness Function and Selection, An Illustrative Example.

Reinforcement Learning – Introduction, The Learning Task, Q Learning.

Text Books:

1. Stuart J Russel and Peter Norvig: "Artificial Intelligence - A Modern Approach", 4th Edition, Pearson Education, 2021.
2. Tom M Mitchell, "Machine Learning", McGraw-Hill Education (Indian Edition), 2013.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B Nair: "Artificial Intelligence", 3rd Edition, Tata McGraw hill, 2011.
2. Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.
3. Peter Harrington. "Machine learning in action", Shelter Island, NY: Manning Publications Co, 2012.
4. Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2016.

Course Outcomes:

At the end of the course, the student should be able to:

1. Identify the modern view of Artificial Intelligence and the problem solving techniques. (PO-1,2,3,4,5)
2. Apply the knowledge representation and Inference techniques to solve real world problems using the agent Philosophy. (PO-1,2,3,4,5)
3. Demonstrate proficiency in applying scientific method to models of machine learning (PO-1,2,3,4,5)
4. Analyze the concept of Artificial neural networks and Bayes classifier for problem solving (PO-1,2,3,4,5)
5. Examine the different applications of Instance Based Learning, Reinforcement Learning and genetic algorithm with their societal impact. (PO-1,2,3,4,5)

Distributed Systems

Course Code: MCSE142 **Credits: 4:0:0**

Prerequisites: Operating Systems **Contact Hours: 56**

Course Coordinator/s: Dr. T N R Kumar

Course Contents:

Unit I

Introduction: Definition, Relation to computer system components, Motivation, Relation to parallel multiprocessor/multicomputer systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communications

Logical time: Introduction, A framework for a system of logical clocks, Scalar time, Vector time, Efficient implementations of vector clocks, Jard–Jourdan's adaptive technique, Matrix time, Virtual time, Physical clock synchronization: NTP.

Unit II

Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels, Variations of the Chandy–Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, monitoring global state, Necessary and sufficient conditions for consistent global snapshots, Finding consistent global snapshots in a distributed computation.

Terminology and basic algorithms: Topology abstraction and overlays, Classifications and basic concepts, Complexity measures and metrics, Program structure, Elementary graph algorithms, Synchronizers, Maximal independent set (MIS), Connected dominating set, Compact routing tables, Leader election, Challenges in designing distributed graph algorithms, Object replication problems**.**

Unit III

Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order, Classification of application-level multicast

algorithms.

Termination detection: Introduction, System model of a distributed computation, Termination detection using distributed snapshots, Termination Distributed Systems 20 Detection by weight throwing, a spanning-tree based termination detection algorithm, Termination detection in a very general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system..

Unit IV

Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-based algorithms, Raymond's tree-based algorithm.

Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Mitchell and Merritt's algorithm for the single resource model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra–Haas algorithm for the OR model, Kshemkalyani–Singhal algorithm for the P-out-of-Q model. Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms.

Unit V

Global predicate detection: Stable and unstable predicates, Modalities on predicates, Centralized algorithm for relational predicates, Conjunctive predicates, Distributed algorithms for conjunctive predicates.

Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure-free system (synchronous or asynchronous), Agreement in (message-passing) synchronous systems with failures, Agreement in asynchronous message-passing systems with failures.

Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, unstructured overlays, Chord distributed hash table. Graph structures of complex networks, Scale-free networks

Text Book:

1. Ajay D. Kshemkalyani and Mukesh Singhal "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2008 (Reprint2013).

Reference Books:

1. John F. Buford, Heather Yu, and Eng K. Lua, "P2P Networking and

Applications", Morgan Kaufmann, 2009 Elsevier Inc.
2. Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, "Distributed and Cloud Computing: From Parallel processing to the Internet of Things", Morgan Kaufmann, 2012 Elsevier Inc.

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Identify the design issues and Challenges in building distributed systems. (PO1,3,4)
2. Explore different ways of managing time (clock) and recording global state of distributed computation.(PO1,3,4)
3. Analyze basic distributed graph algorithms, synchronizers, and practical graph problems, P2P overlay problems(PO1,3,4)
4. Discuss ways to achieve various message ordering schemes and approaches for detecting termination of a distributed computation.(PO1,3,4)
5. Identify different assertion based, and tree based distributed algorithms to implement Distributed Mutual Exclusion.(PO1,3,4)

Computer System Performance Analysis

Course Code: MCSE143 **Credits: 4:0:0**

Prerequisites: Probability Theory, matrices, software engineering aspects and queuing theory **Contact Hours: 56**

Course Coordinator/s: Dr.T N R Kumar

Course Contents:

Unit I

Introduction: The Art of Performance Evaluation, Common Mistakes In performance Evaluation, A Systematic Approach To Performance Evaluation, Selecting An Evaluation Technique, Selecting Performance Metrics, Commonly Used Performance Metrics, Utility Classification Of Performance Metrics, Setting Performance Requirements.

Unit II

Workloads, Workload Selection and Characterization: Types of Work Loads, Addition Instructions, Instruction Mixes, Kernels; Synthetic Programs, Application Benchmarks, Popular Benchmarks. Work Load Selection: Services Exercised, Level Of Detail; Representativeness; Timeliness, Other Considerations In Workload Selection. Work Load Characterization Techniques: Terminology, Averaging, Specifying Dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

Unit III

Monitors, **Program Execution Monitors and Accounting Logs**: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

Unit IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs, Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2^kFactorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2^kFactorial Designs, General full factorial designs with

k factors: Model, Analysis of a General Design, Informal Methods.

Unit V

Queuing Models: Introduction Queuing Notation; Rules for all Queues Litts Law, Types of Stochastic Process. Analysis of Single Queue: Birth- Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks;

Product form networks, queuing Network models of Computer Systems. Operational Laws Utilization Law Forced Flow Law Litts Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis;

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, 1st edition, John Wiley and Sons, 2012.

Reference Books:

1. Paul J Fortier, Howard E Michel: Computer Systems Performance Evaluation and prediction, 1stedition, Elsevier, 2009.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 1st edition, PHI, 2011.

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Compare the techniques to approach performance of two systems and determine the optimal value of a parameter. (PO1,3,4)
2. Identify performance bottlenecks and characterize the future load on a system with reference to the number and size of system components. (PO1,3,4)
3. Explain the use of different analysis strategies like measurement, simulation, analytical modeling and Implement different techniques in experimental design like factorial design techniques. (PO1,3,4, 5)
4. Appraise the use monitors and accounting logs of systems to improve the performance of the system using Queuing models. (PO1,3,4,5)
5. Apply queuing models to solve problems in network models of computer systems. (PO1,3,4, 5)

Pattern Recognition

Course Code: MCSE144 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**

Course Coordinator/s: Dr. Sangeetha J
Course Contents:

Unit I

Introduction: Definition of Pattern Recognition, Applications, Datasets for Pattern Recognition, Different paradigms for Pattern Recognition, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

Unit II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

Unit III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of algorithms, use of for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

Unit IV

Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM.

Unit V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means,Isodata),clustering large datasets, examples, An application: Handwritten Digit recognition.

Text Books:

1. V Susheela Devi, M Narasimha Murthy, Pattern Recognition (An Introduction), Universities Press, 2011.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, PHI, 1996.

Reference Book:

1. Duda R. O., P.E. Hart, D.G. Stork, Pattern Classification, John Wiley and sons,2000

Course Outcomes (COs):

At the end of the course students should be able to:

1. Identify the different paradigms and statistical foundations of Pattern Recognition (PO1, 3, 4)
2. Analyze the data structures and data abstraction techniques for Pattern Recognition. (PO1, 3, 4)
3. Examine the different classifiers and implement the algorithms (PO1, 3,4)
4. Evaluate the use of Bayesian belief networks, decision trees and hidden Markov models for classification tasks. (PO1, 3, 4)
5. Review the hierarchical and partitional clustering techniques and its application in Pattern Recognition. (PO1,3,4)

Quantum Computing

Course Code: MCSE151 **Credit: 4:0:0**
Prerequisite: Linear Algebra, Python Programming **Contact Hours:**
Course Coordinator: Dr. Rajarajeswari S
Course Content: .

Unit I

Fundamental concepts: Introduction and overview, Introduction to quantum mechanics: Linear algebra, the postulates of quantum mechanics, Quantum Computing software: Introduction to Qiskit, Quantum Qudit simulator, QCAD, Programming a quantum computer: The IBMQ, coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.

Unit II

Quantum correlations: Bell inequalities and entanglement, Schmidt decomposition, superdense coding, teleportation, density operator, Quantum Computing software: Quack, qasm2circ. Implementation using Qiskit

Unit III

Quantum computation: Quantum Ciruits, Controlled Operations, Measurement, universal Quantum gates, summary, simulation. Quantum Fourier transform and its applications: Quantum fourier transform, phase estimation, Applications. Implementation using Qiskit

Unit IV

Quantum Search Algorithms: QSA, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, Bernstein-Vazirani Algorithm,Simon's algorithm , Shor's algorithm, Grover's algorithm, Quantum counting, Quantum walk search algorithm .Implementation using Qiskit.

Unit V

Quantum Information: Quantum noise and Quantum operations, Distance measures, Quantum Error Correction, Quantum cryptography: Private Key Cryptography, Privacy amplification and information reconciliation, QKD, privacy and coherent information, security of Quantum Key distribution. Implementation using Qiskit.

Textbooks

1. M. A. Nielsen &I.Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2016).
2. Eleanor G. Rieffel, and Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2014.
3. https://qiskit.org/documentation/

References

1. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020
2. David McMahon, Quantum Computing Explained, Wiley-Interscience, IEEE Computer Society, 2008.
3. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University Press, 2007.
4. Martin Laforest, The Mathematics of Quantum Mechanics, University of Waterloo, Quantum Cryptography School for young students.

Course outcomes:

1. Analyze the behavior of basic quantum computation and Simulate basic quantum measurement and state analysis using Qiskit.(PO-1, 2, 3, 5)
2. Elaborate on quantum non-locality and simulation of the density operators. (PO-1, 3, 5)
3. Prove basic facts about quantum information channels and Implement information channels in the quantum circuit model. (PO-1, 3, 5)
4. Compare, in terms of time complexity, the quantum advantage expected from the quantum algorithms with respect to their classical counterparts. (PO-1, 2, 3, 5)
5. Simulate a simple quantum error-correcting code.(PO-1, 2, 3, 5)

Soft and Evolutionary computing

Course Code: MCSE152 **Credits:** 4:0:0
Prerequisites: Nil **Contact Hours**: 56
Course Coordinator/s: Dr. Sangeetha J
Course Contents:

Unit I

Introduction: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems, Artificial Neural Networks: Fundamental concept, Evolution, Basic model of ANN, Important terminologies of ANN, MP neuron, Hebb Network.

Unit II

Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, multiple adaptive linear neurons, Back propagation Network.

Unit III

Introduction to Fuzzy logic, classical sets and fuzzy sets: Classical sets, Fuzzy sets. Classical relations and fuzzy relations: Cartesian product of relation, Classical relation, Fuzzy relations, Tolerance and equivalence relations. Membership functions: Features, Fuzzification, methods of membership value assignments.

Unit IV

Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy decision making: Individual, multi-person, multi-objective, multi-attibute, and fuzzy Bayesian decision making.

Unit V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA, General genetic algorithms, the schema theorem, Genetic programming, applications.

Text Book:

1. S N Sivanandam, Deepa S. N.: Principles of Soft computing,-- Wiley, India, (Chapters 1, 2, 3(Up to 3.5), 7, 8, 9, 10, 13, 15 (up to 15.6 &15.9,15,10).

Reference Books:

1. J.S.R.Jang, C.T.Sun, E.Mizutani: Neuro-fuzzy and soft computing, PHI (EEE edition) ISBN:978-81-203-2243-1

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Identify and describe soft computing techniques and their roles in building intelligent machines(PO1,3,4)
2. Identify the components and building block hypothesis of Genetic algorithm. (PO1,3,4)
3. Examine the features of neural network and its applications. (PO1,3,4)
4. Apply defuzzification concepts (PO1,3,4)
5. Develop genetic algorithm based real time applications (PO1,3,4,5)

Image processing and Machine Vision

Course Code: MCSE153 **Credits:** 4:0:0
Prerequisites: Nil **Contact Hours:** 56
Course Coordinator/s: Dr. T N R Kumar

Course Contents:

Unit I

Introduction and Digital Image Fundamentals, Motivation & Perspective, Applications, Components of Image Processing System, Fundamentals Steps in Image Processing, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels

Unit II

Image Enhancement in the Spatial and Frequency Domain: Image enhancement by point processing, Image enhancement by neighborhood processing, Basic Gray Level 20% Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Zooming, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering

Unit III

Image Restoration and Image Compression, Model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations. Data Redundancies, Image Compression models, Elements of Information Theory, Lossless and Lossy compression, Huffman Coding, Shanon-Fano Coding, Arithmetic Coding, Golomb Coding, LZW Coding, Run Length Coding, Loss less predictive Coding, Bit Plane Coding, Image compression standards.

Unit IV

Image Segmentation and Morphological Image Processing, Discontinuity based segmentation, similarity based segmentation, Edge linking and boundary detection, 20% Threshold, Region based Segmentation Introduction to Morphology, Dilation, Erosion, Some basic Morphological Algorithms

Unit V

Object Representation and description and Computer Vision Techniques
Introduction to Morphology, Some basic Morphological Algorithms, Representation, Boundary Descriptors, Regional Descriptors, Chain Code, Structural Methods. Review of Computer Vision applications; Fuzzy-Neural algorithms for computer vision applications

Text Books:

1. Rafael C. Gonzalez & Richard E. Woods: Digital Image Processing, Pearson Education, 4th edition, 2018.
2. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, Pearson Education, 2nd edition, 2012.

Reference Books:

1. Wilhelm Burger, Mark J. Burge, Digital Image Processing: An Algorithmic Introduction, Springer; 3rd ed. 2022 edition
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer; 2nd ed. 2021
4. W.K. Pratt, Digital Image Processing, John Wiley & Sons; 4th Edition, 2007.

Course outcomes:

At the end of the course the student will be able to:

1. Explain the fundamentals of image processing and computer vision. (PO1,3,4)
2. Illustrate the image enhancement techniques. (PO1,3,4)
3. Illustrate Image restoration and image compression technique. (PO1,3,4)
4. Explain image segmentation and morphological image processing. (PO1,3,4)
5. Summarize computer vision techniques and its uses. (PO1,3,4)

IoT Technology and Applications

Course Code: MCSE154 **Credits:** 4:0:0
Prerequisites: Nil **Contact Hours:** 56
Course Coordinator/s: Dr. Shilpa Chaudhari / Mrs. Veena G S
Course Contents:

Unit I

Introduction to IoT: What is IoT? IOT terms and Basic Definitions, Disambiguation of IoT vs IoE vs M2M vs Others, Characteristics of IoT. Wireless Sensor Networks

Potential Applications, WSN System Architecture, WSN Network Topologies, Components of a WSN Node. Architecture of IoT systems: Things in IoT, Applications of IoT and IoT Reference model, IoT Ecosystem, Enabling Technologies in IoT, Marketplace and Vision ofIoT.

Unit II

Hardware aspects of IoT: Sensors and Actuators: Introduction to Sensors: Workflow of a Sensor in a typical system, Classification of Sensors, Sampling DAC and ADC conversion. Introduction to Actuators: Workflow of an Actuator in a typical system, Classification of Actuators, Types of Sensors, interfacing concepts to embedded systems.

Unit III

Communications and networking aspects of IoT: High bandwidth networking: Ethernet, gigabit Ethernet, Ethernet topologies like bridge and switches, Passive optical fiber network and topologies, Wi-Fi and WiMax. Wi-Fi routers, radius servers, Wireless security with WPA-2, LEAP, enterprise WPA networks Low Bandwidth Wireless Networks: FSK, LoRa modulation basics, LoRaWAN basics. Peripherals networking: Basics of I2C, SPI, RS232, RS485 and CAN bus, Comparisons and use cases of I2C, SPI, RS232, RS485and CAN bus. Introduction to BLE 5 and industrial Wireless sensor networks, Security in low bandwidth wireless networks, Security in peripheral networks.

Unit IV

Software and middleware aspects of IoT. Middleware: Components of Middleware, Types of Databases, Micro services and API‟s. IP Communication protocols: HTTP, AMQP, MQTT and STOMP. Protocol definitions, use cases and differences.

Unit V

IoT Platform Design Methodology and Domain Specific IoT.

Futuristic view of IoT, problems pertaining to implementation like scaling, feasibility and management.

Text Book:

1. Srinivasa K G, Siddesh G.M and HanumanthaRaju R "Internet of Things", CENGAGE Learning India, 2017.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands - on Approach)", 1st Edition, VPT, 2014. (ISBN:978-8173719547)
2. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley; 1st edition, 2013.

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Identify the basic components of IoT. (PO1,3,4)
2. Recognize the usage various sensors and actuators in applications of IoT. (PO1,3,4)
3. Select appropriate communication protocols for IoT applications depending on distance and data rate. (PO1,3,4)
4. Compare IoT specific protocols like MQTT, AMQP and STOMP for data sharing between devices. (PO1,3,4)
5. Identify components for various domain specific IoT applications. (PO1,3,4,5)

Semester II

Cloud Computing and Big Data

Course Code: MCS21 **Credits:** 3:1:0
Prerequisites: Nil **Contact Hours:** 42+28
Course Coordinator/s: Dr. Ganeshayya Shidaganti
Course Contents:

Unit I

Introduction: Cloud Computing, Delivery Models & Services, Ethical Issues, Cloud Vulnerabilities, Challenges, **Cloud Infrastructure**: Amazon, Google, Azure & Online Services, Open-Source Private Clouds, Cloud Storage Diversity and Vendor Lock-In, Service and Compliance Level Agreements. **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. Different Cloud Architectures, Applications: Healthcare, Energy systems, Transportation, Manufacturing, Education, Government, Mobile Communication, Application Development.

Unit II

Cloud Resource Virtualization: Layering and Virtualization, Virtual Machine Monitors, Virtual Machines, Full Virtualization and Paravirtualization, Hardware Support for Virtualization, A Performance Comparison of Virtual Machines, and The Darker side of Virtualization. **Cloud Resource Management and Scheduling**: Policies and Mechanisms for Resource Management, Resource Bundling: Combinatorial auctions for Cloud Resources, Scheduling Algorithms for Computing Clouds, Fair queuing, Start Time Fair Queuing, Borrowed Virtual Time. **Cloud Security**: Cloud Security Risks, Privacy and Privacy Impact Assessment, Trust, Operating System Security, Virtual Machine Security, Security of Virtualization.

Unit III

Introduction to Big Data: What is big data and why is it Important? Industry Examples of Big Data: Big Data and the New School of Marketing. Marketing. – Advertising and Big data. Types of Digital data, Big Data - Characteristics, Evolution of Big Data, Challenges; Comparison with BI. Cloud Computing and Big Data, Cloud Services for Big Data, Big Data Technology. **NoSQL Data Management:** Introduction to NoSQL, Aggregate Data Models, Graph Databases, Distribution Models.

Unit IV

Basics of Hadoop: Data! Data Storage and Analysis, Data Format, Analyzing

the Data with Hadoop, Data Flow. The Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Data Flow - Anatomy of a File Read - Anatomy of a File Write. **Developing a MapReduce Application**: MapReduce Workflows, writing a Unit Test, Anatomy of a MapReduce Job Run, Classic MapReduce (MapReduce 1), YARN (MapReduce 2), Failures, Job Scheduling, Shuffle and Sort.

Unit V

Interacting with Hadoop Ecosystem: Pig-Data Model, Developing and Testing Pig Latin Scripts. Hive-Data Model and Implementation, Hive Data Manipulation and HiveQL Queries. Hbase - Data Model and Implementation. **Analyzing Big Data**: The Challenges of Data Science, Introducing Apache Spark. Scala for Data Scientists, The Spark Programming Model, Record Linkage, Getting Started: The Spark Shell and Spark Context, Bringing Data from the Cluster to the Client, Shipping Code from the Client to the Cluster, From RDDs to Data Frames. Analyzing Data with the DataFrame API.

Textbooks:

1. Marinescu, Dan C. **Cloud computing: theory and practice**. Morgan Kaufmann, 2022. – 3rd Edition – Elsevier.
2. White, Tom. **Hadoop: The definitive guide**. " O'Reilly Media, Inc.", 2012. Third Edition.
3. Ryza, Sandy, Uri Laserson, Sean Owen, and Josh Wills. **Advanced analytics with spark: patterns for learning from data at scale**. " O'Reilly Media, Inc.", 2017. 2nd Edition,

Reference Books/Links:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra, Geoffrey Fox. MK Publishers.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw Fill, 2010.
3. Cloud Computing A hands - on approach – Arshdeep Bahga & Vijay madisetti Universities press.
4. https://docs.rightscale.com/cm/designers_guide/cm-cloud-computing-system-architecture-diagrams.html

Course Outcomes (COs):

At the end of the course, the student should be able to:

1. Describe the Delivery models, Services and Applications of Cloud Computing. (PO 1,2,3)
2. Demonstrate Cloud Resource Virtualization, Resource Management & Scheduling and Cloud Security (PO-1,2,3)
3. Interpret Big Data Concepts and NoSQL Data Management with respect to Cloud (PO-1,2,3)
4. Examine the role of Hadoop in various MapReduce Applications (PO-1,2,3)
5. Analyze the Big Data using Hadoop Ecosystem and Spark Programming model. (PO-1,2,3)

Advanced Operating Systems

Course Code: MCS22 **Credits:** 4:0:0
Prerequisites: Operating Systems **Contact Hours:** 56
Course Coordinator/s: Dr. Shilpa S Chaudhari
Course Contents:

Unit I

Introduction to the Linux Kernel - Obtaining the Kernel Source, The Kernel Source Tree, Building the Kernel

Unit II

Process Management – process descriptor and task structure, process creation, process termination, Process Scheduling –Linux scheduling algorithm, System Call implementation

Unit III

Kernel Data Structures, Interrupt Handlers, Bottom Halves, softirq, tasklets, An Introduction to Kernel Synchronization

UnitIV

Memory Management – kmalloc, vmalloc, slab layer, memory descriptor, The Page Cache

UnitV

The Virtual Filesystem, The Block I/O Layer , Devices and Modules

Reference Books:

1. Mukesh Singhal, Niranjan G. Shivaratri,"Advanced Concepts In Operating Systems: Distributed, Database and Multiprocessor Operating Systems", TMH, 2009.
2. Andrew S. Tanenbaum,"Modern Operating System", PHI, 2003
3. Pradeep K. Sinha, "Distributed Operating System - Concepts and Design", PHI, 2003.
4. Andrew S. Tanenbaum,"Distributed Operating System", Pearson Education, 2003.

Course Outcomes(COs):
At the end of the course, the students will be able to:

1. Examine the kernel components for building kernel image from kernel source(PO-1,2,3)

2. Implement kernl process and CPU scheduling to observe the process manamgement (PO-1,2,3)
3. Design the interrupt handler considering kernel synchronization(PO-1,2,3)
4. Demonstrate memory manamgent at kernel level(PO-1,2,3)
5. Apply device driver as kernle module(PO-1,2,3)

Cloud Computing and Big Data Laboratory

Course Code: MCSL26 **Credits: 0:0:1**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Dr. Ganeshayya Shidaganti
Course Contents:

List of problems for which student should develop program and execute in the Laboratory

1. Downloading and Installing Hadoop;
2. Understanding Hadoop Distributed File system (HDFS); Explore Basic Hadoop Commands; Different Hadoop Modes. Startup scripts, Configuration files.
3. Understanding Anatomy of MapReduce Job Run and Workflows and Developing various MapReduce Applications.
4. Downloading and Installing Apache Spark; Running Apache Spark Applications using Scala.
5. Developing and Testing Pig Latin Scripts.
6. Understanding Hive Shell and Manipulating HiveQL Quires.
7. Installation of various Hypervisors and Instantiation of VMs with image file using Open Source Hypervisors such as Virtual Box, VMWare Player, Xen, OpenVZ and KVM.
8. Implementation of various Scheduling Mechanisms and Load Balancing Mechanisms using Open Source Cloud Simulator.

References:

1. Tom White "**Hadoop: The Definitive Guide**" Forth Edition, O'reilly Media, 2015.
2. Marinescu, Dan C. **Cloud computing: theory and practice**. Morgan Kaufmann, 2022. – 3rd Edition – Elsevier.
3. Ryza, Sandy, Uri Laserson, Sean Owen, and Josh Wills. **Advanced analytics with spark: patterns for learning from data at scale**. " O'Reilly Media, Inc.", 2017.
4. Gates, Alan, and Daniel Dai**. Programming pig: Dataflow scripting with hadoop.** " O'Reilly Media, Inc.", 2016..
5. Capriolo, Edward, Dean Wampler, and Jason Rutherglen. **Programming Hive: Data warehouse and query language for Hadoop.** " O'Reilly Media, Inc.", 2012.Mining Concepts and Techniques", 2nd Edition,

Elsevier, Reprinted 2008

Course Outcomes (COs):

1. Explore the Hadoop Ecosystem and MapReduce Programming to perform various Business Applications associated with Big Data Analytics.(PO-1, 2, 3, 4, 5)
2. Analyze Big Data Applications Using Pig and Hive and Spark .(PO-1, 2, 3, 4, 5).
3. Apply the concepts of Virtual Machines/Hypervisors, Scheduling and Load Balancing Mechanisms in Cloud using Open-Source Software. .(PO-1, 2, 3, 4, 5)

System Programming Laboratory

CourseCode: MCSL27 **Credits: 0:0:1**
Prerequisites: Operating System, Linux CLI and C programming **Contact Hours: 28**
Course Coordinator: Dr. Shilpa Chaudhari

Course Contents:

This laboratory course helps students to visualize the operating system concepts through various experiments. Following are the list of experiments on the specific operating system concepts.

1. Linux kernel architecture - kernel space components, system calls
2. Kernel logging and printk
3. Key internals aspects regarding task structure
4. key internals aspects regarding CPU scheduling within the kernel
5. Key internals regarding memory management within the kernel -examine kernel segment
6. Understand and work with various dynamic kernel memory alloc/dealloc APIs - kernel page allocator, kernel slab allocator, kmalloc API
7. Kernel memory allocation - vmalloc
8. Find out how to work with key kernel synchronization primitives
9. Write high-quality modular kernel code (LKM framework) for 5.x kernels
10. Write high-quality modular kernel code (LKM framework) with parameters passing for 5.x kernels
11. Configure a kernel from source for a given requirement - Setting up the software, static analysis tools for Linux Kernel
12. Build a kernel from source- customized kernel, kernel image, customize GRUB boot loader

Reference Books:

1. Billimoria, Kaiwan N., Linux Kernel Programming: A comprehensive guide to kernel internals, writing kernel modules, and kernel synchronization. Packt Publishing Ltd, 2021.
2. Bharadwaj, Raghu. Mastering Linux Kernel Development: A kernel developer's reference manual. Packt Publishing Ltd, 2017.

CourseOutcomes(COs):
At the end of the course, the students will be able to:

1. Understand the essentials of key internals topics such as kernel architecture, memory management, CPU scheduling, and kernel synchronization (PO1,3,4)
2. Explore and analyze the operating system concepts by building the kernel from the source using most recent Long-Term Support Linux kernel (PO1,3,4)
3. Discover how to write kernel code using the Loadable Kernel Module framework (PO1,3,4)

Advanced Software Engineering

Course Code: MCSE231 **Credit:** 4:0:0
Prerequisite: Software Engineering **Contact Hours:** 56
Course Coordinator: Dr. Annapurna P Patil
Course Contents:

Unit I

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, the Unified Process, Personal and Team Process Models, Process Technology, Product and Process. (T1: Chapter-2) Agile Development: What Is Agility? Agility and the Cost of Change, What Is an Agile Process? Extreme Programming (XP), Other Agile Process Models, Agile Unified Process (AUP), A Tool Set for the Agile Process. (T1: Chapter-3)

Unit II

DevOps Culture and Practices: Getting started with DevOps, Implementing CI/CD and continuous deployment. (T2: Chapter-1) Continuous Integration and Continuous Delivery: The CI/CD principles, using a package manager, Using Jenkins, Using Azure Pipelines, Using GitLab CI. (T2: Chapter-6). Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management (T3: Chapter-4).

Unit III

Design Concepts: Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model. (T1: Chapter-8) Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow (T1: Chapter-9) User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design (T1: Chapter-11)

Unit -IV

Quality Concepts: What Is Quality? Software Quality, The Software Quality Dilemma, Achieving Software Quality. (T1: Chapter-14) Review Techniques: Cost Impact of Software Defects, Defect Amplification and Removal, Review Metrics and Their Use, Reviews: A Formality Spectrum, Informal Reviews, Formal Technical Reviews. (T1: Chapter-15) Software Quality Assurance:

Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics, Forma lApproaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan (T1: Chapter-16).

Unit V

Software Reuse: The reuse landscape, Application frameworks, Software product lines, COTS product reuse. (T3: Chapter-16) Component-based Software Engineering: Components and component models, CBSE processes, Component composition. (T3: Chapter-17) Service-Oriented Architecture: Services as reusable components, Service engineering, Software development with services. (T3: Chapter-19) Aspect-Oriented Software Engineering: The separation of concerns, Aspects, joins points and point cuts, Software engineering with aspects. (T3: Chapter-21).

Textbooks:

1. Pressman, Roger S. Software Engineering: A Practitioner's Approach, 2010, 7th Edition, McGraw-Hill.ISBN 9780073375977
2. Krief, Mikael. Learning DevOps, 2019, 1st Edition, 2019, Packt Publishing Ltd.ISBN 9781838642730
3. Sommerville, Ian. Software Engineering, 2011, 9th Edition, Pearson Education. ISBN 9780137035151

Reference Textbooks:

1. Verona, Joakim, Practical DevOps, 2016, 1st Edition, Packt Publishing Ltd. ISBN 9781785882876.
2. Blaha, Michael, and James Rumbaugh. Object-Oriented Modeling and Design with UML, 2004, 2nd Edition, Pearson Education, ISBN 9780130159205.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify various software development processes and methodologies. (PO: 1, 2, 3 & 5)
2. Apply the DevOps pipeline process starting with continuous integration and continuous deployment principles. (PO: 1, 2, 3 & 5)
3. Recognize the different Design principles, Architectural Design and User Interface Design for developing a high-quality system or product. (PO: 1, 2, 3 & 5)
4. Recognize the need for applying the Software Quality Assurance practice

throughout the software process. (PO: 1, 2, 3 & 5)

5. Summarize the need for reusing the software components. (PO: 1, 2, 3 & 5)

Natural Language Processing

Course Code: MCSE232 **Credits:** 4:0:0
Prerequisites: Compiler Design **Contact Hours:** 56
Course Coordinator/s: Dr. Jayalakshmi D S/ Chandrika Prasad
Course Contents:

Unit I

Introduction: Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms; Language, Thought, and Understanding; The State of the Art and The Near-Term Future; Regular Expressions and Automata; Morphology and Finite-State Transducers: Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing**.**

Unit II

N-grams: Counting Words in Corpora, Smoothing, N-grams for Spelling and Pronunciation, Entropy; Word Classes and Part-of-Speech Tagging: Part- of-Speech Tagging, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation-Based Tagging; Context-Free Grammars for English: Constituency, Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase.

Unit III

Parsing with Context-Free Grammars: The Earley Algorithm; Features and Unification: Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints; Lexicalized and Probabilistic Parsing: Probabilistic Context-Free Grammars, Problems with PCFGs.

Unit IV

Representing Meaning: First Order Predicate Calculus, Some Linguistically Relevant Concepts, Related Representational Approaches, Alternative Approaches to Meaning; Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English; Lexical Semantics: Relations Among Lexemes and Their Senses, WordNet: A Database of Lexical Relations, The Internal Structure of Words.

Unit V

Discourse: Reference Resolution, Text Coherence, Discourse Structure; Generation: Introduction to Language Generation, An Architecture for Generation; Machine Translation: Language Similarities and Differences, The Transfer Metaphor.

Text Book:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: an introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.

Reference Book:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Interpret how speech and language technology relies on formal models to capture knowledge, and language processing deals with subparts of words (morphology). (PO1,3,4)
2. Illustrate the way *N*-gram tool is used for spelling and pronunciation processing, and part-of-speech tagging mechanism using various categories. (PO1,3,4)
3. Describe feature structures and unification operation which is used to combine them, and probabilistic parsing to capture more syntactic information. (PO1,3,4)
4. Outline representations used to bridge the gap from language to commonsense Knowledge (semantic processing), and meanings associated with lexical items. (PO1,3,4)
5. Emphasize problems that NLP systems face, natural language outputs construction from non-linguistic inputs and machine translation framework approaches. (PO1,3,4)

Fog and Edge Computing

Course Code: MCSE233 **Credit: 4:0:0**
Prerequisite: **Contact Hours: 56**
Course Coordinator: Dr. Rajarajeswari S.
Course Contents:

Unit I

Internet of Things (IoT) and New Computing Paradigms, Addressing the Challenges in Federating Edge Resources, Integrating IoT , Fog , Cloud Infrastructures: System Modeling and Research Challenges

Unit II

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds, Optimization Problems in Fog and Edge Computing, Middleware for Fog and Edge Computing: Design Issues

Unit III

Data Management in Fog Computing, Predictive Analysis to Support Fog Application Deployment, Using Machine Learning for Protecting the Security and Privacy of Internet of Things (IoT) Systems

Unit IV

Applications and Issues: Fog Computing Realization for Big Data Analytics, Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications

Unit V

Testing Perspectives of Fog-Based IoT Application, Legal Aspects of Operating IoT Applications in the Fog, Modeling and Simulation of Fog and Edge Computing Environments Using iFogSim Toolkit.

Text Book:

1. Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley, ISBN: 978-1-119-52498-4 January 2019

Reference Books:

1. Jie Wu , Wei Chang, Fog/Edge Computing For Security, Privacy, and Applications: Advances in Information Security, Springer 6 January 2022
2. Ajith Singh, **“**Fog and Edge Computing: simply in depth”, ISBN-13 979-8725825428, 21 March 2021.
3. Deepak Gupta, Aditya Khamparia, “Fog, Edge, and Pervasive Computing

in Intelligent IoT Driven Applications", IEEE Press, Wiley, 2021.
4. Muhammad Maaz Rehan and Mubashir Husain Rehmani, "Blockchain-enabled Fog and Edge Computing: Concepts, Architectures, and Applications", CRC Press, First edition, 2020.

Course Outcomes

At the end of the course the students will be able to:

1. Provide insights on transitioning from current Cloud-centric and 4G/5G wireless environments to Fog Computing (PO- 1,2,3, 4, 5).
2. Review underlying technologies, limitations, and challenges along with future research direction and discuss generic conceptual framework for optimization problems in fog computing (PO- 1,2,3, 4, 5).
3. Discuss major components of Fog and Edge computing architectures such as middleware, interaction protocols, and autonomic management . (PO-1,2,3, 4, 5).
4. Identify potential technical challenges and offers suggestions for possible solutions for real time problems (PO- 1,2,3, 4, 5).
5. Design and develop simulation scenarios for Edge and Fog Computing using network simulator/ iFogSim Toolkit. (PO- 1,2,3, 4, 5).

Game Theory

Course Code: MCS234 **Credits:** 4:0:0
Prerequisites: Nil **Contact Hours:** 56
Course Coordinator/s: Dr.Annapurna P Patil
Course Contents:

Unit I

Basic Mathematical Preliminaries, Key Notions in Game theory, Extensive form games, Strategic Form games. (TB1: Chapter 33,1,2,3,4)

Unit II

Dominant strategy equilibria, pure strategy Equilibria, mixed strategy and Mixed Strategy Nash Equilibrium, Matrix Games(TB1: Chapter 5,6,7,9)

Unit III

Bayesian games, Introduction to mechanism design , Implementation of social choice functions by mechanisms, Incentive compatibility and revelation theorem (TB1: Chapter 13,14,15,16)

Unit IV

Auctions, Correlates strategies and correlated equilibrium, two persons bargaining problem, coalitional games with transferable utility(TB1: Chapter 20,25,26,27)

Unit V

The core of Coalitional Games, The shapely value, concepts in cooperative game theory, Stable matching. (TB1: Chapter 28,29,30,31)

Text Book:

1. Y Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific**.**

Reference Books:

1. Bernhard von Stengel, "Game Theory Basics", Cambridge University Press, 2021
2. M. Maschler, E. Solan and S. Zamir: Game Theory, CUP, 2nd Edition, 2020.
3. Giacomo Bonanno, Game Theory, 2nd Edition 2018.
4. Ken Binmore, Playing for Real: A Text on Game Theory, CUP, 2007.
5. Elliot Mendelson, Introducing Game Theory and Its Applications, CRC 2004.
6. J. Osborne and A. Rubinstein, A Course in Game Theory, MIT press, 1994

Course Outcomes

At the end of the course the students will be able to:

1. Explain the fundamental concepts of non-cooperative game theory (PO – 1, 2, 3, 4, 5)
2. Apply solution concepts to examples of games, and to state and explain them precisely (PO – 1, 2, 3, 4, 5)
3. Solve unseen games and games with incomplete information that are variants of known examples. (PO – 1, 2, 3, 4, 5)
4. Illustrarte a compelling application of mechanism design. (PO – 1, 2, 3, 4, 5)
5. Develop solution for problems related to cooperative game theory. (PO – 1, 2, 3, 4, 5)

Wireless Networks and Mobile Computing

Course Code: MCSE241 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Shilpa S Chaudhari
Course Contents:

Unit I

Wireless Communication Technology: Overview of Wireless Communication - Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment, Channel Correction Mechanisms, Digital Signal Encoding Techniques, Coding and Error Control, Orthogonal Frequency Division Multiplexing (OFDM, Spread Spectrum. The Wireless Channel- Antennas, Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment, Channel Correction Mechanism

Unit II

Wireless LAN Technology- Overview and Motivation, IEEE 802 Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer, Gigabit Wi-Fi, Other IEEE 802.11 Standards, IEEE 802.11I Wireless LAN Security

Bluetooth and IEEE 802.15- The Internet of Things, Bluetooth Motivation and Overview, Bluetooth Specifications, Bluetooth High Speed and Bluetooth Smart, IEEE 802.15, ZigBee

Unit III

Cellular Wireless Networks- Principles of Cellular Networks, First-Generation Analog, Second-Generation TDMA, Second-Generation CDMA, Third-Generation Systems

Mobile Applications and Mobile IP- Mobile Application Platforms, Mobile App Development, Mobile Application Deployment, Mobile IP

Long Range Communications- Satellite Parameters and Configurations, Satellite Capacity Allocation, Satellite Applications, Fixed Broadband Wireless Access, WiMAX/IEEE 802.16 Smart Grid

Unit IV

Wireless Ad-hoc Networks: Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet.

MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in

Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols -MACAW: A Media Access Protocol for Wireless LANs, MAC Protocols that Use Directional Antennas - MAC Protocol Using Directional Antennas.

Routing Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols.

Multicast Routing in Ad-hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols.

Unit V

Vehicular ad hoc networks- architecture, challenges and primary applications, enabling technologies - DSRC, Wireless Access in Vehicular Environment (WAVE) stack, Data disseminations in VANET, Routing in VANET. Modeling and Simulation of Vehicular Networks: VANET simulation environment, Mobility models, Networking models, Signal propagation models, Model for Incorporating Vehicles as Obstacles in VANET Simulation Environments.

Text Book:

1. Cory Beard and William Stallings, Wireless Communication Networks and Systems, Pearson, 2016

Reference Books:

1. C. Siva Ram Murthy and B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011
2. Xin Wang, "Mobile Ad-Hoc Networks Applications", inteo, 2011.

Course Outcomes (COs):

At the end of the course, a student will be able to:

1. Explore concepts and principles of wireless communication with the evolution of latest wireless networks. (PO1, 2, 3, 4)
2. Discuss wireless network LAN and short range communication

technologies (PO1, 2, 3, 4)

3. Compare the challenge faced in wireless ad hoc network with other wireless networks in addition to the focus on MAC/Network layer protocol design issues and proposed solutions by the research community (PO1, 2, 3, 4)
4. Explore Wireless Mobile Networks and Applications (PO1, 2, 3, 4)
5. Model the vehicular network application in simulated environment focusing efficient resource utilization and QoS provisioning (PO1, 2, 3, 4,5)

Advanced Algorithms

Course Code: MCSE242 **Credits:4 :0:0**

Prerequisites: Knowledge of Analysis and Design of Algorithm

Contact Hours:56

Course Coordinator: Dr.Annapurna P Patil

CourseContents:

Unit I

Analysis Techniques: Growth of Functions, Asymptotic notations, Standard notations and common functions, Recurrences and Solution of Recurrence equations – The Substitution method, The recurrence – tree method, The master method, Amortized Analysis: Aggregate, Accounting and Potential Methods.

Unit II

Graph Algorithms: Bellman-Ford Algorithm, Single source shortest paths in a DAG, Johnson‟s Algorithm for sparse graphs, Maximum bipartite matching. Trees: B-trees, Red-Black trees Hashing: General Idea, Hash Function, Separate Chaining, Open addressing, Rehashing, Extendible hashing.

Unit III

Number – Theoretic Algorithms: Elementary notations, GCD, Modular Arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, RSA cryptosystem. Heaps: Heaps, Priority Queues, Binomial Heaps, FibonacciHeaps.

Unit IV

String Matching Algorithms: Naïve string matching, Rabin – Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm, Boyer- MooreAlgorithms.

Unit V

Algorithmic Puzzles: Magic Square, *n*-queen's problem, Glove Selection, Ferrying Soldiers, Jigsaw Puzzle Assembly, A Stack of Fake Coins, Maximum Sum Descent, Hats of Two Colors, Pluses and Minuses, searching for a Pattern, Locker Doors, Palindrome Counting, inverting a Coin Triangle, Sorting 5 in7.

Text Books:

1. T H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3/e, PHI,2011.
2. Mark Allen Weiss: Data Structures and Algorithm Analysis in C++,

3rd Edition, Pearson Education,2011.
3. Anany Levitin and Maria Levitin: Algorithmic Puzzle, Oxford University Press, 2011

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S Rajasekharan: Fundamentals of Computer Algorithms, University Press,2007.
2. Alfred V Aho, John E Hopcroft, J D Ullman: The Design and Analysis of Computer Algorithms, Pearson Education,2011.

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Devise recurrence relations and amortized cost of various operations. (PO1,3,4)
2. Illustrate graph algorithms such as Bellman-Ford, Shortest path, bipartite matching, B-trees, Red-Black trees and hashing techniques.(PO1,3,4)
3. Identify the methods for solving modular linear equations, Chinese remainder theorem and RSA cryptosystem, types of heaps such as Binomial and Fibonacci heaps.(PO1,3,4)
4. Assess the string matching algorithms such as Boyer-Moore and Knuth-Morris-Pratt algorithm.(PO1,3,4)
5. Compose mathematical models, objective functions and constraints to solve algorithmic puzzles (PO1,3,4,5)

Digital Forensics and Cyber Crime

Course Code: MCSE243 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr.Dayanand R B
Course Contents:

Unit I

Understanding the digital forensics profession and investigations, An overview of digital forensics, Preparing for digital investigations, maintaining, Maintaining professional conduct, preparing a digital forensics investigation, Procedures for private-sector, high tech investigation, understanding, Data recovery workstations and software, conducting an investigation, understanding forensics lab accreditation requirement, Determining the physical requirement for digital lab, Selecting a basic forensic workstation, building a business case for developing a forensics lab and preparing a business case study.

Unit II

Working with Windows and CLI Systems: Understanding File Systems, Exploring Microsoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption, Understanding the Windows Registry, Understanding Microsoft Startup Tasks, understanding Windows 7,8 and NT and later Startup Tasks, and Understanding Virtual Machines.

Unit III

Data Acquisition: Understanding Storage Formats for Digital Evidence, Determining the best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisitions, performing RAID data acquisitions, Using Remote Network Acquisition Tools, Using other Acquisition Tools. Understanding acquisition procedure for mobile device, acquisition in cloud computing. Computer Forensics Analysis and Validation: Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisitions. Conducting a cloud investigation.

Unit IV

Current digital Forensics Tools: Evaluating digital Forensic Tool Needs, digital Forensics Software Tools, Computer Forensics Hardware Tools, understanding Email servers, using specialized email forensics tools. Applying digital forensics to social media, Mobile device Forensics,

understanding mobile device forensics, cloud forensics legal and technical challenges in cloud forensics.

Unit V

Network Forensics: Network Forensic Overview, Performing Live Acquisitions, Developing Standard Procedures for Network Forensics, Using Network Tools. E-mail Investigations: Exploring the Role of E-mail in Investigations, Exploring the Roles of the Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools. Laboratory Lab exercises using forensic software and Case study data**.**

Text Book:

1. Bill Nelson, Phillips, Frank, Christopher Steuart, "Guide to Computer Forensics and Investigations" 5th Edition Cengage Learning, 2014. (Chapters: 1, 2, 3, 5, 6, 9, 10, 13)

Reference Books:

1. Marjie T. Britz: Computer Forensics and Cyber Crime - An Introduction, 2ndEdition, Pearson Education, 2012.
2. Harish Chander: Cyber Laws and IT Protection, PHI, 2012.

Web Reference:

1. http://www.cyberforensics.in/default.aspx

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Conduct, preparing a digital forensics investigation. (PO1,3,4)
2. Classify various types of computer crime. (PO1,3,4)
3. Apply computer forensic techniques to identify the digital fingerprints associated with criminal activities. (PO1,3,4)
4. Analyze hidden information from pictures and other files. (PO1,3,4)
5. Apply Network Forensic tools for network forensic and live data forensic analysis. (PO1,3,4)

Semantic Web and Social Networks

Course Code: MCSE244 **Credits: 4:0:0**
Prerequisites: NIL **Contact Hours: 56**
Course Coordinator/s: Dr.Rajarajeswari S
Course Contents:

Unit I

Web Intelligence Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners- Lee www, Semantic Road Map, Logic on the Semantic Web.

Unit II

Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework (RDF) / RDF Schema, Ontology Web Language (OWL), UML, XML/XML Schema.

Unit III

Ontology Engineering, Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Unit IV

Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

Unit V

Social Network Analysis and semantic web What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Text Books:

1. H. Peter Alesso, Craig F. Smith, "Thinking on the Web: Berners-Lee, Gödel, and Turing", Wiley Interscience, 2008.

2. Peter Mika, “Social Networks and the Semantic Web”, Springer,2007.
3. Liyang Yu, “Introduction to Semantic Web and Semantic Web Services”, CRC Press, 2019.

Reference Books:

1. Heiner Stuckenschmidt, Frank van Harmelen, “Information Sharing on the Semantic Web”, Springer, 2006.
2. T.Segaran, C.Evans, J.Taylor, “Programming the Semantic Web”, O’Reilly publishers, 2013.

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Understand web intelligence and intelligence web applications(PO1,3,4)
2. Explore knowledge implementation of web applications(PO1,3,4)
3. Apply ontology engineering (PO1,3,4)
4. Discuss and analyze web applications(PO1,3,4)
5. Conduct social network analysis (PO1,3,4,5)

Block Chain Essentials & Dapps

Course Code: MCSE251 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Parkavi A

Course Contents:

Unit I

Introduction, Purpose and Scope, Results of the Public Comment Period, Document Structure, Blockchain Categorization, Permissionless, Permissioned, Blockchain Components, Cryptographic Nonce, Transactions, Asymmetric-Key Cryptography, Ledgers, Blocks, Chaining Blocks,Consensus Models, Forking, Smart Contracts, Blockchain Limitations and Misconceptions, Application Considerations, Additional Blockchain Considerations.

Unit II

Introduction to Cryptography & Cryptocurrencies, Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency, How Bitcoin Achieves Decentralization, Centralization vs. Decentralization, Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Mechanics of Bitcoin, Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.

Unit III

Blockchain 3.0: Justice Applications Beyond Currency, Economics, and Markets, Blockchain Technology Is a New and Highly Exective Model for Organizing Activity, Distributed Censorship-Resistant Organizational Models, Namecoin, Digital Art: Blockchain Attestation Services (Notary, Intellectual Property Protection), Blockchain Government, Efficiency and Coordination Applications Beyond Currency, Economics, and Markets, Blockchain Science: Gridcoin, Foldingcoin, Blockchain Genomics, Blockchain Health, Blockchain Learning: Bitcoin MOOCs and Smart Contract Literacy, Blockchain Academic Publishing: Journalcoin, Centralization-Decentralization Tension and Equilibrium, Advanced Concepts.

Unit IV

Ethereum, DApp, Components, EVM, Etherscripter, Hyperledger, Digital Tokens, OmiseGO, EOS, Tether, MetaMask, Wallet Seed, MetaMask Transactions, Objectives of the Hyperledger Project, Mist, Mist wallet, Truffle, Features, Development-Truffle boxes, Truffle Box, Creating a Truffle Box,

Community truffle box, Embark, Solidity, Smart Contracts, Statically typed Language, Contract and Interfaces, Hyperledger Fabric, Mode of operation, Hyperledger Iroha, Components.

Unit V

Hyperledger Sawtooth, Components, Validator registry, Consensus, DApps, Seafood supply chain traceability, Marketplace Digital Asset Exchange, Cello: Features, operator dashboard, Comparison of Bitcoin, Ethereum and Hyperledger, Multichain, Language support, Security, Mining, HydraChain: Smart contracts and HydraChain, IOTA, Corda, Elements Project, deployed Elements, Chain Core, operations available, Development & Security, CoCo Framework, Specialties, Benefits, Tierion, Chainpoint, Benefits of Tierion, BigchainDB, Models, Transaction Models, Block Models,

Text Books:

1. Dylan Yaga, Peter Mell, Nik Roby, Karen Scarfone,Blockchain Technology Overview, NIST Report 8202,US Department of Commerce, Oct 2018.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016

Reference books:

1. Melanie Swan, Block chain, Blueprint for A New Economy, O'Reilly, 2015.
2. Sainul Abideen, Block chain Expert, BlockChain E-Book, Cybrosys Technologies. https://www.blockchainexpert.uk/book/blockchain-book.pdf

Course Outcomes(COs):

At the end of the course, students should be able to:

1. Analyze the fundamental elements of block chain technology(PO1,3,4)
2. Demonstrate the application of hashing and public key cryptography in protecting the blockchain (PO1,3,4)
3. Analyse the block chain applications in a structured manner. (PO1,3,4)
4. Develop block chain based solutions and write smart contract using Ethereum Framework. (PO1,3,4)
5. Use smart contract in real world applications (PO 1,3,4,5)

Web Technologies

Course Code: MCSE252 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. J Geetha
Course Contents:

Unit I

HTML5 and Java script Basics: Introduction, Cascading Styles Sheet: Concept of CS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), CSS Id and Class, Box Model (Border, Padding, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class)

Unit II

JavaScript syntax, Types of Data and Variables, Operations and calculations, The Document Object, Using Events.

JavaScript Advanced: Scopes and Closures, understand "this" and prototypes, OO concepts as applied to JS and prototypal inheritance, Understanding the meaning of asynchronous. Event loops, Promises.

Unit III

Introduction to Server-side JS Framework – Node.js: Introduction - What is Node.js, Architecture, Feature of Node JS, Installation and setup - Creating web servers with HTTP (Request & Response), Understand dependence management: npm and package.json File system APIs.

Unit IV

CRUD Operations using Node.js: Event Handling - GET & POST implementation, Use Express.js to create a REST API. Use GET, POST. Connect to NoSQL MongoDB Database using Node.js, Implementation of CRUD operations.

Unit V

Introduction to Client-side JS Framework – Building blocks of React,

Create-react-app - Create first React app using this CLI, JSX - Understand what it is and how it's required to create components, Simple functional components, CSS - Load CSS and use it via class Name, props - Passing props to components to make them reusable, Event handling, State - Using class components for storing state (legacy), State via hooks - Using use State hook.

Text Books:

1. Steven A. Gabarro, " Web Application Design and Implementation: Apache 2, PHP5, MySQL, JavaScript, and Linux/UNIX", Wiley- IEEE Computer Society Press 2007.
2. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, "Ng-book, The Complete Book on Angular", Fullstack.IO, 1st edition, 2016.
3. KrasimirTsonev, "Node.js by Example", Packt Publishing Limited, 2015

Reference Links:

1. Web link for Node.js: https://nodejs.org/en/
2. Web link for MongoDB: https://www.mongodb.com/
3. https://reactjs.org/:

Course Outcomes (COs):

At the end of the course, the student will be able to:

1. Design a web Page using HTML tags
2. Create and style basic web page
3. Explore Node.js features
4. Design Front-end web pages and connect to the Back-end Databases.
5. Create component based web pages using React features

Future skills & Start-up Engineering

Course Code:MCS253 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Naghabhushan AM

Unit I

Introduction: Current industry overview, Future Skills 2020 research report from IFTF. Sense making: Introduction, VUCA (Volatility, Uncertainty, Complexity and Ambiguity). What is Sense Making? How Sense Making Helps? Steps in sense making, how to do effective sense making? Hurdles in effective sense making. Assignment: A short 1-hour assignment where students will be posed with a situation to exercise their Sense Making ability. It will be assessed at the end of the session.

Unit II

Virtual Collaboration(VC): Introduction, How VC helps? Characteristics of Virtual Collaboration, Types of Virtual Collaboration. Advantages, Disadvantages and Applications of VC. Assignment: The students will be given an assignment applying both the sense making skills and Virtual Collaboration skills using the cloud based tools to complete a specific task. This assignment will also cover working in a team using virtual collaboration tools. In order to focus on learning of the specified skills, the end task is kept small and achievable in short time frame.

Unit III

Social Intelligence: Introduction, Hypothesis, Measuring Social Intelligence, Difference between intelligence and Social Intelligence, derive some of the study done in Social networking theory. Assignment: The assignment will focus on students using their social network to accomplish a specific task.

Unit IV

Cross-cultural competency: Introduction, Importance of cross cultural competence in workplace. Nuances of cross cultural differences, Examples to demonstrate the differences. Assignment: Students will have to work with a team member from another culture to complete a specific task.

Unit V

Introduction, Start up : past & present , NSF AUP Repeal: Internet for Business, The Key Features of Internet Startups, Technological Trends Toward Mobility and Decentralization, Startup engineering, Technologies, Design, Marketing, and Sales, Mobile HTML5 for the Final Project, Interactive Start, Webapp, Setup and Signup- AWS, Gravatar, Github, and Heroku, Connect to

a Cloud Computer,Launch EC2 Instance, Mac: Connect to EC2 instance via Terminal.app, Windows: Connect to EC2 instance via Cygwin, Security Groups, Standard Operating System: Ubuntu 12.04.2 LTS on a t1.micro AWS instance, Deploy code to Test Heroku account.

References:

1. The detailed report can be found at http://www.iftf.org/uploads/media/SR1382A_UPRI_future_work_skills_sm.pdf
2. The reading material for individual lectures will be shared with the students using Tutor Space.

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Identify the Future Work skills needed for next 5 years. (PO 1,3,4)
2. Illustrate sense Making Skills through assignments. (PO 1,3,4)
3. Survey the different Virtual Collaboration skills to complete an assignment. (PO 1,3,4)
4. Describe the social intelligence skill and application of the same. (PO 1,3,4)
5. Compose an assignment using Cross-cultural competence and load management skills. (PO 1,3,4)

Network Security and Ethical Hacking

Course Code: MCSE254 **Credits: 4:0:0**
Prerequisites: Computer Networks **Contact Hours: 56**
Course Coordinator/s: Dr. Shilpa S. Chaudhari
Course Contents:

Unit I

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE
802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, and protected data transfer phase. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol. HTTPS Connection Initiation, Connection Closure. Secure Shell (SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol

Unit II

Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Cyber network security concepts: Security Architecture, anti-pattern signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioral and entropy based malware detection. The problems: cyber antipatterns concept, forensic cyber antipatterns, cyber antipattern templates, cybersecurity antipattern catalog.

Unit III

Casing the Establishment - What is footprinting- Internet Footprinting. – Scanning Enumeration - basic banner grabbing, Enumerating Common Network services. Case study Network Security Monitoring Securing permission - Securing file and folder permission. Using the encrypting filesystem. Securing registry permissions. Securing service-Managing service permission. Remote Access Vs Local access. Remote access. Local access. After hacking root.

Unit IV

Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering,

Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of Dos Attackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows DoS.

Unit V

Remote Control securities, Discovering Remote Control Software, Connection, Weakness. VNC, Microsoft Terminal Server and Citrix ICA, Advanced Techniques Session Hijacking, Back Doors, Trojans, Cryptography, Subverting the systems Environment, Social Engineering, Web Hacking, Web server hacking web application hacking, Hacking the internet Use, Malicious Mobile code, SSL fraud, E-mail Hacking, IRC hacking, Global countermeasures to Internet User Hacking.

Text Books:

1. William Stallings, Cryptography and Network Security, Pearson 6th edition.
2. Thomas J. Mowbray, "CyberSecurity–Managing Systems, Conducting Testing and Investigating Intrusions",Wiley.
3. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers,2010.
4. Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India,2010.

Reference Books:

1. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security, Mc-Graw Hill, 3rd Edition, 2015
2. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
3. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
4. Alfred Basta, Nadine Basta, Mary brown, Ravindra Kumar, Cyber security and Cyber Laws, Cengage Learning.

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Discuss the wireless security issues and threats (PO1,3,4)
2. Explain the transport layer security and address the cyber security issues **(**PO1,3,4)
3. Implement secure permission systems (PO1,3,4)
4. Identify the hacking issues and different types of attacks (PO1,3,4)
5. Implement various ethical hacking issues (PO1,3,4,5)

Semester III
Multicore Architecture and Programming

Course Code: MCS31 **Credits: 3:1:0**
Prerequisites: Computer Organization & Architecture **Contact Hours: 42+28**
Course Coordinator/s: Dr.Shilpa S. Chaudhari / Mr. Mallegowda

Unit I

Introduction to Multi-Core Architecture: Motivation for Concurrency In Software, Parallel Computing Platforms, Parallel Computing In Microprocessors, Differentiating Multi-Core Architectures From Hyper-Threading Technology, Multi-Threading On Single-Core Versus Multi-Core Platforms Understanding Performance, Amdahl‟s Law, Growing Returns: Gustafson‟s Law. System Overview of Threading: Defining Threads, System View of Threads, Threading Above the Operating System, Threads Inside The OS, Threads Inside the Hardware, What Happens When A Thread Is Created, Application Programming Models and Threading, Virtual Environment: Vms And Platforms, Runtime Virtualization, System Virtualization.

Unit II

Fundamental Concepts Of Parallel Programming: Designing For Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You‟ll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of The Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

Unit III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- Based Concepts, Fence, Barrier, Implementation-Dependent Threading Features. Threading Apes: Threading APls for Microsoft Windows, Win32/MFC Thread APls, Threading APls for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

Unit IV

Reductions, Minimizing Threading Overhead, Work-Sharing Sections, Performance Oriented Programming, Using Barrier and No Wait, Loop, Loop-Carried Dependence, Data-Race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of OpenMP: A Portable Solution For Threading: Challenges In Threading A Interleaving Single-Thread And Multi-Thread Execution, Data Copy- In And Copy-Out, Protecting Updates Of Shared Variables, Intel Task Queuing Extension To OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging,Performance.

Unit V

Solutions To Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, And Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions For Heavily Contended Locks, Non-Blocking Algorithms, ABA Problem, Cache Line Ping-Ponging, Memory Reclamation Problem, Recommendations, Thread-Safe Functions And Libraries, Memory Issues, Bandwidth, Working In The Cache, Memory Contention, Cache-Related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High- Level Languages, Avoiding Pipeline Stalls On IA-32,Data Organization For High Performance.

Text Books:

1. Shameem Akhter and Jason Roberts, Multicore Programming, Intel Press,2010.
2. Hennessey and Patterson: "Computer Architecture A Quantitative Approach", Elsevier; 6th edition, 2017.

Reference Book:

1. Kai Hwang, Naresh Jotwani: Advanced Computer Architecture, 3rd Edition, Tata McGraw Hill, 2017.

Course Outcomes (COs):

At the end of the course, the students should be able to:

1. Identify performance related parameters in the field of Computer Architecture. (PO1,3,4)
2. Identify the limitations of ILP and the need for multi-core architectures. (PO1,3,4)
3. Analyze the issues related to multiprocessing and suggest solutions. (PO1,3,4)
4. Appraise the salient features of different multi-core architectures and

how they exploit parallelism. (PO1,3,4)

5. Explain the concept of multi-threading and OpenMP. (PO1,3,4)

Deep Learning

Course Code: MCSE331 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Sangeetha J
Course Contents:

Unit I

Introduction: What is a Neural Network?, The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

Multilayer Perceptrons: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back-Propagation Algorithm Perform Better, Back Propagation and Differentiation.

Unit II

Regularization for Deep Learning: Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Dropout, Adversarial Training.

Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions. Cliffs and Exploding Gradients, Basic Algorithms, Algorithms with Adaptive Learning Rates

Unit III

Convolution neural 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, Convolutional Networks and the History of Deep Learning.

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs

Unit IV

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters,

Debugging Strategies, Example: Multi-Digit Number Recognition.
Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications
Auto-encoders: Under complete Auto-encoders, Regularized Auto-encoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Auto-encoders, Learning Manifolds with Auto-encoders, Contractive Auto- encoders, Predictive Sparse Decomposition, Applications of Auto-encoders.

Unit V

Deep Generative Models: Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Boltzmann Machines for Real-Valued Data, Convolutional Boltzmann Machines, Boltzmann Machines for Structured or Sequential Outputs, Other Boltzmann Machines, Back-Propagation through Random Operations, Directed Generative Nets, Drawing Samples from Autoencoders, Generative Stochastic Networks, Other Generation Schemes, Evaluating Generative Models.

Text Books:

1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

References:

1. Neural Networks and Deep Learning by Michael Nielsen http://neuralnetworksanddeeplearning.com/

Course Outcomes (COs):

At the end of the course, the student will be able to:

1. Illustrate the concepts and applications of single layer and multilayer perceptron. (PO - 1, 2, 3, 4, 5)
2. Illustrate the regularization and optimization for training deep learning models. (PO - 1, 2, 3, 4, 5)
3. Apply deep feed forward networks like convolutional and recurrent recursive nets function to solve practical problems. (PO - 1, 2, 3, 4, 5)
4. Demonstrate the practical methodology, autoencoders and applications of deep learning network. (PO - 1, 2, 3, 4, 5)
5. Design end-to-end deep learning architectures involving various types of deep generative models for practical applications. (PO - 1, 2, 3, 4, 5)

Business Intelligence and its Applications

Course Code: MCSE322 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr.T N R Kumar

Course Contents

Unit I

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved in These Activities, Risks of not Performing Step, Hardware, Middleware, DBMS Platform, Non-Technical Infrastructure Evaluation

Unit II

Managing the BI Project, Defining and Planning the BI Project, Project Planning Activities,
Roles and Risks Involved in these Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

Unit III

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles and Risks Involved in These Activities, Incremental Rollout, Security Management, Database Backup and Recovery

Unit IV

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, the Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, the Intelligence Dashboard

Unit V

Business View of Information Technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.

Text Books:

1. Larissa T Moss and Shaku Atre, Business Intelligence Roadmap, Addison Wesley Information Technology Series 2003.
2. R N Prasad, SeemaAcharya, Fundamentals of Business Analytics, 2nd edition, Wiley India, 2016**.**

Reference Books:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics: Systems for Decision Support, Pearson Education; Tenth edition, 2018.
2. James R Evans, Business Analytics, Third Edition, Pearson, 2021.
3. David Loshin, Business Intelligence: The Savvy Manager's Guide, Morgan Kaufmann
4. Brian Larson, Delivering Business Intelligence with Microsoft SQL Server 2016, 4th edition, McGraw Hill, 2017.
5. Lynn Langit, Smart Business Intelligence Solutions with Microsoft SQL Server 2008, Microsoft Press, 2011.

Course outcomes:

At the end of the course the student will be able to:

1. Explain the complete life cycle of BI/Analytical development (PO 1,2,3,5)
2. Illustrate technology and processes associated with Business Intelligence framework. (PO 1,2,3,5)
3. Illustrate various database design philosophies. (PO 1,2,3,5)
4. Demonstrate the concepts involved in management and release of BI applications, (PO 1,2,3,5)
5. Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal. (PO 1,2,3,5)

Robotic Process Automation

Course Code: MCSE323 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr.Ganeshayya Shidaganti
Course Contents:

Unit I

Programming Basics: Introduction to Programming, Data and Data Structure, Algorithms, Variables and Arguments, Software Application and Software Development Life Cycle (SDLC), Frameworks and Languages

Automation and RPA: History of Automation, Automation and its benefits, Introduction to RPA, Automation vs RPA, Process and Flowchart, RPA Programming Constructs, Robots in RPA, Introduction to Robots, Types of Robots, Benefits and Implementation of RPA

Unit II

RPA Tool Introduction and Basics: RPA Development Life Cycle, How does RPA Work, Challenges in RPA, Variables and Types of Variables, Variables vs. Arguments, Namespaces, and Importing New Namespace.

Control Flow Activity: Sequences, Control Flow and its types, Decision control-IF, Switch, IF vs Switch, Loops-Do While, While, For each, Other control flow activities - Delay, Break, Assign, Continue and Parallel

Unit III

Data Manipulation: Data Manipulation and Its Importance, String Manipulations, Data Table Manipulations, Collection, Its Types and Manipulations.

UI Automation & Selectors: UI interactions, Input actions and Input methods, Containers, Recording & its types, Selectors, Types of Selectors- Full and Partial, Containers and Partial Selectors, Dynamic Selectors

Unit IV

Automation Concepts and Techniques: Desktop and Web Recording, Extraction and its techniques- Screen scraping, Data scraping and PDF Extraction. Automation Techniques- Workbook and Excel automation (read/write).

Mail Automation: Incoming Email automation - Sending Email automation

Unit V

Error and Exception Handling: Errors, Error handling approach, Try Catch, Retry Scope, Exception Handling, Types of Exceptions, Global Exception Handler, Best Practice for Error Handling

Orchestrator: Overview, Orchestrator Functionalities, Orchestrator User Interface- Automations, Management and Monitoring

Text Book:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940.

Reference Books:

1. Frank Casale, Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic ProcessAutomation.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

Course Outcomes :

At the end of the course, students should be able to:

1. Describe the history of automation, Adven of automation and benefits of RPA (PO-1, 2, 3, 4, 5)
2. Demonstrate the use of sequence, flowchart and control flow activities to build workflow in automation (PO-1, 2, 3, 4, 5)
3. Examine the RPA techniques for Data Manipulation and VI automation (PO-1, 2, 3, 4, 5)
4. Experiment the automation concepts and techniques to interact with desktop, web and Email Applications (PO-1, 2, 3, 4, 5)
5. Test the bot using Orchestration server and use exception handling techniques for error free Applications (PO-1, 2, 3, 4, 5)

Software Project Management and Professional Ethics

Course Code: MCSE324 **Credits: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Jayalakshmi D S
Course Contents:

Unit I

Introduction: Importance of Software Project Management, Project, Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Categorizing Software Projects, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, Management and Management Control, Traditional versus Modern Project Management Practices

Project Evaluation and Programme Management: Project Portfolio Management, Evaluation of Individual Projects, Cost-benefit Evaluation Techniques, Risk Evaluation

An Overview of Step Wise Project Planning

Unit II

Selection of an Appropriate Project Approach: Introduction, Build or Buy?, Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods, Extreme Programming (XP), Scrum, Managing Iterative Processes, Selecting the Most Appropriate Process Model.

Software Effort Estimation: Introduction, Where are Estimates Done?, Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Points Mark I, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.

Unit III

Activity Planning: Objectives, When to Plan, Project Schedules, Projects and Activities,

6.6 Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, The Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Network,

Risk Management: Introduction, Risk, Categories of Risk, Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts.

Unit IV

Resource Allocation: Introduction, The Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, The Scheduling Sequence

Monitoring and Control: Introduction, Creating the Framework, Collecting the Data, Review, Project Termination Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM)

Managing Contracts: Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Unit V

Software Quality: Introduction, The Place of Software Quality in Project Planning, The Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans

Working in Teams: Introduction, Becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership

Project Closeout: Reasons for Project closure, project closure process, performing a financial closure, project closeout report

Text book:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", 6th Edition (Special Indian Edition) , McGraw Hill Education, 2017.

Reference Books:

1. Kathy Schwalbe, "Information Technology Project Management", 7th edition, Cengage learning, 2014.
2. Pankaj Jalote, "Software Project Management In Practice", Pearson India; 1st edition, 2016.

Course Outcomes:

At the end of the course, students should be able to:

1. Recognize issues in a realistic project scenario. (PO-1,2, 3,4, 5)
2. Select suitable approaches for project effort estimation. (PO-1,2, 3,4, 5)
3. Plan project activities in consideration with identified project risks. (PO-1, 2, 3,4, 5)
4. Identify suitable methods for resource allocation, project monitoring and control as per the contract. (PO-1,2, 3,4, 5)
5. Appraise the use different software quality models, organizational structures and communication plans to ensure successful project closure. (PO-1,2, 3,4, 5)

INTERNSHIP / INDUSTRIAL TRAINING

Course Code: MCSI33 **Credits:0:0:4**
Prerequisites:Nil **Contact Hours: 28**
Course Coordinator/s: Dr. Shilpa S. Chaudhari

Course Contents:

Internship Work-flow

1. Students submit the initial details including broad area of work and choice of guide in a prescribed format
2. The PG Coordinator along with Head of the department finalizes the guide allocation process
3. Students are given an option to change the guide with mutual consent by applying through prescribed form
4. Students submit the Internship details to guide on the day of registration
5. Problem statement is submitted to PG Coordinator within one week of registration.
6. Students update their progress on weekly basis
7. Weekly meeting with guide is also recorded.
8. Guide evaluates the student on a regular basis according to the rubrics defined in the worksheet for total of 100 marks
9. Evaluation is based on following criteria
    - Tools and technology learnt
    - Relevance of the topic chosen to the current market
    - Report writing
    - Demonstration of tools learnt
    - Presentation of the work carried out as part of internship and viva voce

CourseOutcomes(COs):

At the end of the course students will be able to:

1. Appraise the requirements of the software projects and project managment for instry related projects (PO- 1,2, 3, 4, 5)
2. Design, implement and validate the system according to the requirement and project plan (PO- 1,2, 3, 4)

3. Identify technical tools and technology relavant to inductry project deveopment (PO- 1, 3, 4)
4. Exploit effective tools and techniques for technical report writing and presentation (PO- 1,2, 3, 4, 5)
5. Work in industry driven proejct team (PO- 1, 3, 4, 5)

Project Work - I

Course Code: MCSI34 / MCNI34 **Credits 0: 0: 4**
Prerequisites:Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Shilpa Chaudhari

Course Contents:

Project Work-flow

1. Students submit the broad area of work and choice of guide in a prescribed format.
2. The PG Coordinator along with Head of the department finalizes the guide allocation process.
3. Students are given an option to change the guide with mutual consent by applying through prescribed form.
4. Students submit the project details to guide on the day of registration
5. Problem statement is submitted to PG Coordinator within one week of registration.
6. Students update their progress on weekly basis
7. Weekly meeting with guide is also recorded.
8. Guide evaluates the student on a regular basis according to the rubrics defined in the worksheet for total of 100 marks
9. Evaluation is based on following criteria

- Identification of problem domain, relevance of the topic chosen to the current market
- Study of existing system/literature survey - comparison in terms of various functional and performance parameters
- Identification of research gaps and formulation of problem statement
- Literature survey paper draft preparation/submission/publication
- Objective of the proposed work, methodology and planning for achieving the objectives
- Software requirement specification document preparation
- Initial draft of High level design and low level design document preparation

- Implementation details -Tools and technology to be used
- Demonstration, presentation and viva voce of the work done (in two phases - mid-term review and final review)
- Regularity
- Project phase-I report

Course Outcomes (COs):

At the end of the course students will be able to:

1. Compare and contrast the available literature in the context of the project for formulation of project problem statement (PO- 1,2, 3, 4, 5)
2. Write the research article on the litarature study done (PO- 1,2, 3, 4, 5)
3. Formulate the requirements of the chosen projects and project managment plan (PO- 1,2, 3, 4, 5)
4. Utilize technical tools and technology relavant to the project deveopment (PO- 1, 3, 4)
5. Exploit effective tools and techniques for technical report writing and presentation (PO- 1,2, 3, 4, 5)

Project Work - II

Course Code: MCSP41 **Credits 0: 0: 20**
Prerequisites: Project Work-I **Contact Hours: 56**
Course Coordinator/s: Dr. Shilpa S Chaudhari

Course Contents:

Project Work-flow:

1. Students will continue the work done in project -I. (Course Code: MCSI34 / MCNI34)
2. The PG Coordinator, guide along with Head of the department relook into the project titles and objectives based on the finding from the project work -I (Course Code: MCSI34 / MCNI34).
3. Students are given an option to change problem statement in the same area wherein they done the literature survey in project -I. (Course Code: MCSI34 / MCNI34) by applying through prescribed form.
4. Students submit the project details to guide on the day of registration
5. Revised problem statement is submitted to PG Coordinator within one week of registration.
6. Students update their progress on weekly basis
7. Weekly meeting with guide is also recorded.
8. Guide evaluates the student on a regular basis according to the rubrics defined in the worksheet for total of 100 marks
9. Evaluation is based on following criteria
    - Revised (if necessary)problem statement, objective of the proposed work and methodology used for to achieve the objectives,
    - High level design and low level design document preparation
    - Implementation details -Tools and technology used
    - Research article draft on the original work done - preparation/submission/publication
    - Demonstration, presentation and viva voce of the work done in two phase - mid-term review an final review)
    - Regularity
    - Project phase-II report

CourseOutcomes(COs):

At the end of the course students will be able to:

1. Design the software system using SRS document created in Proejct work-I (PO- 1, 3, 4)
2. Develop the dsigned system using relavant technical tools and technology (PO- 1, 3, 4)
3. Test the developed system for result analysis (PO- 1,2, 3, 4, 5)
4. Write the research article on the original work done (PO- 1,2, 3, 4, 5)
5. Demonstrate the work done with the help of effective tools and techniques for technical report writing and presentation (PO- 1,2, 3, 4, 5)