



RAJALAKSHMI ENGINEERING COLLEGE CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

M.E. COMPUTER SCIENCE AND ENGINEERING REGULATION 2023

Vision

To promote highly ethical and innovative computer professionals through excellence in teaching, training and research.

Mission

- To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.
- To promote research activities amongst the students and the members of faculty that could benefit the society.
- To impart moral and ethical values in their profession.

PROGRAMME OUTCOMES (POs)

The Post Graduate Degree Program in Computer Science and Engineering will prepare students to be able to:

PO1: Independently carry out research /investigation and development work to solve practical problems.

PO2: Write and present a substantial technical report/document.

PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Analyze existing complex problems in an area of specialization; develop innovative and research-oriented methodology to provide ICT based solutions.

PO5: Apply algorithmic principles, computer science theory to design a system that meet the specified needs with appropriate consideration on health and safety, environmental, societal, ethical and sustainable factors.

CURRICULUM

M.E. COMPUTER SCIENCE AND ENGINEERING Regulation 2023 | Total Credits: 70

SEMESTER I								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MH23113	Advanced Statistical Methods	FC	4	3	1	0	4
2.	CP23111	Networking Technologies	PC	3	3	0	0	3
3.	PG23111	Research Methodology and IPR	MC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CP23131	Advanced Data Structures and Algorithms	PC	5	3	0	2	4
5.	CP23132	Advanced Database Technology	PC	5	3	0	2	4
NON CREDIT COURSES								
6.	AC23111	English for Research Writing	MC	3	3	0	0	0
TOTAL				23	18	1	4	18

SEMESTER II								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	CP23211	Advanced Software Engineering	PC	3	3	0	0	3
2.		Program Elective – I	PE	3	3	0	0	3
3.		Program Elective – II	PE	3	3	0	0	3
4.		Program Elective – III	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
5.	CP23231	Applied Machine Learning	PC	5	3	0	2	4
LABORATORY COURSES								
6.	CP23221	Advanced Software Engineering Laboratory	PC	4	0	0	4	2
7.	CP23222	Mini Project with Seminar	EEC	4	0	0	4	2
NON CREDIT COURSES								
7.	AC23211	Constitution of India	MC	3	3	0	0	0
TOTAL				28	18	0	10	20

SEMESTER III								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Program Elective –IV	PE	3	3	0	0	3
2.		Program Elective – V	PE	3	3	0	0	3
3.		Program Elective – VI	PE	3	3	0	0	3
4.		Open Elective	OE	3	3	0	0	3
LABORATORY COURSES								
5.	CP23321	Project Phase – I	EEC	12	0	0	12	6
TOTAL				24	12	0	12	18

SEMESTER IV								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
LABORATORY COURSES								
1.	CP23421	Project Phase – II	EEC	28	0	0	28	14
TOTAL				28	0	0	28	14

Total Credits: 70

PROGRAM ELECTIVES (PE)						
S.No	Course Code	Course Title	L	T	P	C
Data Science						
1.	DS23112	Data Science Foundation	3	0	0	3
2.	CP23A11	Applied Deep Learning	3	0	0	3
3.	CP23A12	Data and Information Visualization	3	0	0	3
4.	CP23A13	Data Analytics	3	0	0	3
5.	DS23A11	AI for Computer Vision	3	0	0	3
6.	DS23B12	Health Care Data Analytics	3	0	0	3
7.	DS23A13	Natural Language Processing and Applications	3	0	0	3
Business Analytics						
1.	CP23B11	Time Series Analysis	3	0	0	3
2.	CP23B12	Statistics for Data Science	3	0	0	3
3.	CP23B13	Database Foundation for Business Analytics	3	0	0	3
4.	DS23B13	Applied Business Analytics	3	0	0	3
5.	CP23B14	Predictive Modelling	3	0	0	3
6.	CP23B15	Prescriptive Analytics	3	0	0	3
7.	CP23B16	Web Analytics	3	0	0	3

OPEN ELECTIVE COURSES OFFERED BY CSE

S.No	Course Code	Course Title	L	T	P	C
1	CP23O11	Cyber Security	3	0	0	3

Credit Distribution

Category	AICTE 2018	R2019	R2023
Mathematical courses FC	3	4	4
Professional core courses PC	19	21	20
Professional Elective courses PE	15	17	18
Open Electives from other technical and /or emerging subjects OE	3	3	3
Project work, seminar and internship in industry or elsewhere EEC	26	22	22
Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] MC	2	3	3
Total	68	70	70

SUMMARY OF ALL COURSES

S.NO	Course Category	Credits per Semester				Total Credits
		1	2	3	4	
1.	FC	4				4
2.	PC	11	9			20
3.	PE		9	9		18
4.	OE			3		3
5.	EEC		2	6	14	22
6.	MC	3				3
	Total	18	20	18	14	70

Subject Code	Course Title	Category	L	T	P	C
MH23113	ADVANCED STATISTICAL METHODS	FC	3	1	0	4

Objectives:

- To provide basic estimation and detection background for engineering applications.
- To explain data, and synthesis of the information to provide valid conclusions using design of experiments.
- To apply the multivariate methods in the framework of the multivariate analysis.
- To distinguish nonparametric methods in estimation, testing, model fitting, and in analyses.
- To analyse the underlying structure(s) and to forecast the trend pattern exhibited by the given data by using various methods.

UNIT-I	ESTIMATION THEORY	12
Unbiased Estimators – method of moments – maximum likelihood estimation - curve fitting by principle of least squares – regression lines		
UNIT-II	LINEAR STATISTICAL MODELS	12
Scatter diagram, Linear regression and correlation. Least squares method. Rank correlation. Multiple regression and multiple correlation, Analysis of variance (one way, two way with and without interaction).		
UNIT-III	MULTIVARIATE ANALYSIS	12
Random vectors and matrices - mean vectors and covariance matrices –multivariate normal density and its properties - principle components population principal components- principle components from standardized variables.		
UNIT-IV	NON PARAMETRIC TESTS	12
Sign test, Wilcoxon signed rank test, Mann Whitney test, Run test, Kolmogorov Smirnov test, Spearman and Kendall's test , Tolerance region.		
UNIT-V	BASICS OF TIME SERIES	12
Stationary, ARIMA models: Identification, estimation and Forecasting		
Total Contact Hours:60		

Course Outcomes: On completion of the course, students will be able to

- Use the main concepts and algorithms of detection and estimation theory for practical applications as well as for their research.
- Interpret data, and synthesis of the information to provide valid conclusions using design of experiments.
- Apply the multivariate methods in the framework of the multivariate analysis.
- Distinguish nonparametric methods in estimation, testing, model fitting, and in analyses.
- Forecast the trend pattern exhibited by the given data by using various methods.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):	
1.	Gupta S.C. and Kapoor V.K, “Fundamentals of Mathematical Statistics”,10 th edition, Sultan and Sons.
2.	Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, 6 th Edition.
3.	Douglas C. Montgomery George, C. Runger “Applied Statistics and Probability for Engineers”, 7 th Edition, (2016), John Wiley & Sons.
4.	Veerarajan T, “Probability, statistics and random process with queueing theory and queueing networks”, 4 th Edition, McGraw - Hill Publishing Company Limited.
5.	Chris Chattfield, “The analysis of Time series: An Introduction”.

Reference Books(s):	
1.	Gupta S.C. and Kapoor V.K, “Fundamentals of Mathematical Statistics”, 10 th edition, Sultan and Sons.
2.	Douglas C. Montgomery George, C. Runger “Applied Statistics and Probability for Engineers”, 7 th Edition, (2016), John Wiley & Sons.
3.	Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, 6 th Edition.
4.	R. Johnson, “Miller & Freund’s Probability and Statistics for Engineers”, (9 th Edition), PHI.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
MH23113.1	1	2	3	-	-
MH23113.2	3	-	2	2	-
MH23113.3	-	-	1	-	3
MH23113.4	2	1	3	2	2
MH23113.5	2	2	1	-	1
AVERAGE	2	1.67	2	2	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
CP23111	NETWORKING TECHNOLOGIES	PC	3	0	0	3

Objectives:	
•	To understand the principles required for network design.
•	To explore various technologies in the wireless domain.
•	To study about 3G and 4G cellular networks.
•	To understand the paradigm of Software defined networks.

UNIT-I	NETWORK DESIGN	9
Advanced multiplexing – CDM, DWDM and OFDM – Shared media networks – Switched networks – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, QoS – End to end level and network level solutions. LAN cabling topologies – Ethernet Switches, Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP – Core networks, and distribution networks.		
UNIT-II	WIRELESS NETWORKS	9
IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX -802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security– IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles		
UNIT-III	CELLULAR NETWORKS	9
GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface –UTRAN –Core and Radio Network Mobility Management – UMTS Security		
UNIT-IV	4G NETWORKS	9
LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks –Scheduling – Mobility Management and Power Optimization – LTE Security Architecture –Interconnection with UMTS and GSM – LTE Advanced (3GPP Release 10) – 4G Networks– Protocol Boosters – Hybrid 4G Wireless Networks Protocols –Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G		
UNIT-V	SOFTWARE DEFINED NETWORKS	9
Introduction to SDN – Control and Data Planes – Open Flow –SDN Controllers – General Concepts –VMWare – VLANs – NVGRE –Data Center – Multi Tenant Data Centre – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework		
		Total Contact Hours : 45

Course Outcomes: On completion of the course, the students will be able to	
•	Identify the components required for designing a network.
•	Design a network at a high-level using different networking technology.
•	Analyze the various protocols of wireless and cellular networks.
•	Discuss the features of 4G and 5G networks.
•	Experiment with software defined networks.

Reference Books(s):	
1	Erik Dahlman, Stefan, Johan Skold, “4G: LTE/LTE-Advanced for Mobile Broadband”, Academic Press, 2013.
2	Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.
3	Larry Peterson and B Davie, “Computer Networks: A Systems Approach”, 5 th edition, Morgan Kauffman, 2011
4	Paul Goransson, C. Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kauffman, 2014.
5	Thomas D. Nadeau and Ken Gray, “SDN Software Defined Networks”, O’Reilly, 2013.
6	Ying Dar Lin, Ren Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2011.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
CP23111.1	2	-	2	1	-
CP23111.2	2	-	2	1	1
CP23111.3	2	-	2	2	1
CP23111.4	2	-	2	2	1
CP23111.5	2	-	2	2	1
AVERAGE	2	-	2	2	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
PG23111	RESEARCH METHODOLOGY AND IPR	MC	3	0	0	3

Objectives:	
•	To inculcate the importance of research methodology and Intellectual Property Rights. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
•	To get registration of patents in our country and foreign countries of invention, designs and thesis or theory written. To get knowledge of patents, copy right, trademarks and designs

UNIT-I	FUNDAMENTALS OF RESEARCH METHODOLOGY	9
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations		
UNIT-II	REVIEW OF LITERATURE AND TECHNICAL WRITING	9
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal.		
UNIT-III	INTELLECTUAL PROPERTY RIGHTS	9
Nature of Intellectual Property: Patents, Designs, Trade and Copyright, copyright registration in India Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under Patent Cooperation Treaty.		
UNIT-IV	PATENT RIGHTS AND RECENT DEVELOPMENTS IN IPR	9
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies.		
UNIT-V	INDUSTRIAL DESIGNS AND GEOGRAPHICAL INDICATIONS	9
Industrial designs and IC Layout design, Registrations of designs, conditions and procedures of industrial designs- Cancellation of Registration, International convention of design- types and functions. Semiconductor Integrated circuits and layout design Act- Geographical indications-potential benefits of Geographical Indications		
		Total Contact Hours : 45

Course Outcomes: On completion of the course, the students will be able to	
•	Apply knowledge on research problem formulation and analyze research related information
•	Apply IPR concept to important place in growth of individuals & nation.
•	Describe the importance of copyright and industrial designs.
•	Apply patent right to new products developed.
•	Describe the procedure and the tools to get patent copy right for their innovative work.

Reference Books(s):	
1	Neeraj Pandey and Khushdeep D, "Intellectual Property Rights", 1 st edition, PHI learning Pvt. Ltd., Delhi, 2014.
2	Uma Sekaran and Roger Bougie, "Research methods for Business", 5 th Edition, Wiley India, New Delhi, 2012.
3	Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", 2 nd edition, Juta Academic, 2001.
4	Ramakrishna B & Anilkumar H S, "Fundamentals of Intellectual Property Rights", 1 st Ed. Notion Press, 2017.
5	William G Zikmund, Barry J Babin, Jon C. Carr, Atanu Adhikari, Mitch Griffin, "Business Research methods, A South Asian Perspective", 8 th Edition, Cengage Learning, New Delhi, 2012.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
PG23111.1	3	1	1	3	2
PG23111.2	1	-	1	2	3
PG23111.3	2	2	2	2	3
PG23111.4	2	1	2	3	3
PG23111.5	2	2	3	3	2
AVERAGE	2.0	1.5	1.8	2.6	2.6

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
CP23131	ADVANCED DATA STRUCTURES AND ALGORITHMS	PC	3	0	2	4

Objectives:						
•	To understand the usage of algorithms in computing.					
•	To learn and use hierarchical data structures and its operations.					
•	To learn the usage of graphs and its applications.					
•	To select and design data structures and algorithms that is appropriate for problems.					
•	To study about NP Completeness of problems.					

UNIT-I	ROLE OF ALGORITHMS IN COMPUTING	9
Algorithms –Introduction: Classical Algorithms–Analyzing Algorithms – Designing Algorithms– Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions– Solving Recurrences: The Substitution Method – Master theorem method– The Recursion–Tree Method.		
UNIT-II	HIERARCHICAL DATA STRUCTURES	9
Binary Search Trees: Basics –Insertion, Deletion and Search– Red-Black Trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion –B-Trees: Definition– Basic operations on B-Trees – Deleting a key from a B-Tree– Fibonacci Heaps: structure – Merge able-heap operations– Decreasing a key and deleting a Node–Bounding the maximum degree.		
UNIT-III	GRAPHS	9
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components– Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim– Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra’s Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd, Warshall Algorithm, Johnson’s algorithm for sparse graphs.		
UNIT-IV	ALGORITHM DESIGN TECHNIQUES	9
Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming –Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy– Huffman Codes.		
UNIT-V	NP COMPLETE AND NP HARD	9
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP-Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems		
Contact Hours		: 45

List of Experiments			
1	Implementation of graph search algorithms.		
2	Implementation and application of network flow and linear programming problems.		
3	Implementation of algorithms using dynamic programming techniques.		
4	Implementation of recursive backtracking algorithms.		
5	Implementation of randomized algorithms.		
6	Implementation of various locking and synchronization mechanisms for concurrent linked lists, concurrent queues and concurrent stacks.		
7	Developing applications involving concurrency.		
		Contact Hours	: 30
		Total Contact Hours	: 75

Platform Needed:	
HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

Course Outcomes: On completion of the course, the students will be able to	
•	Design data structures and algorithms to solve computing problems.
•	Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.
•	Understand the importance of Graphs and its applications.
•	Apply suitable design strategy for problem solving.
•	Differentiate NP complete and NP hard.

Reference Books(s):	
1	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2006.
2	Robert Sedgewick and Kevin Wayne, “Algorithms”, Fourth Edition, Pearson Education.
3	S. Sridhar, “Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
4	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, Prentice-Hall, 2011.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
CP23131.1	3	-	1	2	-
CP23131.2	2	-	1	1	1
CP23131.3	3	-	2	1	-
CP23131.4	2	-	1	2	1
CP23131.5	2	-	2	1	1
AVERAGE	2	-	1	1	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
CP23132	Advanced Database Technology	PC	3	0	2	4

Objectives:	
•	To acquire knowledge on parallel and distributed databases and its applications.
•	To study the usage and applications of Object-Oriented database.
•	To understand the principles of intelligent databases.
•	To learn emerging databases such as XML, Cloud and Big Data.
•	To acquire inquisitive attitude towards research topics in databases.

UNIT-I	PARALLEL AND DISTRIBUTED DATABASES	9
Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems– Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems– Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies		
UNIT-II	OBJECT AND OBJECT RELATIONAL DATABASES	9
Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.		
UNIT-III	EMERGING TECHNOLOGIES	9
XML Databases: XML–Related Technologies–XML Schema– XML Query Languages– Storing XML in Databases– XML and SQL– Native XML Databases– Web Databases– Cloud Based Databases: Data Storage Systems on the Cloud– Cloud Storage Architectures–Cloud Data Models– Query Languages		
UNIT-IV	BIG DATA STORAGE ANALYSIS	9
Big Data introduction: The Hadoop ecosystem– Querying big data with Hive: Introduction, From SQL to HiveQL– Introduction to HIVE e HIVEQL – Using Hive to query Hadoop files.		
UNIT-V	INTELLIGENT DATABASES	9
Active databases – Deductive Databases – Knowledge bases – Multimedia Databases– Multidimensional Data Structures– Image Databases – Text/Document Databases– Video Databases – Audio Databases – Multimedia Database Design.		
Contact Hours		: 45

List of Experiments	
A	<p>Data Definition Language</p> <ul style="list-style-type: none"> • Create, Alter and Drop • Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints • Creating Views <p>Data Manipulation Language</p> <ul style="list-style-type: none"> • Insert, Delete, Update • Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join • Aggregate Functions • Set Operations • Nested Queries <p>Transaction Control Language</p> <ul style="list-style-type: none"> • Commit, Rollback and Save Points
B	<ul style="list-style-type: none"> • Distributed Database Design and Implementation • Row Level and Statement Level Triggers • Accessing a Relational Database using PHP, Python and R

C	<ul style="list-style-type: none"> • Creating XML Documents, Document Type Definition and XML Schema • Using a Relational Database to store the XML documents as text • Using a Relational Database to store the XML documents as data elements • Creating or publishing customized XML documents from pre-existing relational databases • Extracting XML Documents from Relational Databases • XML Querying 			
D	<ul style="list-style-type: none"> • Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j. • Writing simple queries to access databases created using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j 			
E	<ul style="list-style-type: none"> • Implementing Access Control in Relational Databases 			
F	Documenting the project			
		Contact Hours	:	30
		Total Contact Hours	:	75

Platform Needed:	
HARDWARE :	Personal Computer with Dual Core Processor with 8 GB RAM.
SOFTWARE :	AGRO UML/STAR UML for Design
	Selenium/Junit (any automated testing software) for testing
	Jile Software/Jeera (any Agile planning Software) to do agile planning

Course Outcomes: On completion of the course, the students will be able to	
•	Model and represent the real-world data using object-oriented database.
•	Design a semantic based database to meaningful data access.
•	Embed the rule set in the database to implement intelligent databases.
•	Represent the data using XML database for better interoperability.
•	Handle Big data and manipulate using HIVE.

Reference Books(s):	
1	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 5 th Edition, Pearson Education, 2007
2	Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 3 rd Edition, Pearson Education, 2007.
3	Henry F Korth, A. Silberschatz, S. Sudharshan, "Database System Concepts", 5 th Edition, McGraw Hill, 2006.
4	Simon St. Laurent and Michael Fitzgerald, "XML Pocket Reference", 3 rd Edition, O'Reilly, 2012.

CO - PO matrices of course

PO	PO1	PO2	PO3	PO4	PO5
CO					
CP23132.1	-	3	-	-	-
CP23132.2	2	-	3	2	-
CP23132.3	2	3	-	2	-
CP23132.4	3	-	-	2	1
CP23132.5	-	-	-	3	2
AVERAGE	2.3	3.0	3.0	2.3	1.5

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

Subject Code	Course Title	Category	L	T	P	C
AC23111	ENGLISH FOR RESEARCH WRITING	MC	3	0	0	0

Objectives:	
•	To express technical ideas in writing.
•	To plan and organize the research paper.
•	To understand the structure and familiarize the mechanics of organized writing.
•	To improvise academic English and acquire research writing skills.

UNIT-I	INTRODUCTION TO RESEARCH WRITING	9
Research – Types of Research – Selecting the Primary resources – Categorizing secondary sources – Discovering a researchable area and topic – Need Analysis – Research Question–Focusing on the Research Problem–Developing Research Design – Framing the Hypothesis – Identifying the Scope of the Research – Writing – General and Academic Writing.		
UNIT-II	LANGUAGE OF WRITING	9
Active reading – text mining – use of academic words – jargons – ambiguities – use of expression – use of tense - proper voices – third person narration – phraseology – use of foreign words – use of quotes – interpreting quotes.		
UNIT-III	THE FORMAT OF WRITING	9
Types of Journals – different formats and styles – IEEE format – Structure – Margins – Text Formatting – Heading and Title – Running Head with Page Numbers – Tables and illustrations – Paper and Printing – Paragraphs – Highlighting – Quotation – Footnotes.		
UNIT-IV	ORGANISING A RESEARCH PAPER	9
Title- Abstract – Introduction – Literature review – Methodology – Results –Discussion –Conclusion – Appendices – Summarizing– Citation and Bibliography.		
UNIT-V	PUBLISHING PAPER	9
Finding the Prospective publication or Journal –analyzing the credits – Reviewing – Revising – Plagiarism Check – Proof reading – Preparing the Manuscript– Submitting – Resubmitting – Follow up – Publishing.		
Total Contact Hours		: 45

Course Outcomes:	
On completion of the course, the students will be able to	
•	Understand the basic structure of research work.
•	Apply proper use of language in writing paper.
•	Comprehend different formats of journal paper.
•	Learn the process of writing a research paper.
•	Know the process of publishing journal paper.

Reference Books(s):	
1	Adrian Wallwork, “English for Writing Research Papers”, Springer Science Business Media, 2 nd Edition, 2011.
2	Stephen Howe and Kristina Henriksson, “Phrasebook for Writing Papers and Research in English”, The Whole World Company Press, Cambridge, 4 th Edition 2007
3	The Modern Language Association of America, “MLA Handbook for Writers of Research Papers” 8 th Edition, The Modern Language Association of America, 2016
4	Rowena Murray, “The Handbook of Academic Writing: A Fresh Approach”, Sarah Moore Open University Press, 2006.
5	Stephen Bailey: “Academic Writing: A Practical Guide for Students”, Routledge Falmer, 2003
6	Joseph M. Moxley, “Publish, Don't Perish: The Scholar's Guide to Academic Writing and Publishing”, Praeger Publishers, 1992

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
AC23101.1	1	1	1	1	1
AC23101.2	2	2	2	2	2
AC23101.3	3	3	3	3	3
AC23101.4	3	3	3	3	3
AC23101.5	3	3	3	3	3
AVERAGE	2.4	2.4	2.4	2.4	2.4

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
CP23211	ADVANCED SOFTWARE ENGINEERING	PC	3	0	0	3

Objectives:	
•	To understand basic concepts of software engineering and agile methodology.
•	To analyze and design a software project with Unified Process.
•	To do project management and cost estimation.
•	To understand software testing approaches.
•	To be familiar with advance software engineering concepts.

UNIT-I	INTRODUCTION	9
Software engineering concepts – Development activities – Software lifecycle models – Rational unified process–Agile methods– Project Management– Project Planning		
UNIT-II	REQUIREMENTS ENGINEERING	9
Software Requirements: Functional and Non-Functional requirements– User Requirements– System Requirements – Requirements elicitation and analysis–Requirement Discovery– Requirements Validation and Management		
UNIT-III	ARCHITECTURE AND DESIGN	9
Architectural patterns – Design patterns – Modeling Data – Object-oriented design using the UML Data Flow Diagrams– Software Implementation Techniques–Coding Practices–Refactoring.		
UNIT-IV	TESTING	9
Software Testing – Software testing strategies – Testing Conventional applications – OO Testing – Development testing– Test-driven development– Release testing– User testing – Software maintenance Quality Management		
UNIT-V	ADVANCE SOFTWARE ENGINEERING	9
Software Reuse–Component based software engineering–Distributed software engineering – Distributed software Engineering		
Total Contact Hours		: 45

Course Outcomes: On completion of the course, the students will be able to	
•	Gain knowledge on project management approaches as well as cost and schedule estimation strategies.
•	Use UML diagrams for analysis and design.
•	Architect and design using architectural styles and design patterns.
•	Understand software testing approaches.
•	Understand the concepts to design advance software engineering concepts.

Reference Books(s):	
1	Ian Sommerville, “Software Engineering”, 9th edition, 2010, Pearson Education.
2	Roger S, “Software Engineering – A Practitioner’s Approach”, 7 th Edition, Pressman, 2010.
3	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
CP19103.1	1	-	-	-	2
CP19103.2	2	3	3	3	2
CP19103.3	1	3	3	3	2
CP19103.4	2	-	3	3	2
CP19103.5	-	-	3	2	2
AVERAGE	1.5	2.3	3.0	2.8	2.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”

Subject Code	Course Title	Category	L	T	P	C
CP23231	APPLIED MACHINE LEARNING	PC	3	0	2	4

Objectives:	
•	To introduce students to the basic concepts and techniques of Machine Learning.
•	To have a thorough understanding of the Supervised learning techniques
•	To have a thorough understanding of the Unsupervised learning techniques
•	To study the various probability-based learning techniques
•	To understand graphical models of machine learning algorithms

UNIT-I	INTRODUCTION	9
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Regression.		
UNIT-II	LINEAR MODELS	9
Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.		
UNIT-III	TREE AND PROBABILISTIC MODELS	9
Learning with Trees – Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.		
UNIT-IV	DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS	9
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms –Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.		
UNIT-V	GRAPHICAL MODELS	9
Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods		
		Contact Hours
		: 45

List of Experiments			
1	Demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples..		
2	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.		
3	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.		
4	Apply k-Means algorithm to cluster a set of data stored in a .CSV file and comment on the quality of clustering.		
5	Interpret the results of PCA analysis .		
6	Implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.		
		Contact Hours	: 30
		Total Contact Hours	: 75

Platform Needed:	
HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Tools : SAS / NumPy, Software: Weka, TensorFlow, RapidMiner.

Course Outcomes:

On completion of the course, the students will be able to

•	Understand the concept of machine learning fundamentals
•	Apply the appropriate machine learning strategy for linear and graphical model
•	Apply the tree and probabilistic approach in learning
•	Analyze the evolutionary model in machine learning
•	Design and develop machine learning applications using the following Tools : SAS / NumPy, Software: Weka, TensorFlow, RapidMiner.

Reference Books(s):

1	Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014
2	Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014
3	Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
4	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
CP23231.1	3	-	1	2	-
CP23231.2	2	-	1	1	1
CP23231.3	3	-	2	1	-
CP23231.4	2	-	1	2	1
CP23231.5	2	-	2	1	1
AVERAGE	2	-	1	1	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

Course Code	Course Title	Category	L	T	P	C
CP23221	Advanced Software Engineering Laboratory	PC	0	0	4	2

Objectives:

●	To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web
●	Present case studies to demonstrate practical applications of different concepts.
●	Provide a scope to students where they can solve small, real-life problems.

List of Experiments	
1.	Write a Problem Statement to define a title of the project with bounded scope of project
2.	Select relevant process model to define activities and related task set for assigned project
3.	Prepare broad SRS (Software Requirement Specification) for the above selected projects
4.	Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5.	Develop the activity diagram to represent flow from one activity to another for software development
6.	Develop data Designs using DFD Decision Table & ER Diagram
7.	Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned project
8.	Write Test Cases to Validate requirements of assigned project from SRS Document
9.	Evaluate Size of the project using function point metric for the assigned project
10.	Estimate cost of the project using COCOMO and COCOMOII for the assigned project
11.	Use CPM/PERT for scheduling the assigned project
12.	Use timeline Charts or Gantt Charts to track progress of the assigned project
Total Contact Hours :	
60	

Course Outcomes:

On completion of the course students will be able to:	
●	Can produce the requirements and use cases the client wants for the software being Produced.
●	Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture
●	create and specify such a software design based on the requirement specification that the software can be implemented based on the design.
●	Can assess the extent and costs of a project with the help of several different assessment methods.

CO - PO – PSO matrices of course

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5
CO					
CP23221.1	3	3	3	3	3
CP23221.2	2	3	3	3	2
CP23221.3	3	1	2	2	-
CP23221.4	2	3	1	2	-
Average	1.5	1.5	2.25	1.5	1.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-“

Subject Code	Subject Name (Non-Credit course)	Category	L	T	P	C
AC23211	CONSTITUTION OF INDIA	MC	3	0	0	0

Objectives:	
•	To inculcate the values enshrined in the Indian constitution.
•	To create a sense of responsible and active citizenship.
•	To know about Constitutional and Non-Constitutional bodies
•	To understand sacrifices made by the freedom fighters.

UNIT-I	Introduction	9
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Features – Basic Structure – Preamble.		
UNIT-II	Union Government	9
Union and its territory – Citizenship – Fundamental Rights – Directive Principles of State Policy (DPSP) – Fundamental Duties. Union Government: Executive, Legislature and Judiciary: President – Vice President – Prime Minister – Central Council of Ministers – Cabinet Committees – Parliament: Committees, Forums and Groups – Supreme Court.		
UNIT-III	State Government & Union Territories	9
State Government: Executive, Legislature and Judiciary–Governor - Chief Minister – State Council of Ministers – State Legislature – High Court – Subordinate Courts –Panchayat Raj – Municipalities–Union Territories –Scheduled and Tribal Areas.		
UNIT-IV	Relations Between Union and States	9
Relations between Union and States – Services under Union and States. Cooperative Societies – Scheduled and Tribal Areas – Finance, Property, Contracts and Suits – Trade and Commerce within Indian Territory – Tribunals.		
UNIT-V	Constitutional Bodies and Amendments	9
Introduction to Constitutional & Non-Constitutional Bodies–Elections – Special Provisions relating to certain classes – Languages - Emergency Provisions – Miscellaneous – Amendment of the Constitution – Temporary, Transitional and Special Provisions – Short title, date of commencement, Authoritative text in Hindi and Repeals. Schedules of the Constitution of India – Appendices in the Constitution of India.		
Total Contact Hours		: 45

Course Outcomes:	
On completion of the course, the students will be able to:	
•	Appreciate the philosophical foundations of the Indian Constitution.
•	Understand the functions of the Indian government.
•	Understand and abide the rules of the Indian constitution.
•	Gain knowledge on functions of state Government and Local bodies.
•	Gain Knowledge on constitution functions and role of constitutional bodies and amendments of constitution.

Reference Books(s):	
1	M Lakshmikanth “Indian Polity”, McGraw Hill Education, 5 th edition 2017.
2	Durga Das Basu, “Introduction to the Constitution of India “, Lexis Nexis, New Delhi., 21 st edition, 2013.
3	Sharma, Brij Kishore, “Introduction to the Constitution of India”, PHI, New Delhi, 7 th edition, 2015.
4	Subhash Kashyap, “Our Constitution: An Introduction to India’s Constitution and Constitutional Law”, National Book Trust India, 1994.
5	Mahendra Prasad Singh and Himanshu Roy, “Indian Political System”, Pearson India, 4 th edition, 2017.

CO - PO matrices of course

PO CO	PO1	PO2	PO3	PO4	PO5
AC19201.1	-	-	1	-	2
AC19201.2	-	-	1	-	2
AC19201.3	-	-	1	-	2
AC19201.4	-	-	1	-	2
AC19201.5	-	-	1	-	2
AVERAGE	0	0	1	0	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : “-”