SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

(Deemed to be University U/S 3 of UGC Act 1956) (Accredited with "A" Grade by NAAC)

Enathur, Kanchipuram – 631561

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS FOR FULL TIME

M.E. (Computer Science and Engineering)

(Applicable for students admitted from 2024-2025 onwards)

M.E. COMPUTER SCIENCE AND ENGINEERING

These regulations are applicable to the students admitted from the AY 2024-25 Onwards.

CHOICE BASED CREDIT SYSTEM FOR M.E.(CS) FULL-TIME / PART TIME MODE PROGRAMME

ELIGIBILITY

Candidates for the admission to the first year course leading to the degree of M.E(CSE) will be required to possess:

1. A pass in B.E / B.Tech degree examination in Computer Science and Engineering (or) Information Technology (or) Electrical and Electronics Engineering (or) Electronics and Instrumentation (or) Electronics and Communication Engineering with atleast 50% of marks. (or)
2. A pass in M.Sc in Computer Science or Information Technology with atlest 50% of marks. (or)
3. A pass in M.C.A with atleast 50% of marks.

CREDITS

Each course is normally assigned one credit per lecture per week and one credit for two periods of tutorials or part thereof for laboratory or practical per week.

Each semester curriculum shall normally have a blend of theory and practical courses. The Total credits for the entire degree course will be 80. For the award of the degree a student has to earn a minimum of 80 credits.

DURATION OF THE PROGRAMME

A student is normally expected to complete M.E(CS) programme in two years in the case of full time and three years for part time mode. But in any case not more than four years for full time and five years for part time mode from the time of admission.

REGISTRATION FOR COURSES

A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option.

Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the dean on the recommendation of the head of the department along with a late fee will be done, up to the last working day.

ASSESSMENT

The break-up of assessment and examination marks for theory subjects is as follows.

First Assessment Test	:	15 Marks
Second Assessment Test	:	15 Marks
Assignment & Attendance	:	10 Marks
Total (Internal Marks)	:	40 Marks
End semester Examination (External Marks)	:	60 Marks
Total (Internal + External)	:	100 Marks

The break-up of the assessment and examination marks for practical is as follows.

Observations	:	15 Marks
Model Test	:	15 Marks
Record book & Attendance	:	10 Marks
Total (Internal Marks)	:	40 Marks
End semester Examination (External Marks)	:	60 Marks
Total (Internal + External)	:	100 Marks

The project work will be carried out in the final semester in two phases first phase in pre final semester and second phase in final semester. The project work will be assessed for 40 marks by a committee consisting of the guide and a minimum of two members nominated by the head of the department. The head of the department may himself be a member or the chairman. 60 marks are allotted for the project work and viva voce examination at the end of the final semester.

STUDENT COUNSELLOR

To help the students in planning their course of study and for general advice on the academic programme, the head of the department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the head of the department.

CLASS COMMITTEE

For each semester separate class committee will be constituted by the head of the department. The composition of the class committee will be as follows.

Course co-ordinators of the entire course shall be appointed by the head of the department from among the staff members teaching the course.

A project co-ordinator shall be appointed by the head of the department from among the project supervisors.

Teaching staff of other individual courses

One professor or reader, preferably not teaching the concerned class, appointed by the head of the department.

The head of the department may opt to be a member or the chairman.

All student counsellors of the class, and the head of the department (if not already a member) or any staff member nominated by the head of the department may opt to be special invitees.

The class committee shall meet three times during the semester

The first meeting will be held within two weeks from the date of class commencement in which type of assessment like test, assignment etc for the first and second assessments and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The second meeting will be held within a week after the second assessment is completed to review the performance and for follow-up action.

The third meeting will be held after all the assessments are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 40 marks will be finalised for every student and tabulated and submitted to the head of the department for approval and transmission to the controller of examinations.

WITHDRAWAL FROM A COURSE

A student can withdraw from a course at any time before a date fixed by the head of the department prior to the second assessment, with the approval of the dean of the faculty on the recommendation of the head of the department.

TEMPORARY BREAK OF STUDY

A student can take a one-time temporary break of study covering the current year / semester and / or the next semester with the approval of the dean on the recommendation of the head of the department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire programme within the maximum period of four years for part time mode and five years for part time mode .

SUBSTITUTE ASSESMENT

A student who has missed, for genuine reasons accepted by the head of the department, one or more of the assessments of a course other than the examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the head of the department within a week from the date of the missed assessment.

ATTENDANCE REQUIREMENTS

To be eligible to appear for the examination in a particular course, a student must put in a minimum of 80% of attendance in the course. However, if the attendance is 70% or above but less than 80% in any course, the authorities can permit the student to appear for the examination in the course on payment of the prescribed condonation fee.

A student who withdraws from or does not meet the minimum attendance requirement in course must re-register for and repeat the course.

PASSING AND DECLARATION OF EXAMINATION RESULTS

All assessments of all the courses on the absolute mark basis will be considered and pass by the results passing board in accordance with the rules of the university. Thereafter, the controller of examinations shall convert the marks for each courses to the corresponding letter grade as follows, compute the grade point average and cumulative grade point average, and prepare the grade cards.

90 to 100 marks	-	Grade 'S'
80 to 89 marks	-	Grade 'A'
70 to 79 marks	-	Grade 'B'
60 to 69 marks	-	Grade 'C'
55 to 59 marks	-	Grade 'D'
50 to 54 marks	-	Grade 'E'
less than 50 marks	-	Grade 'F'
Insufficient attendance	-	Grade 'I'
Withdrawn from the course	-	Grade 'W'

A student who obtains less than 50 marks out of 100 in the subject or is absent for the examination will be awarded Grade 'F'.

A student who earns a grade of S,A,B,C,D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade F in a course has to reappear for the examination in that course.

A student who obtains letter grade I or W in a course has to re-register for and repeat the course.

The following grade points are associated with each letter grade for calculating the grade point average.

S – 10;   A-9;   B-8;   C-7;   D-6;   E-5;   F-0

Course with grades I and W are not considered for calculation of grade point average or cumulative grade point average. F Grade will be considered for computing GPA and CGPA.

A student can apply for retotaling of one or more of his examination answer papers within a week from the date of issue of grade sheet to the student on payment of the prescribed fee per paper. The application must be made to the controller of examinations with the recommendation of the head of the department.

After results are declared, grade cards will be issued to the students. The grade card will contain the list of courses registered during the semester, the grades scored and the grade point average(GPA) for the year/semester.

GPA is sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the Semester , divided by the sum of the number of credits for all courses taken in that semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

For First Class with Distinction the student must earn a minimum of 73 credits within two years for full time mode and three years for part time mode from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class the student must earn a minimum of 73 credits within three years for full time mode and four years for part time mode from the time of admission and obtain a CGPA of 6.5 or above.

For Second Class the student must earn a minimum of 73 credits within four years for full time mode and five years for part time mode from the time of admission

ELECTIVES

Apart from the various elective courses offered in the curriculum of the branch of specialization, a student can choose electives from any specialization under the faculty during the entire period of study, with the approval of the head of the department offering the course. Some of the electives have lab components along with theory and hence have more credits than the electives which are only theoretical.

M.E PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. The graduates of Computer Science and Engineering would demonstrate an exceptional involvement and active participation in Research and Development related to Computer Science and Engineering through precise education

II. The graduates of Computer Science and Engineering would practice their careers in industry/academia/research/ government with a strong foundation and in-depth knowledge

III. The graduates of Computer Science and Engineering would analyze, design and create products, solutions to problems with good scientific and engineering breadth

IV. The graduates of Computer Science and Engineering would demonstrate professional expertise by communicating their engineering ideas and solutions ethically to the society.

PROGRAMME OUTCOMES (POs)

Post Graduating student of Computer Science and Engineering programme will be able to

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.

b) Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.

c) Design a system component or process to meet desired needs with realistic constraints such as economic, environmental, social, ethical, manufacturability and sustainability.

d) Define, assess, tailor the software quality practices and software processes with methodologies for appropriate application on software development projects in various domain areas.

e) Identify, analyze, formulate and solve engineering problems

f) Understand the impact of engineering solutions in a global, economic, environmental and societal context.

g) Recognize the necessity and ability to engage in life-long learning.

h) Acquire the knowledge of contemporary issues.

i) Use the techniques, skills and modern Engineering tools necessary for engineering practice.

j) Pursue life-long learning through post graduate education, participation in professional activities or the acquisition of new technical proficiencies with managerial and leadership skills.

PROGRAMME EDUCATIONAL OBJECTIVES PROGRAM OUTCOMES MAPPING

			Programme Educational Objective(s)	Program Outcome(s)
PEO:	I		Provide engineering insight to problem solving to succeed in Technical Profession through precise education and to prepare students to excel in research	a), b) and c)
PEO:	II		II Strengthen foundation and depth for successful Computer Science and Engineering careers in industry, academia, research or government	d) and f)
PEO:	III		Equip with good scientific and engineering breadth so as to analyze, design and create products, solutions to problems in the area of Computer Science and Engineering	e), g) and h)
PEO:	IV		Demonstrate professional expertise by communicating their engineering ideas and solutions ethically to the society	i) and j)

M.E. (Computer Science and Engineering)
__SEMESTER – I__

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1.	1CS01	Program Core-I for (Advanced Mathematics for Computer Science)	3	1	0	4
2.	1CS02	Program Core-II (Advanced Data Structures & Algorithm)	3	1	0	4
3.	1CS03	Program Core-III Advanced Computer Architecture	3	1	0	4
4.	1CSEC-01	Program Elective-I (Data Science)	3	0	0	3
		Program Elective-I (AI & Machine Learning)	3	0	0	3
		Program Elective-I (Distributed Systems)	3	0	0	3
5.	1ARM01	Research Methodology and IPR	2	0	0	2
6.	1AAC-01	Audit Course	2	0	0	0
7.	1CS04	Laboratory – I (Advanced Data Structures & Algorithm lab)	0	0	4	2
8.	1CS05	Laboratory – II (Data Science Lab)	0	0	4	2
		Laboratory – II (Machine Learning Lab)	0	0	4	2
		Laboratory – II (Distributed Systems Lab)	0	0	4	2
Total			**16**	**3**	**8**	21

SEMESTER – II

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1.	2CS06	Program Core-IV Data Analytics	3	1	0	4
2.	2CS07	Program Core-V (Soft Computing)	3	1	0	4
3.	2CSEC-02	Program Elective-II (Data Preparation and Analysis)	3	0	0	3
		Program Elective-II (Secure Software Design & Enterprise Computing)	3	0	0	3
		Program Elective-II (Computer Vision)	3	0	0	3
4.	2CSEC-03	Program Elective-III (Human and Computer Interaction)	3	0	0	3
		Program Elective-III (GPU Computing)	3	0	0	3
5.	2CS08	Laboratory-III (Data Analytics Lab)	0	0	4	2
6.	2CS09	Laboratory-IV (Human and Computer Interaction Lab)	0	0	4	2
		Laboratory-IV (GPU Computing Lab)	0	0	4	2
7.	2CS10	Mini Project with Seminar	2	0	0	2
Total			**14**	**2**	**8**	**20**

SEMESTER – III

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1.	3CSEC-04	Program Elective-IV (Mobile Applications and Services)	3	0	0	3
		Program Elective-IV (Compiler for HPC)	3	0	0	3
		Program Elective-IV (Optimization Techniques)	3	0	0	3
2.	3CSEC-05	Open Elective (Business Analytics)	3	0	0	3
		Open Elective (Cost Management of Engineering Projects)	3	0	0	3
		Open Elective (Software Project Management)	3	0	0	3
		Open Elective (Software Architecture)	3	0	0	3
3.	3CS11	Dissertation-I/Project Work – I	0	0	20	**10**
		Total	**6**	**0**	**20**	**16**

SEMESTER – IV

Sl. No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1.	4CS12	Dissertation-II/Project Work – II	0	0	32	16
		Total	**0**	**0**	32	16

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Stress Management by Yoga
6. Personality Development through Life Enlightenment Skills.

I - SEMESTER

Course Title	ADVANCED MATHEMATICS FOR COMPUTER SCIENCE	L	T	P	C
Course Code		3	1	0	4

OBJECTIVES

- To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	To understand the basic notions of discrete and continuous probability.
2.	To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
3.	To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

UNIT – I	

Random variables – Events – Distribution functions – Discrete random variables – Continuous random variables – Moments of random variables – Expectation – Moments – Variance – Conditional expectation – The Chebyshev inequality – The Markov inequality – Special Probability Distributions: Bernoulli, Binomial, Negative binomial, Poisson, Exponential, Uniform, Normal.

UNIT – II	

Statistical inference: Parameter estimation – Method of moments – Maximum – Likelihood estimation – Confidence intervals – Sampling from the: Normal, Exponential, Poisson, Bernoulli distributions.

UNIT – III	

Regression – Introduction – Least-squares Curve Fitting – The Coefficients of Determination – Confidence Intervals in Linear Regression – Trend Detection and Slope Estimation – Correlation Analysis.

UNIT – IV	

Graph Theory: Isomorphism-Planar graphs - Graph colouring - Hamilton circuits and Euler cycles.
General Counting Methods for Arrangements and Selections: Basic counting principles - Simple arrangements and selections - Arrangements and selections with repetitions - Specialized techniques to solve combinatorial enumeration problems: Counting with venn diagrams - Inclusion-Exclusion formula - Restricted positions and Rook polynomials.

UNIT – V	

Recent Trends In Various Distribution Functions In Mathematical Field Of Computer Science For Varying Fields Like Bio-Informatics and Soft Computing.	
REFERENCES	
1.	Oliver C.Ibe, Fundamentals of Applied Probability and Random Processes, Academic Press. Unit I: Chapters 2, 3 and 4
2.	K.Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, Wiley Unit II: Chapter 10 : 10.1 to 10.2.3 Unit III: Chapter 11: 11.1 to 11.6
3.	Alan Tucker, Applied Combinatorics, Wiley Unit-IV: Chapters: 1.2, 1.4, 2.1 to 2.3, 5.1 to 5.3, 8.1 to 8.3.
4.	M.Mitzenmacher and E.Upfal, Probability and Computing: Randomized Algorithms and Probabilistis Analysis. N.Matloff, A Course in Probabilistic and Statistical Modeling in Computer Science.
PREPARED BY	
Dept. of Mathematics	

Course Title	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
Course Code		3	1	0	4

PRE-REQUISITE

Problem Solving

OBJECTIVES

- Understand and apply data structures-List, Stack and Queue.
- Understand the graph algorithms.
- Learn different algorithms analysis techniques.
- Able to analyze the efficiency of algorithm

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand the implementation of basic types of data structures and time complexity.
2.	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3.	Develop algorithms for usage of graph and its applications
4.	To select and design data structures and algorithms that is appropriate for problems.
5.	Identify suitable data structures and develop algorithms for computational geometry problems.

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	S	M		M	M				S	S	S	S	L	S	S
CO02	L		M	S						S	S	L	S	S
CO03		M		S			S			M	M	L	S	
CO04	L			M					S	L		L	S	
CO05	L	M							S	S		L	L	S	

UNIT – I	BASIC DATA STRUCTURES AND ALGORITHM	09

Stack- Queue - Linked List Implementation - Min/Max heap – Algorithm Analysis-Asymptotic Analysis- Solving Recurrence Relation – Amortized Analysis

UNIT – II	BALANCED TREE AND HEAP STRUCTURES	09

Binary Search Trees – AVL Trees – Red-Black Trees – Multi-way Search Trees –B-Trees – Splay Trees – Tries, Heaps- Fibonacci Heaps.

UNIT – III	GRAPHS	09

Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra"s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms.

UNIT – IV	ALGORITHM DESIGN TECHNIQUES	09
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	09
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs for Vertex Cover & Hamiltonian Cycle – NP-Complete		

TEXT BOOK	
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, Fourth Edition 2022.
2.	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson, 2014.
3.	R.C.T Lee, S.S Tseng, R.C Chang and Y.T Tsai, "Introduction to the Design and Analysis of Algorithms", Tata McGraw-Hill Edition, 2012.

REFERENCES	
1.	Robert Kruse & Clovis L. Tondo " Data Structures and Program Design in C",Prentice Hall , 2012.
2.	M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2015.

PREPARED BY
Dr.C.Sunitha Ram, Assistant Professor/CSE

Course Title	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
Course Code		3	1	0	4

UNIT – I	PIPELINING AND ILP	09

Fundamentals of Computer Design - Measuring and Reporting Performance – Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation – Multiple Issue Processors – Case Studies.

UNIT – II	ADVANCED TECHNIQUES FOR EXPLOITING ILP	09

Compiler Techniques for Exposing ILP - Limitations on ILP for Realizable Processors - Hardware versus Software Speculation - Multithreading: Using ILP Support to Exploit Thread-level Parallelism - Performance and Efficiency in Advanced Multiple Issue Processors - Case Studies.

UNIT – III	MULTIPROCESSORS	09

Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of Memory Consistency

- Interconnection networks – Buses, crossbar and multi-stage switches.

UNIT – IV	MULTI-CORE ARCHITECTURES	09

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell architecture- hp architecture.

UNIT – V	MEMORY HIERARCHY DESIGN	09

Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

TEXT BOOK

1.	John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 5th. edition, 2011.
2.	David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A hardware/ software approach" , Morgan Kaufmann / Elsevier, 1997.
3.	William Stallings, " Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006

Course Title	DATA SCIENCE	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Produce Python code to statistically analyses a dataset
- Critically evaluate data visualizations based on their design and use for communicating stories from data

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Explain how data is collected, managed and stored for data science;
2.	Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
3.	Implement data collection and management scripts using MongoDB

UNIT –I		

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

UNIT – II		

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

UNIT – III		

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT – IV		

Data Visualization: Introduction, Types Of Data Visualization, Data For Visualization: Data Types, Data Encodings, Retinal Variables, Mapping Variables To Encodings, Visual Encodings.

UNIT – V		

Applications of Data Science, Technologies for visualization, Bokeh (Python)

REFERENCES

1.	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2.	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Miningof Massive Datasets. v2.1, Cambridge University Press.

Course Title	AI & MACHINE LEARNING	L	T	P	C
Course Code		3	0	0	3

PRE-REQUISITE:

Basic knowledge of Mathematical Logic and Linear Algebra and Calculus

OBJECTIVES

- Introduce and define the meaning of Intelligence and explore various paradigms for knowledge encoding in computer systems.
- Introduce subfields of AI such as NLP, Game Playing, Bayesian Models, etc.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.
- Introduce the concept of AI Techniques
- Introduce the research skills of AI

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.
2.	Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
3.	Build awareness of AI facing major challenges and the complexity of typical problems within the field.
4.	Assess critically the techniques presented and apply them to real world problems.
5.	Develop self-learning and research skills to tackle a topic of interest on his/her own or as part of a team.

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	M	M							S						M
CO02	M	M				L			S		L		H		
CO03	M	M							S						
CO04	M	M							S			L		H	
CO05								H							

UNIT –I	

Defining Artificial Intelligence, Defining AI techniques - State Space Search and Heuristic Search Techniques - Production systems and characteristics, Hill Climbing, Breadth first and depth first search, Best first search

UNIT –II	

Representations and Mappings, Approaches to knowledge representation - Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic

Programming, Forward vs backward reasoning- Non-monotonic Reasoning, Logics for non-monotonic reasoning	

UNIT –III		

Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning - Model representation for singlevariable, Single variable Cost Function, Gradient Decent for Linear Regression, Multivariable model representation, Multivariable cost function, Gradient Decent in practice, Normal Equation and non-invertibility

UNIT –IV		

Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting, Regularization

UNIT –V		

Case Studies: Neural Networks - Support Vector Machines - Recommender Systems

TEXT BOOK	
1.	Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig 2013
2.	Artificial Intelligence, 2nd Edition, Rich and Knight 2009
3.	Machine Learning, Tom M. Mitchell 2008
4.	Building Machine Learning Systems with Python, Richert & Coelho 2008

REFERENCES	
1.	Artificial Intelligence by Elaine Rich, Kevin Knight and Nair ISBN-978-0-07- 008770-5, TMH, 2000
2.	Prolog Programming for A.I. by Bratko, TMH 2009
3.	Artificial Intelligence by SarojKausik ISBN:- 978-81-315-1099-5, Cengage Learning 2008
4.	Artificial Intelligence and Intelligent Systems by Padhy, Oxforfd University Press, 2009

PREPARED BY
Dr.R.Prema Assistant Professor CSE

Course Title	DISTRIBUTED SYSTEMS	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Design trends in distributed systems.
2.	Apply network virtualization.
3.	Apply remote method invocation and objects.

UNIT – I	**INTRODUCTION**	09

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

UNIT – II	**DISTRIBUTED DATABASE DESIGN**	09

Alternative design strategies; Distributed design issues; Fragmentation; Data allocation.
SEMANTICS DATA CONTROL : View management; Data security; Semantic Integrity Control.
QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

UNIT – III	**DISTRIBUTED QUERY OPTIMIZATION**	09

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

TRANSACTION MANAGEMENT: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models
CONCURRENCY CONTROL: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT – IV	**RELIABILITY**	09

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

UNIT – V	**PARALLEL DATABASE SYSTEMS**	09

Parallel architectures; parallel query processing and optimization; load balancing

UNIT – VI	**ADVANCE TOPICS**	09

Mobile Databases, Distributed Object Management, Multi-databases.
REFERENCES

1.	Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall,1991.
2.	Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Course Title	RESEARCH METHODOLOGY AND IPR	L	T	P	C
Course Code		2	0	0	2

<div align="center">

OUTCOMES

</div>

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand research problem formulation.
2.	Analyze research related information
3.	Follow research ethics
4.	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5.	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular
6.	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT – I		09

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		09

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT – III		09

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – IV		09

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V		09

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT – VI		09

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

REFERENCES	
1.	Stuart Melville and Wayne Goddard, "Research methodology: an introduction for

	science & engineering students'"
2.	Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3.	Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4.	Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5.	Mayall, "Industrial Design", McGraw Hill, 1992.
6.	Niebel, "Product Design", McGraw Hill, 1974.
7.	Asimov, "Introduction to Design", Prentice Hall, 1962.
8.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9.	T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Course Title	AUDIT COURSE (English For Research Paper Writing)	L	T	P	C
Course Code		2	0	0	0

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand that how to improve your writing skills and level of readability
2.	Learn about what to write in each section
3.	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT – I		09

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT – II		09

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT – III		09

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT – IV		09

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT – V		09

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT – VI		09

Useful Phrases, How To Ensure Paper Is As Good As It Could Possibly Be The First- Time Submission.

REFERENCES

1.	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2.	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3.	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4.	Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Title		AUDIT COURSE (Disaster Management)	L	T	P	C
Course Code			2	0	0	0

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
2.	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
3.	Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

UNIT – I	INTRODUCTION	09

Disaster: Definition, Factors And Significance; Difference Between HazardAnd Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT – II	REPERCUSSIONS OF DISASTERS AND HAZARDS	09

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT – III	DISASTER PRONE AREAS IN INDIA	09

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslide And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT – IV	DISASTER PREPAREDNESS AND MANAGEMENT	09

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT – V	RISK ASSESSMENT	09

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT – VI	DISASTER MITIGATION	09

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES

1.	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2.	Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3.	Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Title	AUDIT COURSE (Sanskrit For Technical Knowledge)	L	T	P	C
Course Code		2	0	0	0

OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

OUTCOMES

After the course the students will be able to

Sl. No	Course Outcome
1.	Understanding basic Sanskrit language
2.	Ancient Sanskrit literature about science & technology can be understood
3.	Being a logical language will help to develop logic in students

UNIT – I		

Alphabets in Sanskrit,
Past/Present/Future Tense,
Simple Sentences

UNIT – II	REPERCUSSIONS OF DISASTERS AND HAZARDS	

Order
Introduction of roots
Technical information about Sanskrit Literature

UNIT – III	DISASTER PRONE AREAS IN INDIA	

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

REFERENCES

1.	"Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2.	"Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3.	"India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Title	AUDIT COURSE (Value Education)	L	T	P	C
Course Code		2	0	0	0

OBJECTIVES

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Knowledge of self-development
2.	Learn the importance of Human values
3.	Developing the overall personality

UNIT – I

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value Judgments

UNIT – II

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline

UNIT – III

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

UNIT – IV

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Character and Competence –Holy books vs Blind faith.

• Self-management and Good health.
• Science of reincarnation.
• Equality, Nonviolence ,Humility, Role of Women.
• All religions and same message.
• Mind your Mind, Self-control.
• Honesty, Studying effectively Science of reincarnation.
• Equality, Nonviolence ,Humility, Role of Women.
• All religions and same message.
• Mind your Mind, Self-control.
• Honesty, Studying effectively.

REFERENCES	
1.	Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course Title	AUDIT COURSE (Stress Management By Yoga)	L	T	P	C
Course Code		2	0	0	0

OBJECTIVES

- To achieve overall health of body and mind
- To overcome stress

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Develop healthy mind in a healthy body thus improving social health also
2.	Improve efficiency

UNIT – I		

Definitions of Eight parts of yog. (Ashtanga)

UNIT – II		

Yam and Niyam. Do`s and Don't's in life.
- Ahinsa, satya, astheya, bramhacharya and aparigrah
- Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT – III		

Asan and Pranayam
- Various yog poses and their benefits for mind & body
- Regularization of breathing techniques and its effects-Types of Pranayam

REFERENCES	
1.	"Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2.	"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata

Course Title	AUDIT COURSE (Personality Development Through Life Enlightenment Skills)	L	T	P	C
Course Code		2	0	0	0

OBJECTIVES

•	To learn to achieve the highest goal happily
•	To become a person with stable mind, pleasing personality and determination
•	To awaken wisdom in students

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2.	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3.	Study of Neetishatakam will help in developing versatile personality of students.

UNIT – I

Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT – II

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT – III

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3- Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOK

1.	"Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2.	Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Title	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
Course Code		0	0	4	2

PRE-REQUISITE

Problem Solving

OBJECTIVES

•	Understand and apply data structures-List, Stack and Queue.
•	Understand the graph algorithms.
•	Learn different algorithms analysis techniques.
•	Able to analyze the efficiency of algorithm

COURSE OUTCOMES

1.	Understand the implementation of basic types of data structures and time complexity.
2.	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3.	Develop algorithms for usage of graph and its applications.
4.	Apply Greedy, divide and Conquer algorithms for real time applications
5.	Identify suitable data structures and develop algorithms for computational geometry problems.

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	S	M		M	M				S	S	S	S	L	S	S
CO02	L		M	S						S	S	L	S	S
CO03		M		S				S			M	M	L	S	
CO04	L			M						S	L		L	S	
CO05	L	M							S	S		L	L	S	

EXPERIMENTS

1.	Implementation of Singly linked list
2.	Implementation of polynomial addition using doubly linked list
3.	Implementation of Circular linked list.
4.	Implementation of Multi stacks in a Single Array.
5.	Implementation of Binary Search trees.
6.	Implementation of Heaps-Fibonacci Heaps.
7.	Implementation of AVL Rotations.
8.	Implementation of Breadth First Search Techniques.
9.	Implementation of Depth First Search Techniques.
10.	Implementation of Prim's Algorithm.

11.	Implementation of Kruskal's Algorithm
12.	Implementation of Hamiltonian cycle

PREPARED BY

Dr.C.Sunitha Ram, Assistant Professor/CSE

II - SEMESTER

Course Title	DATA ANALYTICS	L	T	P	C
Course Code		3	1	0	4

PRE-REQUISITE

- Should have knowledge of one Programming Language (Java preferably)
- Practice of SQL (queries and sub queries)
- Exposure to Linux Environment

OBJECTIVES

- The students should be able to understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects. The student should identify and successfully apply appropriate techniques and tools to solve big data problems.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.
2.	Apply appropriate techniques and tools to solve big data problems
3.	Describe big data and use cases from selected business domains
4.	Explain No SQL big data management
5.	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	M	-	-	M	-	-	-	-	L	S	-	-			
CO02	-	-	M	L	S	-	S	-	-	-	-	-			
CO03	-	-	S	M	-	-	S	-	-	-	-	-			
CO04	-	-	-	M	S	-	-	-	M	L	-	-			
CO05	-	-	-	M	S	-	-	-	S	-	-	-			

UNIT – I	INTRODUCTION TO BIG DATA	09

Introduction to BigData Platform, Traits of Big data, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability, Analysis vs Reporting, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference, Prediction Error.

UNIT – II	BASIC DATA ANALYSIS & DATA ANALYTIC METHODS USING R	09

Regression Modelling, Multivariate Analysis, Bayesian Modelling, Inference and Bayesian Networks, Support Vector and Kernel Methods, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Introduction to R, Statistics for Model Building and Evaluation.

UNIT – III	FREQUENT ITEM SETS AND CLUSTERING	09

Mining Frequent item sets: Market Based Model, Apriori Algorithm, Handling Large Data Sets

in Main Memory, Limited Pass Algorithm, Counting Frequent item sets in a Stream, Clustering Techniques: Hierarchical, K-Means, Frequent Pattern based Clustering Methods.

UNIT – IV	MINING DATA STREAMS	09

Introduction to Streams Concepts: Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream: Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.

UNIT – V	FRAMEWORK, TECHNOLOGIES, TOOLS AND VISUALIZATION	09

Map Reduce: Hadoop, Hive, MapR, Sharding, NoSQL Databases: S3, Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Interaction Techniques; Systems and Analytics Applications, Analytics using Statistical packages, Industry challenges and application of Analytics

TEXT BOOK	
1.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to data Science and its Applications", Wiley publications, 2014.
2.	V.K. Jain, Big Data & Hadoop, Khanna Book Publishing Co., Delhi. (ISBN 978-93-82609-131)
3.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2003.

REFERENCES	
1.	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2020.
2.	Jeeva Jose, Beginner's Guide for Data Analysis using R Programming, Khanna Book Publishing House, 2019.
3.	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley, 2012.
4.	Glenn J. Myatt, "Making Sense of Data", Wiley, 2006

PREPARED BY
Dr.R.Poorvadevi, Assistant Professor/CSE

Course Title	SOFT COMPUTING	L	T	P	C
Course Code		3	1	0	4

OBJECTIVES

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide student an hand-on experience on MATLAB to implement various strategies.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Identify and describe soft computing techniques and their roles in building intelligent machines
2.	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering Problems
3.	Apply genetic algorithms to combinatorial optimization problems.
4.	Evaluate and compare solutions by various soft computing approaches for a given problem

UNIT – I	INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS	09

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT – II	FUZZY LOGIC	09

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT – III	NEURAL NETWORKS	09

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT – IV	GENETIC ALGORITHMS	09

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT – V	MAT LAB / PYTHON LIB	09

MAT Lab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

UNIT – VI		09

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

	REFERENCES
1.	Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.
2.	George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.
3.	MATLAB Toolkit Manual

Course Title	DATA PREPARATION AND ANALYSIS	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES	
•	To prepare the data for analysis and develop meaningful Data Visualizations

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Able to extract the data for performing the Analysis.

UNIT – I	DATA GATHERING AND PREPARATION	09
Data formats, parsing and transformation, Scalability and real-time issues		

UNIT – II	DATA CLEANING	09
Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation		

UNIT – III	EXPLORATORY ANALYSIS	09
Descriptive and comparative statistics, Clustering and association, Hypothesis generation		

UNIT – IV	VISUALIZATION:	09
Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity		

REFERENCES	
1.	Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Course Title	SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- To fix software flaws and bugs in various software.
- To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
- Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Differentiate between various software vulnerabilities.
2.	Software process vulnerabilities for an organization.
3.	Monitor resources consumption in a software.
4.	Interrelate security and software development process.

UNIT – I	SECURE SOFTWARE DESIGN	09

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT – II	ENTERPRISE APPLICATION DEVELOPMENT	09

Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT – III	ENTERPRISE SYSTEMS ADMINISTRATION	09

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT – IV		09

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT – V		09

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

UNIT – VI		09

Case study of DNS server, DHCP configuration and SQL injection attack.

	REFERENCES
1.	Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2.	Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Title	COMPUTER VISION	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- Be familiar with both the theoretical and practical aspects of computing with images.

- Have described the foundation of image formation, measurement, and analysis. Understand the geometric relationships between 2D images and the 3D world. Grasp the principles of state-of-the-art deep neural networks.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Developed the practical skills necessary to build computer vision applications.
2.	To have gained exposure to object and scene recognition and categorization from images.

UNIT – I		09

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

UNIT – II		09

Edge detection, Edge detection performance, Hough transform, corner detection

UNIT – III		09

Segmentation, Morphological filtering, Fourier transform

UNIT – IV		09

Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing

UNIT – V		09

Pattern Analysis:
Clustering: K-Means, K-Medoids, Mixture of Gaussians
Classification: Discriminant Function, Supervised,Un-supervised,Semi supervised
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods

UNIT – VI		09

Recent trends in Activity Recognition, computational photography, Biometrics.

REFERENCES

1.	Computer Vision: Algorithms and Applications by Richard Szeliski.
2.	Deep Learning, by Goodfellow, Bengio, and Courville.
3.	Dictionary of Computer Vision and Image Processing, by Fisher et al.

Course Title	HUMAN AND COMPUTER INTERACTION	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile Human Computer interaction.
- Learn the guidelines for user interface.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand the structure of models and theries of human computer interaction and Vision.
2.	Design an interactive web interface on the basis of models studied

UNIT – I		09

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT – II		09

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering
– Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT – III		09

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT – IV		09

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT – V		09

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

UNIT – VI		09

Recent Trends: Speech Recognition and Translation, Multimodal System

REFERENCES

1.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2.	Brian Fling, "Mobile Design and Development", First Edition , O Reilly Media Inc., 2009 (UNIT – IV)
3.	Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, OReilly, 2009.(Unit-V)

Course Title	GPU COMPUTING	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- To learn parallel programming with Graphics Processing Units (GPUs).

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Students would learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

UNIT – I		09

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs

UNIT – II		09

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

UNIT – III		09

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

UNIT – IV		09

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

UNIT – V		09

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

UNIT – VI		09

Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

REFERENCES

1.	Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-mei Hwu; Morgan Kaufman; 2010 (ISBN: 978-0123814722)
2.	CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Course Title	DATA ANALYTICS LABORATORY	L	T	P	C
Course Code		0	0	4	2

PRE-REQUISITE

- Engineering Mathematics, Artificial Intelligence & Machine Learning, Numerical and Statistical Methods, Fundamental of Mechanical Engineering

OBJECTIVES

- To explore the fundamental concepts of data analytics.
- To understand the various search methods and visualization techniques.
- To apply various machine learning techniques for data analysis.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	The basics of data analytics using concepts of statistics and probability.
2.	Various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
3.	The data analytics techniques using various tools
4.	Data science concept and methods to solve problems in real world context
5.	Advanced techniques to conduct thorough and insightful analysis and interpret the results

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	M	L	-	M	M	-	-	-	-	-	-	-	S		
CO02	M	L	L	M	S	-	-	-	-	-	-	-			
CO03	M	M	L	L	S	-		-	-	-	-	-		M	
CO04	M	-	L	M	M	-	-	-	-	-	-	-	S		
CO05	M	-	L	M	S	-	-	-	-	-	-	-	S		

UNIT – I		09

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs

UNIT – II		09

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

UNIT – III		09

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence.

Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.	
UNIT – IV	**09**
Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.	
UNIT – V	**09**
Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning	
UNIT – VI	**09**
Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing	
REFERENCES	

1.	Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-mei Hwu; Morgan Kaufman; 2010 (ISBN: 978-0123814722)
2.	CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN: 978-0124159334)

III - SEMESTER

Course Title		MOBILE APPLICATIONS AND SERVICES	L	T	P	C
Course Code			3	0	0	3

OBJECTIVES

- This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
- It explores emerging technologies and tools used to design and implement feature- rich mobile applications for smartphones and tablets
- It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	On completion of the course the student should be able to identify the target platform and users and be able to define and sketch a mobile application
2.	Understand the fundamentals, frameworks, and development lifecycle of mobile Application platforms including iOS, Android, and PhoneGap
3.	Design and develop a mobile application prototype in one of the platform (challenge project)

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	M	-	-	M	-	-	-	-	L	S	-	-			
CO02	-	-	M	L	S	-	S	-	-	-	-	-			
CO03	-	-	S	M	-	-	S	-	-	-	-	-			
CO04	-	-	-	M	S	-	-	-	M	L	-	-			
CO05	-	-	-	M	S	-	-	-	S	-	-	-			

UNIT – I

Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

UNIT – II

More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

UNIT – III

Communications via Network and the Web:State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

UNIT – IV

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia	
UNIT – V	
Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android	
UNIT – VI	
Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.	
REFERENCES	
1.	Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Course Title	COMPILER FOR HPC	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- The objective of this course is to introduce structure of compilers and high performance compiler design for students. Concepts of cache coherence and parallel loops in compilers are included

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Familiar with the structure of compiler Parallel loops, data dependency and exception handling and debugging in compiler

UNIT – I

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.

UNIT – II

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.

UNIT – III

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter- procedural Analysis. Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality

UNIT – IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

UNIT – V

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.

UNIT – VI

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

REFERENCES

1.	Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson

Course Title	OPTIMIZATION TECHNIQUES	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- The objective of this course is to provide insight to the mathematical formulation of real world problems.
- To optimize these mathematical problems using nature based algorithms. And the solution is useful specially for NP-Hard problems.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Formulate optimization problems.
2.	Understand and apply the concept of optimality criteria for various types of optimization problems.
3.	Solve various constrained and unconstrained problems in Single variable as well as multivariable.
4.	Apply the methods of optimization in real life situation.

UNIT – I

Engineering application of Optimization, Formulation of design problems as mathematical programming problems

UNIT – II

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

UNIT – III

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

UNIT – IV

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

UNIT – V

Real life Problems and their mathematical formulation as standard programming problems.

UNIT – VI

Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.

REFERENCES

1.	Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366- 9.
2.	Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3.	An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
4.	Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
5.	John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN

	978-0-8493-1914-3.
6.	H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0- 387-92279-9.
7.	Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of- the-Art. Springer. ISBN 978-3-540-68274-5.
8.	Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

Course Title	**BUSINESS ANALYTICS**	L	T	P	C
Course Code		3	0	0	3

OBJECTIVES

- Understand the role of business analytics within an organization.
- Analyse data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Manage business processes using analytical and management tools. problems from different industries such as manufacturing,
- Analyse and solve service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc

COURSE OUTCOMES

The end of course, the students can able to

1.	Students will demonstrate knowledge of data analytics.
2.	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3.	Students will demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.
4.	Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT - I

Business analytics:: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT - II

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT - III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.
Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

UNIT - IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting

Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality. Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT - V
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, Utility and Decision Making. The Value of Information

UNIT - VI
Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

REFERENCES	
1.	Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Pearson FT Press.
2.	Business Analytics by James Evans, persons Education.

Course Title	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
Course Code		3	0	0	3

UNIT – I	

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT – II	

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT – III	

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

UNIT – IV	

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT – V	

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

REFERENCES	
1.	Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2.	Charles T. Horngren and George Foster, Advanced Management Accounting
3.	Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4.	Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5.	N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Course Title	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Course Code		3	0	0	3

PRE-REQUISITE

- Basic Knowledge of Software engineering principle

OBJECTIVES

- To present the software concepts, techniques and metrics for software development
- To develop a good understanding of issues, techniques needed for software industry.
- To study about tools for software project management metrics and measurement.
- To gain a working knowledge of techniques for software project standardization

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Understand project management processes
2.	Distinguish between the various activities of project planning
3.	Understand the project activities and durations
4.	Understand the importance of standards in the project management process
5.	To develop skills that will enable them to evaluate software of high quality

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	S				M				L				L		
CO02		M						L							
CO03			S						S					M	
CO04															S
CO05								M					L		

UNIT – I	INTRODUCTION	

Software projects-various type of projects-problems with software projects-an overview of project planning –project evaluation-project analysis and technical planning –software estimation.

UNIT – II	SOFTWARE PLANNING	

Activity planning-project schedules-sequencing and scheduling projects-network planning model shortening project duration identifying critical activities

UNIT – III	SOFTWARE CHECKING	

Risk Management-resource allocation-monitoring and control- managing people and organizing teams-planning for small projects

UNIT – IV	SOFTWARE CONFIGURATION MANAGEMENT	

Software– basic functions-responsibilities-standards-configuration management-prototyping models of prototyping

UNIT – V	SOFTWARE ACT	
Case Study – PRINCE project management.		
TEXT BOOK		
1.	Adolfo Viiiafiorita,"Introduction to Software Project Management ", CRC Press, April 2016	
REFERENCES		
1.	Darel Ince,H.Sharp and M.Woodman,"Introduction to Software Project Management and Quality Assurance ", Tata McGraw Hill.	
2.	Mike Cotterell,Bob Hughes , "Software Project Management ", Inclination/Thomas Computer Press,1995.	

Course Title	SOFTWARE ARCHITECTURE	L	T	P	C
Course Code		3	0	0	3

PRE-REQUISITE

- Software Engineering

OBJECTIVES

- Understand the fundamentals of software architecture.
- Study the various software development methodologies.
- Learn the importance of architectural documentation and evaluation.
- Learn the various software architecture design components.
- Relate software architecture and software quality.

OUTCOMES

After the course the students will be able to

Sl.No	Course Outcome
1.	Develop Software applications starting from software architecture and design.
2.	Learn and evaluate existing software architectures.
3.	Realize importance of architectural documentation and document them.
4.	Employ various software architecture design components.
5.	Design methods for improving software quality from the perspective of software architecture

POs and COs MAPPING TABLES

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO01	H												M		
CO02		M		M									M		
CO03										L				L	
CO04			H						H					H	
CO05					M		L								L

UNIT – I	INTRODUCTION	

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture-Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures.

UNIT – II	DESIGN METHODOLOGIES	

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

UNIT – III	ARCHITECTURAL DESCRIPTION DOCUMENTATION & EVALUATION	

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors – Architecture Tradeoff Analysis Method – Lightweight Architecture Evaluation – ATAM.

UNIT – IV	ARCHITECTURE DESIGN	

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

UNIT – V	IMPLEMENTATION AND CONFORMANCE TO ARCHITECTURE	

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes-Introduction to tactics – Achieving Quality Attributes through Tactics –Tactics types – Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

TEXT BOOK	
1.	Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Third Edition, Addison,Wesley, 2012.
2.	David Budgen, "Software Design", Third Edition, Pearson Education, 2020.

REFERENCES	
1.	Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, "Software Architecture, Foundations, Theory and Practice", Wiley 2010.
2.	Mary Shaw and David Garlan, "Software Architecture –Perspectives on an emerging Discipline", Pearson Education, first edition, 2015.

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