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Scheme and Syllabus of I – IV semester

(Autonomous System of 2022 Scheme)

Master of Technology (M.Tech.)

in

INFORMATION TECHNOLOGY (MIT)

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Glossary of Abbreviations

1.	AS	Aerospace Engineering
2.	BS	Basic Sciences
3.	BT	Biotechnology
4.	CH	Chemical Engineering
5.	CHY	Chemistry
6.	CIE	Continuous Internal Evaluation
7.	CS	Computer Science & Engineering
8.	CV	Civil Engineering
9.	EC	Electronics & Communication Engineering
10.	EE	Electrical & Electronics Engineering
11.	EI	Electronics & Instrumentation Engineering
12.	ET	Electronics & Telecommunication Engineering
13.	GE	Global Elective
14.	HSS	Humanities and Social Sciences
15.	IM	Industrial Engineering & Management
16.	IS	Information Science & Engineering
17.	L	Laboratory
18.	MA	Mathematics
19.	MBT	M. Tech in Biotechnology
20.	MCE	M. Tech. in Computer Science & Engineering
21.	MCN	M. Tech. in Computer Network Engineering
22.	MCS	M. Tech. in Communication Systems
23.	MDC	M. Tech. in Digital Communication
24.	ME	Mechanical Engineering
25.	MHT	M. Tech. in Highway Technology
26.	MIT	M. Tech. in Information Technology
27.	MMD	M. Tech. in Machine Design
28.	MPD	M. Tech in Product Design & Manufacturing
29.	MPE	M. Tech. in Power Electronics
30.	MSE	M. Tech. in Software Engineering
31.	MST	M. Tech. in Structural Engineering
32.	MVE	M. Tech. in VLSI Design & Embedded Systems
33.	N	Internship
34.	P	Projects (Minor / Major)
35.	PHY	Physics
36.	SDA	Skill Development Activity
37.	SEE	Semester End Examination
38.	T	Theory
39.	TL	Theory Integrated with Laboratory
40.	VTU	Visvesvaraya Technological University

POSTGRADUATES PROGRAMS

Sl. No	Core Department	Program	Code
1.	BT	M. Tech in Biotechnology	MBT
2.	CS	M. Tech in Computer Science & Engineering	MCE
3.	CS	M. Tech in Computer Network Engineering	MCN
4.	CV	M. Tech in Structural Engineering	MST
5.	CV	M. Tech in Highway Technology	MHT
6.	EC	M. Tech in VLSI Design & Embedded Systems	MVE
7.	EC	M. Tech in Communication Systems	MCS
8.	EE	M. Tech in Power Electronics	MPE
9.	ET	M. Tech in Digital Communication	MDC
10.	IS	M. Tech in Software Engineering	MSE
11.	IS	M. Tech in Information Technology	MIT
12.	ME	M. Tech in Product Design & Manufacturing	MPD
13.	ME	M. Tech in Machine Design	MMD

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

VISION

To be the hub for innovation in Information Science & Engineering through Teaching, Research, Development and Consultancy; thus make the department a global resource center in advanced, sustainable and inclusive

MISSION

1. To enable students to become responsible professionals, strong in fundamentals of information science and engineering through experiential learning

2. To bring research and entrepreneurship into classrooms by continuous design of innovative solutions through research publications and dynamic development-oriented curriculum.

3. To facilitate continuous interaction with the outside world through student internship, faculty consultancy, workshops, faculty development programs, industry collaboration and association with the professional societies.

4. To create a new generation of entrepreneurial problem solvers for a sustainable future through green technology with an emphasis on ethical practices, inclusive societal concerns, and environment

5. To promote teamwork through interdisciplinary projects, co-curricular and social activities.

PROGRAMME OUTCOMES (PO)

M. Tech in **Information Technology** graduates will be able to:

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

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

PO3: Acquire in-depth knowledge of information technology with global perspective, analyse & synthesize with existing and new knowledge to enhance the skills.

PO4: Apply appropriate techniques to use modern engineering & IT tools by analysing its limitations.

PO5: Recognise opportunities and contribute positively to collaborative multidisciplinary scientific research in Information Technology, demonstrate a capacity for self-management and teamwork.

PO6: Demonstrate knowledge and understanding of Information Technology principles & apply the same to one's own work, as a member and leader in a team, manage projects efficiently.

INDEX

SEMESTER: I						
Course Code	:	MMA203T	**LINEAR ALGEBRA AND PROBABILITY THEORY**	CIE Marks	:	100
Credits L-T-P	:	3-1-0		SEE Marks	:	100
Hours	:	42L+28T	*Common Course (MDC, MIT, MSE)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Sowmya M				

UNIT - I	**9 Hrs**
Matrices and Vector spaces: Geometry of system of linear equations, vector spaces and subspaces, linear independence, basis and dimension, four fundamental subspaces, change of basis. Rank-nullity theorem (without proof), linear transformations, representation of transformations by matrices.	
UNIT - II	**9 Hrs**
Orthogonality and least square approximations: Inner product, orthogonal vectors, orthogonal projections, orthogonal bases, Fourier expansion. Eigen subspaces, Gram-Schmidt orthogonalization process. QR factorisation, least square problems, application to linear models (least square lines and least square fitting of other curves).	
UNIT - II	**8 Hrs**
Symmetric and Quadratic forms: Quadratic forms, constrained optimization, symmetric forms, diagonalization, singular value decomposition, mean and covariance matrix, principal component analysis.	
UNIT - IV	**8 Hrs**
Multiple Random variables: Joint probability mass functions and probability density functions, marginal density function, conditioning of random variables, statistical independence, correlation and covariance functions, covariance and correlation matrices, transformation of random variables, Markov and Chebyshev inequalities, Gaussian distribution-Multivariate normal density and its properties.	
UNIT - V	**8 Hrs**
Random Processes: Introduction, classification of random processes, stationary and independence, auto correlation function and properties, cross correlation, cross covariance functions. Markov processes, transition and state probability in Markov chain, ergodic processes and ergodicity.	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of vector spaces, orthogonality, joint probability distributions and random process arising in various fields engineering.
CO2	:	Derive the solution by applying the acquired knowledge and skills of linear algebra/probability/optimization techniques to solve problems of probability distributions, linear algebra and random process.
CO3	:	Evaluate the solution of the problems using appropriate linear algebra, statistical and random process techniques to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of multivariate probability distributions, linear algebra and random process methods gained to engage in life – long learning.

Reference Books:
1. Alberto Leon-Garcia, "Probability, Statistics, and Random Processes for Electrical Engineering", Pearson Prentice Hall, 3rd Edition, 2008, ISBN: 978-0-13-147122-1.
2. Edgar G. Goodaire "Linear Algebra: Pure & Applied Kindle Edition", World Scientific, 1st Edition, 2013, ISBN-13: 978-9814508360.
3. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN: 97809802327.
4. Hwei P. Hsu, Schaum's Outline of Theory and Problems of Probability, Random Variables, and Random Processes, McGraw Hill Education, 2017, ISBN-10: 978-0070589506.
5. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill Education Private Limited, 3rd Edition, 2008, ISBN:978-0-07-066925-3.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I					
Course Code	:	MIT201I	**Advanced Algorithms and Applications**	CIE Marks	100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	100
Hours	:	42L + 28P	*(Professional Core - 1)*	SEE Durations	3 Hrs
Faculty Coordinator:			Dr. B M Sagar		

UNIT - I	**9 Hrs**
Analysis Techniques: Growth of Functions: Asymptotic notations, Recurrences relations and solutions Amortized Analysis: Aggregate, Accounting and Potential Methods. Advanced Data structures: Abstract data types (ADTs), Graph, Directed Acyclic Graph; Trees: 2-3-4 tree, Red Black tree. Heaps: Binary Heap, Priority Queues	
UNIT - II	**9 Hrs**
Leftist Heap, Skew Heap, Binomial Heap, Fibonacci Heap. Shortest Path Algorithms: Bellman - Ford Algorithm, Shortest paths in a DAG, Dijkstra's algorithm, Johnson's Algorithm for sparse graphs, Flow networks and Ford-Fulkerson method, Maximum bipartite matching.	
UNIT - III	**8 Hrs**
Tries: Suffix, Ternary search. String-Matching Algorithms: Naïve string Matching, Rabin - Karp algorithm, String matching with finite automata, Number Theoretic Algoritms: Elementary Notions, Chinese Remainder Theorem, RSA Public-Key Cryptosystems	
UNIT - IV	**8 Hrs**
Dynamic Programming: Matrix-Chain Multiplication,Longest Common Subsequence. Greedy Algorithms: An Activity Selection Problem, A task Scheduling Problem, Computational Geometry: Line-Segment-Properties and Intersection; Finding closest points and Convex-Hull	
UNIT - V	**8 Hrs**
Decision Problem -Problem Classes: P, NP;Polynomial time verification; NP-Completeness; Problem Reduction: Definition and Examples- 3-CNF-SAT to CLIQUE and CLIQUE to Vertex-Cover; Approximation Algorithms: Definition, Approximation Ratio, Vertex-Cover Problem, TSP	
LABORATORY	**28 Hrs**
Laboratory Programs The following programs will be executed on Java/C/C++/Python any equivalent tool/language by adapting exception handling technique wherever it is suitable Part-A 1. Design, develop, and write a program to implement insertion and search operation in a 2-3-4 tree. Determine its complexity. 2.Design, develop, and write a program to implement the Dijkstra's algorithm using Binary heap. Determine its complexity. 3 Design, develop, and write a program to implement to solve string matching problem using naive approach and the Rabin Karp algorithm and compare their complexity. 4. Design, develop, and write a program to implement to solve matrix chain multiplication problem 5. Design and implement RSA public key to decrypt ciphertext Part-B Design and Implement Realtime applications using the available data structures	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand the fundamentals of different Data Structures and their applications
CO2	:	Evaluate advanced data structures and algorithms with an emphasis on persistence.
CO3	:	Analyze the impact of Data Structures on algorithms with efficiency as a parameter

CO4	:	Design and implement efficient solutions to real world problems or Prove NP-Complete otherwise

Reference Books

1. Introduction to algorithms, Cormen, Thomas H., Leiserson, Charles E., Rivest, Ronald L. and Clifford Stein – 3rd Edition, MIT Press, 2009, ISBN-13: 978-0262033848.

2. Data Structures and Algorithms Analysis in C++, Mark Allan Weiss, 4th Edition, 2014, Pearson, ISBN-13: 9780132847377 Java, 3rd Edition, 2012, ISBN:0-132-57627-9 / 9780132576277.

3. Data structures and algorithms, Aho, Hopcroft and Ullman, 1st Edition, Pearson Education India, 2002, ISBN: 8177588265, 9788177588262.

4. The Algorithm Design Manual, Steven S Skiena, Springer, 2008, ISBN: 9781848000704, 9781848000698.

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The average of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 30 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (10), Video based seminar /presentation /demonstration (20) adding upto 30 marks.

Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16 Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with Laboratory

RUBRIC of CIE			***RUBRIC of SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	10	Each unit consists of TWO questions of 16 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.		
2	Tests - T1 & T2	30			
3	Experiential Learning - EL1 & EL2	30	1 & 2	Unit-1: Question 1 or 2	16
4	Laboratory	30	3 & 4	Unit-2: Question 3 or 4	16
	Total Marks	100	5 & 6	Unit-3: Question 5 or 6	16
NO SEE for Laboratory			7 & 8	Unit-4: Question 7 or 8	16
			9 & 10	Unit-5: Question 9 or 10	16
			11	Laboratory Component (Compulsory)	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MIT101T	**Enterprise Application Development**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*(Professional Core - 2)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Rashmi R			

UNIT - I **9 Hrs**

Overview of Enterprise Applications :
Introduction, Architecture, Enterprise Applications,Kinds of Enterprise Application,Thinking About Performance, Patterns, The Structure of the Patterns, Limitations of Patterns, Layering, The Evolution of Layers in Enterprise Applications, The Three Principal Layers, Choosing Where to Run Layers. Organizing Domain Logic, Making a Choice, Service Layer.

UNIT - II **9 Hrs**

Mapping to Relational Databases: Architectural Patterns, The Behavioral Problem, Reading in Data, Structural Mapping Patterns, Mapping, Inheritance, Building the Mapping, Double Mapping, Using Metadata,Database Connections, Web Presentation: View Patterns, Input control patterns.

UNIT - III **8 Hrs**

Concurrency and Session State: Concurrency, Concurrency Problems, Execution Contexts, Isolation and Immutability, Optimistic and Pessimistic Concurrency Control. Preventing Inconsistent Reads, Deadlocks, Transactions ACID, Transactional Resources, Reducing Transaction Isolation for Liveness, Business and System Transactions, Patterns for Of□ine Concurrency Control, Application Server Concurrency.
Session state: Value of statelessness, Session state, Ways to store session state.

UNIT - IV **8 Hrs**

Distributed Objects: The Allure of Distributed Objects, Remote and Local Interfaces, Where You Have to Distribute, Working with the Distribution Boundary, Interfaces for Distribution, Layers all together: Domain Layer, Data Source Layer, Data Source for Transaction Script, Data Source Table Module, Data Source for Domain Model, The Presentation Layer, Other Layering schemes.

UNIT - V **8 Hrs**

Constructing Enterprise Applications :
Construction Readiness: Defining construction plan, package structure, Setting up Configuration plan, Development environment Defining software construction Map. Constructing Solution layers: Infrastructure services layer, Presentation layer, Business layer, Data access layer, Integration layer component.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Comprehend the concepts of prime layers in Enterprise application development to solve real world problems.
CO2	:	Design the architecture of EA through mapping of patterns to database and implementing concurrency.
CO3	:	Develop Enterprise Application with appropriate web presentation techniques and Session state attributes.
CO4	:	Plan and define software construction map for building layers for enterprise applications.

Reference Books

1. Martin Fowler, With Contributions from David Rice, Matthew Foemmel, Edward Hieatt, Robert Mee and Randy Stafford, Patterns of Enterprise Application Architecture, 1st Edition, Addison-Wesley Publication, Reprint Version – 2016, ISBN 0-321-12742-0

2. Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu Anubhav Pradhan, Raising Enterprise Applications: A Software Engineering Perspective, 1st Edition, 2010, Wiley-India Publication, ISBN: 9788126519460

3. Eric A. Marks, Michael Bell, Service-Oriented Architecture: A Planning and Implementation Guide for Business and Technology, 1st Edition, Wiley Publication, 2008, ISBN: 978-0-471-76894-4

4. Pallab Saha, A systematic perspective to managing complexity with enterprise architecture, 1st Edition, 2013, ISBN:9781466645189

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MIT401L	**Full Stack Development Lab**	CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Rashmi R			

Content

Prerequisites: Fundamentals of Java programming and object-oriented concepts HTML + CSS + JavaScript Knowledge.

Objective: The course aims at enhancing skills required for frontend (JavaScript) development, backend development using java and database management using MongoDB.

Syllabus: Introduction: React ES6, React Render HTML, React JSX, React Components, React Class, React Props, React Events, React Conditionals, React Lists, React Forms, React Router, React Memo, React CSS Styling, React Sass Styling.

React Hooks: What is a Hook?, useState, useEffect, useContext, useRef, useReducer, useCallback, useMemo, Custom Hooks.

React Components, React State Management, React Event Handling, Routing in React, React Application Testing, React Native.

Creating a Spring Boot Web Application: Creating a simple Spring Boot web application, Implementing a simple REST service, Understanding the Spring Boot application context, Understanding application properties.

Spring Boot Components, Beans, and Autowiring: Defining components, Accessing beans, Autowiring beans together, Injecting property values.

Configuration classes: Defining a configuration class and beans, Initializing bean properties, Autowiring dependencies.

Integrating with Data Sources: Orview of Spring Data, Defining entity classes, Defining a repository Integrating the repository into the application.

MongoDB: Overview, Advantages, Environment, Data Modeling, Create Database, Drop Database, Create Collection, Drop Collection, Data Types, Insert Document, Query Document, Update Document, Delete Document, Projection, Limiting Records, Sorting Records, Indexing, Aggregation, Replication, Sharding, Create Backup, Deployment.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Comprehend the concepts of react JS elements and components.
CO2	:	Apply knowledge of hooks, events, state managements and routing in web and mobile application development.
CO3	:	Design and develop queries in MongoDB.
CO4	:	Develop and test applications using specific tools.

Reference Books

1. Nathan Hull, ReactJS: Ultimate Beginners Guide, 1st Edition, CreateSpace Independent Publishing Platform,
2022, ISBN 9781537659510.

2. Bonnie Eisenman, Learning React Native: Building Native Mobile Apps With Javascript, 1st Edition, Shroff Publishers & Distributors, 2016, ISBN 9789352132980.

3. Shannon Bradshaw, Kristina Chodorow, Mongodb: The Definitive Guide: Powerful and Scalable Data Storage, 1st Edition, O'Reilly Media, 2019, ISBN 9781491954461.

4. Eric Bush, Node.Js, Mongodb, React, React Native Full-Stack Fundamentals and Beyond, 1st Edition, Zaccheus Entertainment, 2018, ISBN 0997196688

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50. Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40 Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks

RUBRIC FOR CIE			RUBRIC FOR SEE	
Sl.No	Content	Marks	Content	Marks
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions	40
2	Innovative Experiment/Concept Design & Implementation	10		
3	Laboratory Internal	10	Viva Voce	10
	Total Marks	50	Total Marks	50

SEMESTER: I						
Course Code	:	MCE301 A1	**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Shanta Rangaswamy and Dr. Soumya A			

UNIT - I	**9 Hrs**
Introduction: Intelligent agents, searching: Basics of AI, Intelligent Agents: Agents and environment; Rationality; the nature of environments; the structure of agents. Problem-solving: Problem-solving agents; Searching for solution; Uninformed search strategies; Informed search strategies, Heuristic Functions	
UNIT - II	**9 Hrs**
Adversarial search, constraint satisfaction problems, logical agents: Games, Optimal decision in games, Alpha-Beta Pruning, Defining Constraint satisfaction problems; Backtracking search for CSPs;Knowledge-based agents **Probabilistic reasoning:** Representing knowledge in an uncertain domain; Semantics of Bayesian Networks; Efficient representation of conditional distributions; Exact inference in Bayesian Networks; Approximate inference in Bayesian Networks	
UNIT - III	**8 Hrs**
Introduction, Concept Learning and Decision Trees Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning –Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning– Representation – Algorithm – Heuristic Space Search.	
UNIT - IV	**8 Hrs**
Bayesian And Computational Learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model	
UNIT - V	**8 Hrs**
Instant Based Learning K- Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning **Reinforcement Learning:** The Learning Task, Q-Learning, Temporal Difference Learning	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Explore the fundamentals of Artificial intelligence technology and Machine learning algorithms
CO2	:	Apply the working of various searching algorithms, games, pruning, inferencing, etc. with suita
CO3	:	Analyze and determine appropriate algorithms and techniques for AI and ML applications.
CO4	:	Evaluate AI and ML based solutions for classical problems.

Reference Books

1 AI – A Modern Approach, Stuart Russel, Peter Norvig, 3rd Edition, 2010, Pearson, ISBN-13: 978-0136042594.

2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, July 2017, McGraw Hill Education, 1st Edition, ISBN-10 1259096955, ISBN-13 978-1259096952

3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2007, ISBN 9788131714720

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

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MCN301A2	**BLOCKCHAIN TECHNOLOGIES**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Ramakanth Kumar P and Dr. Sharvani G S			

UNIT - I	**9 Hrs**
Blockchain: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain	
UNIT - II	**9 Hrs**
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys	
UNIT - III	**8 Hrs**
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	
UNIT - IV	**8 Hrs**
Smart Contracts and Ethereum: Smart Contracts: Definition, Ricardian contracts. Ethereum: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	
UNIT - V	**8 Hrs**
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Apply fundamentals, technologies and models of blockchain
CO2	:	Develop decentralised systems using bitcoin, smart contracts and Etherum platform to implement the Block chain Application
CO3	:	Design secure decentralization algorithm using block chains for real time use cases
CO4	:	Analyze the function of Blockchain as a method of securing distributed ledgers in different case

Reference Books

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, 2nd Edition, 2017, ISBN 978-1- 78712-544-5.

2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau,Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016, ISBN: 9780691171692

3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017, ISBN-13:978-1484226032

4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos,O'Reilly Media, First Edition, 2014, ISBN-13: 978-1449374044

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MIT301A3	**MOBILE APPLICATION DEVELOPMENT**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Sharadadevi K			

UNIT - I **9 Hrs**

Essentials For Mobile Application Development :
Background about mobile technologies, Overview of Android, Android architecture, Android for mobile application development, Android development Framework – Android SDK, Emulators / Android AVD Android Project Framework , Setting up development environment, Running android app, Dalvik Virtual Machine & .apk file extension, android debug bridge. Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents & Intent Filters, Android API levels (versions & version names)

UNIT - II **9 Hrs**

Android UI Architecture & UI Widgets :
Application context, Intents, Activity life cycle, Supporting different devices, multiple screen sizes, Fundamental Android UI design – Layouts, Drawable resources, UI widgets, Notification, Toasts, Menu, Dialogs, Lists & Adapters, Building dynamic UI with fragments.

UNIT - III **8 Hrs**

Data Storage, Services & Content Providers :
Saving Data, Interacting with other Applications, Working with system permissions, Applications with content sharing, Shared Preferences, Preferences activity, Files access, SQLite database, Threads, Overview of services in Android, Implementing a Service, Service lifecycle, Inter Process Communication.

UNIT - IV **8 Hrs**

Advanced Android :
Building apps with Multimedia, Building apps with Graphics & Animations, Building apps with Location Based Services and Google maps, Building apps with Connectivity & Cloud, Sensors, Bluetooth, Camera, Telephony Services.

UNIT - V **8 Hrs**

Testing, Debugging & Deployment of Android Application:
Role and use of Dalvik Debug Monitor Server (DDMS), adb tool, How to debug Android application, Use of Step Filters, Breakpoints, Suspend and Resume, How to use LogCat, Preparing for publishing – Signing & Versioning of apps, Using Google Play to distribute & Monetize, Best practices for security & privacy.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Comprehend the basic features of Android Platform and the Application Development Process. Acquire familiarity with basic building blocks of Android Application and its architecture.
CO2	:	Apply and explore the basic framework, usage of SDK to build apps incorporating Android features in developing mobile applications.
CO3	:	Demonstrate proficiency in coding on a mobile programming platform using advanced Android technologies like multimedia, involving the sensors and hardware features of the phone.
CO4	:	Demonstrate proficiency in testing, debugging and deployment of Android applications.

Reference Books
1. Android Programming, Phillips, Stewart, Hardy and Marsicano, 2nd edition, 2015; Big Nerd Ranch Guide; ISBN-13 978-0134171494
2. Professional Android 2 Application Development; Reto Meier; 1st Edition; 2012,Wiley India Pvt.ltd; ISBN-13: 9788126525898
3. Beginning Android 3; Mark Murphy; 1st Edition; 2011; A press Springer India Pvt Ltd. ; ISBN-13: 978-1-4302-3297-1
4. Android Programming – Pushing the limits by Hellman; Eric Hellman; Wiley; 2013; ISBN 13: 978-1118717370

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

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SEMESTER: I						
Course Code	:	MIT205A4	**MULTI-CORE ARCHITECTURE**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Anala M R			

UNIT - I	**9 Hrs**
Introduction to Multi-Core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Threads Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.	
UNIT - II	**9 Hrs**
Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.	
UNIT - III	**8 Hrs**
Shared -Memory Programming with OpenMP : Compiling and running OpenMP programs, The program, Error checking, The Trapezoidal Rule, A first OpenMP version, Scope of Variables, The Reduction Clause, The parallel for Directive, Caveats, Data dependences, Finding loop-carried dependences, Estimating π, More on scope, More About Loops in OpenMP: Sorting, Bubble sort, Odd-even transposition sort, Scheduling Loops, The schedule clause, The static schedule type, The dynamic and guided schedule types, The runtime schedule type. The atomic directive, Critical sections and locks, Using locks in the message-passing program, critical directives, atomic directives, or locks, Caches, Cache Coherence, and False Sharing, Thread-Safety.	
UNIT - IV	**8 Hrs**
Distributed-Memory Programming with MPI : Compilation and execution, MPI programs, MPI Init and MPI Finalize, Communicators- MPI Comm size and MPI Comm rank, SPMD programs, Communication- MPI Send, MPI Recv, Message matching, The status_p argument, Semantics of MPI Send and MPI Recv, The Trapezoidal Rule in MPI- The trapezoidal rule, Parallelizing the trapezoidal rule, Dealing with I/O- Output, Input, Collective Communication-Tree-structured communication, MPI Reduce Collective vs. point-to-point communications, MPI Allreduce, Broadcast, Data distributions, Scatter, Gather, Allgather, MPI Derived Datatypes, Performance Evaluation of MPI Programs- Taking timings , Results, Speedup and efficiency, Scalability, A Parallel Sorting Algorithm- serial sorting algorithms, Parallel odd-even transposition sort, Safety in MPI programs.	
UNIT - V	**8 Hrs**
Parallel Programming in OpenACC : OpenACC Syntax, Compute Constructs, Data environment, Loop level parallelism- Kernels Versus Parallel Loops, Three Levels of Parallelism, Other Loop Constructs, Programming Tools for OpenACC - Common Characteristics of Architectures, Compiling OpenACC Code.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Explain the fundamentals of multi-core architectures.
CO2	:	Apply the knowledge of parallel programming constructs
CO3	:	Analyze the performance of multi-core and many-core parallel programming and Design parallel programming solutions to common problems.
CO4	:	Compare and contrast programming for serial processors and programming for parallel processors.

Reference Books

1. Shameem Akhter and Jason Roberts, Multi-core Programming, Intel Press, 2006, ISBN 0-976432-4-6
2. Peter Pacheco, An Introduction to parallel programming, Morgan Kaufmann, 2011, ISBN 978-0-12-374260-5
3. Sunita Chandrasekaran, Guido Juckeland, OpenACC for Programmers: Concepts and Strategies, 1st edition, Addison-Wesley, 2018 , ISBN- 978-0134694283.
4. Yan Solihin, Fundamentals of Parallel MULTICORE Architecture, Edition, Chapman & Hall/CRC Computational Science, 2015, ISBN - 978-1482211184

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MCN201B1	**SOCIAL NETWORK ANALYSIS**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Deepamala N and Prof. Prapulla S B			

UNIT - I	**9 Hrs**
Overview: Aspects of Networks, Central Themes and Topics Graphs Basic Definitions, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview	
UNIT - II	**9 Hrs**
Strong and Weak Ties: Triadic Closure, The Strength of Weak Ties, Tie Strength and Network Structure in Large-Scale Data, Tie Strength, Social Media, and Passive Engagement, Closure, Structural Holes, and Social Capital, Advanced Material: Betweenness Measures and Graph Partitioning. **Networks in Their Surrounding Contexts** Homophily, Mechanisms Underlying Homophily: Selection and Social Influence, Affiliation, Tracking Link Formation in On-Line Data, A Spatial Model of Segregation	
UNIT - III	**8 Hrs**
Games: What is a Game? Reasoning about Behaviour in a Game, Best Responses and Dominant Strategies, Nash Equilibrium, Multiple Equilibria: Coordination Games, Multiple Equilibria: The Hawk-Dove Game, Mixed Strategies, Mixed Strategies: Examples and Empirical Analysis, Pareto-Optimality and Social Optimality, Advanced Material: Dominated Strategies and Dynamic Games	
UNIT - IV	**8 Hrs**
The Structure of the Web: The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, The Emergence of Web 2.0. **Link Analysis and Web Search Searching the Web:** The Problem of Ranking, Link Analysis using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search, Applications beyond the Web, Advanced Material: Spectral Analysis, Random Walks, and Web Search	
UNIT - V	**8 Hrs**
Power Laws and Rich-Get-Richer Phenomena Popularity as a Network Phenomenon, Power Laws, Rich-Get-Richer Models, The Unpredictability of Rich-Get-Richer Effects, The Long Tail, The Effect of Search Tools and Recommendation Systems, Advanced Material: Analysis of Rich-Get-Richer Processes **Applications of Social Networks** Fraud, Crime, terrorism etc.	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Explore notation and terminology used in Social Networks.
CO2	:	Analyse basic principles behind Social Network analysis algorithms.
CO3	:	Design applications like web search using algorithms of social networks
CO4	:	Apply social networks on real world applications

Reference Books
1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010. ISBN: 978-05211953311.
2. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994. ISBN: 978-0521387071
3. Eric Kolaczyk, Gabor Csardi, "Statistical Analysis of Network Data with R", Springer, 2014. ISBN: 978-1-4939-0983-4
4. Newman, Mark, "Networks", Oxford university press, 2018. ISBN:978-0199206650

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: I							
Course Code	:	MIT207B2	**NETWORKS AND RYPTOGRAPHY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Sushmitha N			

UNIT - I	**9 Hrs**
Introduction: Uses of Computer Networks, Types of Computer Networks, Network Technology, from Local to Global, Examples of Networks, Network Protocols, Reference Models Cryptography: Introduction to Cryptography, Two Fundamental Cryptographic Principles, Substitution Ciphers, Transposition Ciphers, One-Time Pads	
UNIT - II	**9 Hrs**
Symmetric Ciphers: Classical Encryption Techniques, Block Ciphers and the Data Encryption Standard, Advanced Encryption Standard	
UNIT - III	**8 Hrs**
Asymmetric Ciphers: Public-Key Cryptography and RSA, Other Public-Key Cryptosystems	
UNIT - IV	**8 Hrs**
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA) Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs	
UNIT - V	**8 Hrs**
Information and Network Security Concepts, Wireless Network Security: Wireless Security, Mobile Device Security, Cloud Security: Cloud Computing, Cloud Security Concepts, Cloud Security Risks and Countermeasures, Internet of Things (IoT) Security: The Internet of Things, IoT Security Concepts and Objectives	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Understand and explore the needs and concepts of network technology and cryptography
CO2	:	Apply the knowledge of encryption and decryption to real time issues.
CO3	:	Comprehend and analyse the need for security in wireless networks and cloud.
CO4	:	Apply the knowledge of cryptanalysis to design and develop algorithms to perform encryption.

Reference Books

1. Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall , Computer Networks, 6th edition, 2020, Pearson, ISBN 10: 1-292-37406-3, ISBN 13: 978-1-292-37406-2, eBook ISBN 13: 9781292374017

2. William Stallings , Cryptography and Network Security, 8th Edition, Pearson, 2020, ISBN: 978-0-13-670722-6

3. Behrouz A Forouzan, Cryptography and Network Security, Tata McGraw-Hill, Special Indian Edition, 2008, ISBN-13: 978-0,07-066046-5, ISBN-10: 0-07-06.6046-8

4. Cryptography Theory and Practice, Douglas Stinson, 2nd Edition, 2005, Chapman & Hall/CRC, ISBN: 978-1584885085

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

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Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MIT208B3	**IOT AND APPLICATIONS**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Prof. B K Srinivas				

UNIT - I **9 Hrs**

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT - II **9 Hrs**

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT - III **8 Hrs**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles
and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT - IV **8 Hrs**

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational
Environment

UNIT - V **8 Hrs**

IoT Physical Devices and Endpoints : Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO2	:	Appraise the role of IoT protocols for efficient network communication.
CO3	:	Elaborate the need for Data Analytics and Security in IoT.
CO4	:	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Reference Books
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, 2017, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
4. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

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Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MIT301B4	**COMPUTER SYSTEMS PERFORMANCE ANALYSIS**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Kavitha S N			

UNIT - I	**9 Hrs**

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

UNIT - II	**9 Hrs**

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter
Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

UNIT - III	**8 Hrs**

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

UNIT - IV	**8 Hrs**

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

UNIT - V	**8 Hrs**

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

Course Outcomes: After going through this course the student will be able to:		
CO1	:	Comprehend the need for performance evaluation and its systematic approach.
CO2	:	Apply performance measurement techniques to evaluate computer systems.
CO3	:	Design and analyse various performance evaluation techniques.
CO4	:	Compare and evaluate performance of computer systems using sophisticated models.

Reference Books

1. Measuring Computer Performance: A Practitioner's Guide; David J. Lilja; 2005,Cambridge University Press, ISBN: 9781107439863.

2. The Art of Computer Systems Performance Analysis; Raj Jain; 2008, John Wiley; ISBN: 8126519053.

3. Probability and Statistics with Reliability, Queuing and Computer Science Applications; Trivedi K S, Kishor S. Trivedi; 2nd Edition; 2008, John Wiley; ISBN: 978-0-471-33341-8.

4. Research Methodology; R. Panneerselvam; 2004, Prentice Hall; ISBN - 9788120324527

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: II						
Course Code	:	MIM431T	**RESEARCH METHODOLOGY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Common Course to all M.Tech Programs*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Rajeswara Rao K V S			

UNIT - I	8 Hrs
Research Problem: Problem Solving – General Problem Solving, Logical Approach, Soft System Approach, Creative Approach, Group Problem Solving Techniques for Idea Generation. Formulation of Research Problems – Approaches to Research Problem, Exploration for Problem Identification, Hypothesis Generation and Formulation of the problem.	
UNIT - II	9 Hrs
Research Design: Experimental Design – Principles of Experiment, Laboratory Experiment, Experimental Design, Quasi Experimental Design, Action. Research, Validity and Reliability of Experiment and Quasi Experiments. Ex Post Facto Research – Exploratory Research, Historical Research, Descriptive Research, Field Studies, Survey Research, Qualitative Research Methods.	
UNIT - II	8 Hrs
Research Design for Data Acquisition: Measurement Design – Primary types of Measurement scales, Validity and Reliability Measurement, Sample Design – Non-Probability Sampling, Probability Sampling. Data Collection Procedures – Sources of secondary data, Primary data collection methods, Validity and Reliability of data collection procedures.	
UNIT IV	9 Hrs
Data Analysis: Exploratory Data Analysis, Statistical Estimation, Hypothesis Testing, Parametric Tests, Non-Parametric Tests, Multiple Regression, Factor Analysis, Cluster Analysis	
UNIT - V	8 Hrs
Research Proposal: Purpose, Types, Development of Proposal, Evaluation of Research Proposal. **Report Writing**: Pre-writing consideration, Format of Reporting, Briefing, Best practices for Journal writing.	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Recognize the principles and concepts of research types, data types and analysis procedures.
CO2	:	Apply appropriate method for data collection and analyze the data using statistical principles.
CO3	:	Express research output in a structured report as per the technical and ethical standards.
CO4	:	Develop a research design for the given engineering and management problem context.

Reference Books:

1. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Integration of Principles, Methods and Techniques, 17th Impression, Pearson India Education Services Pvt. Ltd, 2018. ISBN: 978-81-7758-563-6

2. William M. K. Trochim, James P. Donnelly, The Research Methods Knowledge Base, 3rd Edition, Atomic Dog Publishing, 2006, ISBN: 978-1592602919

3. Kothari C.R., Research Methodology Methods and Techniques, 4th Edition, New Age International Publishers, 2019, ISBN: 978-93-86649-22-5.

4. Levin, R.I. and Rubin, D.S., Statistics for Management, 8th Edition, Pearson Education: New Delhi, 2017, ISBN-13- 978-8184957495.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based
seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: II						
Course Code	:	MSE432I	**CLOUD NATIVE DEVOPS**	CIE Marks	:	100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	:	100
Hours	:	42L + 28P	*(Professional Core - 3)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. G S Mamatha			

UNIT - I	**9 Hrs**
Revolution in the cloud: The creation of the cloud, The dawn of DevOps, The Coming of Containers, Conducting the Container Orchestra, Kubernetes, Cloud Native,The Future of Operations. **First Steps with Kubernetes:** Running Your First Container, The Demo Application, Building a Container, Container Registries, Hello Kubernetes, Minikube. **Getting Kubernetes:** Cluster Architecture, The Costs of Self-Hosting Kubernetes, Managed Kubernetes Services, Kubernetes Installers, Clusterless Container Services.	
UNIT - II	**9 Hrs**
Working with Kubernetes Objects: Deployments, Pods, ReplicaSets, Maintaining Desired State, The Kubernetes Scheduler, Resource Manifests in YAML Format, Helm: A Kubernetes Package Manager. **Managing Resources:** Understanding Resources, Managing the Container Life Cycle, Using Namespaces, Optimizing Cluster Costs.	
UNIT - III	**8 Hrs**
Operating Clusters: Cluster Sizing and Scaling, Conformance Checking, Chaos Testing. Kubernetes Power Tools: Mastering kubectl, Working with Resources, Working with Containers, Contexts and Namespaces, Kubernetes Shells and Tools Kubernetes IDEs.	
UNIT - IV	**8 Hrs**
Running Containers: Containers and Pods, Container Manifests, Container Security, Volumes, Restart Policies, Image Pull Secrets, Init Containers. **Managing Pods:** Labels, Node Affinities, Pod Affinities and Anti-Affinities, Taints and Tolerations, Pod Controllers, Ingress, Service Mesh.	
UNIT - V	**8 Hrs**
Configuration and Secrets: ConfigMaps, Kubernetes Secrets, Secrets Management Strategies, Encrypting Secrets with Sops, Sealed Secrets. **Security, Backups, and Cluster Health**: Access Control and Permissions, Cluster Security Scanning, Container Security Scanning, Backups, Monitoring Cluster Status.	
LABORATORY	**28 Hrs**
1. Introduction to Source Control like (Git, Gitlab, Code Review, Pull request, etc) 2. Docker Fundamentals (Image, Container, volumes, networking) 3. Kubernetes (Introduction, Deployment platform) 4. Continuous Integration(CI) and Continuous Deployment(CD). 5. Hands on working with IBM CI/CD Devops toolchains. 6. Best industry practices for Devops on cloud. Pre-requisite (Must be completed by students before start of the lab) 1. IBM Cloud Account. (https://cloud.ibm.com/registration) 2. IBM Kubernetes Cluster (https://www.ibm.com/in-en/cloud/free/kubernetes) 3. Docker Desktop (https://www.docker.com/products/docker-desktop) for windows/Mac 4. IBM Cloud CLI (https://cloud.ibm.com/docs/cli?topic=cli-getting-started)	

5. Git (https://git-scm.com) IBM portals for hands-on lab study: Docker Essentials https://www.credly.com/org/ibm/badge/docker-essentials-a-developer-introduction Kubernetes Essentials https://www.credly.com/org/ibm/badge/operating-kubernetes-on-ibm-cloud
Cloud Native Applications
https://www.credly.com/org/ibm/badge/building-cloud-native-and-multicloud-applications
https://developer.ibm.com/tutorials/build-a-cicd-tekton-pipeline-for-deploying-a-nodejs-application/

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Apply the concept of cloud native DevOps to applications.
CO2	:	Analyse the usage of cloud, creating a docker image, kubernetes deployment for a given application
CO3	:	Design and implement cloud native applications and deployment.
CO4	:	Evaluate the building, deploying and scaling of applications in cloud.

Reference Books

1. Justin Domingus and John Arundel, Cloud Native DevOps with Kubertnetes, 2nd Edition, ORielly, 2022, ISBN: 9789355421944
2. Mitesh Soni, Agile, DevOps and Cloud Computing with Microsoft Azure, BPB Publications, 2019, ISBN: 978-93-88511-902
3. Nicole Forsgren, Jez Humble and Gene Kim, The Science of Lean Software and DevOps, ACCELERATE, IT Revolution Press, 2018, ISBN: 978-1942788331
4. IBM,IBM Cloud DevOps Field Guide, IBM Corporation, 2021, ISBN

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The average of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 30 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (10), Video based seminar /presentation /demonstration (20) adding upto 30 marks.

Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16 Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is Compulsory (Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with aboratory

RUBRIC of CIE		
Sl.No	**Content**	**Marks**
1	Quizzes - Q1 & Q2	10
2	Tests - T1 & T2	30
3	Experiential Learning - EL1 & EL2	30
4	Laboratory	30
	Total Marks	100
NO SEE for Laboratory		

RUBRIC of SEE		
Q. No	**Contents**	**Marks**
Each unit consists of TWO questions of 16 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.		
1 & 2	Unit-1: Question 1 or 2	16
3 & 4	Unit-2: Question 3 or 4	16
5 & 6	Unit-3: Question 5 or 6	16
7 & 8	Unit-4: Question 7 or 8	16
9 & 10	Unit-5: Question 9 or 10	16
11	Laboratory Component (Compulsory)	20
	Total Marks	100

SEMESTER: II						
Course Code	:	MIT233T	**Cyber Security And Digital Forensics**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*(Professional Core - 4)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Sushmitha N			

UNIT - I	**9 Hrs**
Introduction : Cyber Security, Cyber Security Policy, Domains of Cyber Security Policy, Strategy versus Policy Cyber Security Objectives: Cyber Security Metrics, Security Management Goals, Counting Vulnerabilities, Security Frameworks, Security Policy Objectives **Cyber Security Policy Catalog :** Cyber Governance Issues, Cyber User Issues, Cyber Conflict Issues, Cyber Management Issues, Cyber Infrastructure Issues,	
UNIT - II	**9 Hrs**
The Threat and Vulnerability Landscape : Protect What You Value, What is Privacy, Anonymity and Pseudonymity, Security, Vulnerabilities, Threats and Adversaries, Threat Modeling and Risk Assessments, Security vs Privacy vs Anonymity **The Current Threat and Vulnerability Landscape :** Why You Need Security – The Value of a Hack, The Top 3 Things You Need To Stay Safe Online, Security Bugs and Vulnerabilities, Hackers, crackers and cyber criminals, Malware, viruses, rootkits and RATs, Spyware, Adware, Scareware, PUPs & Browser hijacking, What is Phishing, Vishing and SMShing, Spamming & Doxing, Social engineering - Scams, cons, tricks and fraud, Darknets, Dark Markets and Exploit kits	
UNIT - III	**8 Hrs**
Understanding the Digital Forensics Profession and Investigations : An Overview of Digital Forensics , Preparing for Digital Investigations, Maintaining Professional Conduct , Preparing a Digital Forensics Investigation, Procedures for Private-Sector High-Tech Investigations, Understanding Data Recovery Workstations and Software, Conducting an Investigation. **Current Digital Forensics Tools :** Evaluating Digital Forensics Tool Needs , Digital Forensics Software Tools , Digital Forensics Hardware Tools , Validating and Testing Forensics Software.	
UNIT - IV	**8 Hrs**
Mobile Device Forensics : Understanding Mobile Device Forensics , Understanding Acquisition Procedures for Mobile Devices Cloud Forensics: An Overview of Cloud Computing , Legal Challenges in Cloud Forensics , Technical Challenges in Cloud Forensics , Acquisitions in the Cloud , Conducting a Cloud Investigation , Tools for Cloud Forensics	
UNIT - V	**8 Hrs**
Digital Forensics Analysis and Validation : Determining What Data to Collect and Analyze, Validating Forensic Data , Addressing Data-Hiding Techniques Virtual Machine Forensics, Live Acquisitions, and Network Forensics: An Overview of Virtual Machine Forensics , Performing Live Acquisitions, Network Forensics Overview	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Interpret the basic concepts of cyber security and digital forensics.
CO2	:	Compare different software and hardware tools used in validating forensic data.
CO3	:	Understand the current cybersecurity policy issues
CO4	:	Demonstrate through use of proper tools knowledge on the cyber security, Cybercrime and forensics.

Reference Books
1. Jennifer L. Bayuk , Jason Healey, Cyber Security Policy Guidebook, 2012, Wiley, ISBN: 978-1-118-02780-6
2. Nathan House , The Complete Cyber Security Course, StationX, First edition, January 2017
3. Bill Nelson, Amelia Phillips, Chris Steuart , Guide to Computer Forensics and Investigations, 5th Edition, 2015, ISBN: 978-1-285-06003-3
4. Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, SunitBelapure and Nina Godbole, 2013, Wiley India Pvt Ltd, ISBN: 978-81-265-21791

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MSE333C1	**ROBOTIC PROCESS AUTOMATION**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Mamatha G S			

UNIT - I	**9 Hrs**
What is Robotic Process Automation? Scope and Techniques of automation: what should be automated? What can be automated? Techniques of automation Roboic Process Automation: What can RPA do? Benefits of RPA Components of RPA, RPA platforms. About UiPath. The future of automation. Record and Play: UiPath stack, Downloading and Installing UiPath Studio, Learning UiPath Studio, Task Recorder, Emptying trash in Gmail, Emptying Recycle Bin.	
UNIT - II	**9 Hrs**
Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, how to use a sequence, how to use a flowchart, step by step example using sequence and control flow. Data Manipulation: Variables and scope, Collections, Arguments-purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example. CSV/Excel to data table and vice versa examples.	
UNIT - III	**8 Hrs**
Taking control of the controls : Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls-mouse and keyboard activities, working with UiExplorer, Handling events, Revisit recorder, Screen scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points. Tame that Application with Plugins and Extensions Terminal plugin: SAP automation, Java Plugin, Citrix automation, Mail plugin, PDF plugin, web integration, Excel and Word plugins, Credential management.	
UNIT - IV	**8 Hrs**
Handling User Events and Assistant Bots: What are assistant bots? Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event. Exception Handling, Debugging, and Logging Exception handling: Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting.	
UNIT - V	**8 Hrs**
Managing and Maintaining the Code: Project Organization, Nesting workflows, Reusability of workflows, commenting techniques, State Machine, When to use Flowcharts, State Machines or sequences, Using config files and examples of a config file. Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots.	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Apply the concept of Robotic Process Automation to automate various applications.
CO2	:	Analyse the usage of appropriate Robotic Process Automation technique for a given application.
CO3	:	Design and implement techniques of Robotic Process Automation.
CO4	:	Evaluate the code for deployment and maintenance.

Reference Books
1. Alok Mani Tripathi, Learning Robotic Process Automation, 1st Edition, Packpub.com, 2018, ISBN: 178847094X
2. Ed Freitas, Robotic Process Automation Succinctly, Succinctly EBook Series, 2020, ISBN: 978-1-64200-199-0
3. Nividous, Robotic Process Automation, www.nividous.com, 2018
4. Vaibhav Srivastava, Getting started with RPA using Automation Anywhere, BPB publishers, 2018, ISBN: 9789389898286

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MSE335C2	**SOFTWARE PROJECT MANAGEMENT**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Rekha B S			

UNIT - I	**9 Hrs**
Project Evaluation And Project Planning : Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	
UNIT - II	**9 Hrs**
Project Life Cycle And Effort Estimation : Software process and Process Models – Selection of an Appropriate Project Approach - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.	
UNIT - III	**8 Hrs**
Activity Planning And Risk Management : Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk Management – Nature of Risks, Types of Risks, Managing Risks, Risk Planning and Control, Evaluating risks to the schedule – Resource Allocation – Identifying Resources Requirements, Scheduling Resources, Creation of critical paths – Cost schedules.	
UNIT - IV	**8 Hrs**
Project Monitoring And Control : Framework for monitoring and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.	
UNIT - V	**8 Hrs**
Managing People And Organizing Teams : Organizational behavior – Best methods of staff selection - Instruction in the best method - Motivation – Working in teams – Decision making – Leadership, Organizational structures	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Understand Software Project Manamement principles to be followed during its development.
CO2	:	Estimate the risks involved in various Project activities.
CO3	:	Gain extensive knowledge about the basic concepts, framework and the process models.
CO4	:	Obtain adequate knowledge about software process models and software effort estimation techniques.

Reference Books
1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Sixth Edition, Tata McGraw Hill, 2016, ISBN - 9789387067189
2. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2015, ISBN- ISBN: 0471360287, ISBN13-9780471360285.
3. Gopalaswamy & Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), 2017, ISBN13 - 9780070598973.
4. Walker Royce: ―Software Project Management- Addison-Wesley, 2000.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: II						
Course Code	:	MIT236C3	**CLOUD COMPUTING**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. B K Srinivas			

UNIT - I **9 Hrs**

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Opensource software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact

UNIT - II **9 Hrs**

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

UNIT - III **8 Hrs**

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization.

UNIT - IV **8 Hrs**

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a twolevel resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling.

UNIT - V **8 Hrs**

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Course Outcomes: After going through this course the student will be able to:

CO1	:	Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost
CO2	:	Understand system, network and storage virtualization and outline their role in enabling the cloud computing system model
CO3	:	Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS
CO4	:	Analyze various cloud programming models and apply them to solve problems on the cloud.

Reference Books

1. Dan C. Marinescu, Cloud Computing - Theory and Practice, Morgan Kaufmann, Elsevier, 2013 Edition, ISBN: 978-0-12404-627-6

2. Srinivasan A., Cloud Computing: A practical approach for learning and implementation, 2014, Pearson Education India

3. Thomas, E., Zaigham, M., & Ricardo, P. , 2013, Cloud Computing Concepts, Technology & Architecture

4. Hurwitz, J. S., & Kirsch, D, 2020, Cloud computing for dummies. John Wiley & Sons

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MIT337C4	**DATA ENGINEERING**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Poornima Kulkarni			

UNIT - I **9 Hrs**

Data Warehousing and Online Analytical Processing: Basic Concepts Data Warehouse, Data Warehouse Modelling: Data Cube, A Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models. Dimensions: The Role of Concept Hierarchies, Measures: The Categorization and Computation. Typical OLAP Operations, Starnet query model for querying multidimensional databases.

UNIT - II **9 Hrs**

Data Analytics Life Cycle: Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case study of GINA. Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods, Frequent Item set Mining Methods, Which Patterns Are Interesting? Pattern Evaluation Methods. Learning Models: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Linear Regression.

UNIT - III **8 Hrs**

Introduction to NOSQL Databases: Definition and Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Understanding the Storage Architecture - Working with Column-Oriented Databases, HBase Distributed Storage Architecture, Document Store Internals, Performing CRUD operations - Creating Records, Accessing Data, Updating and Deleting Data, Querying NOSQL stores - Similarities Between SQL and MongoDB Query Features, Accessing Data from Column-Oriented Databases Like HBase, Indexing and Ordering datasets - Essential Concepts Behind a Database Index, Indexing and Ordering in MongoDB Creating and Using Indexes in MongoDB, CAP theorem.

UNIT - IV **8 Hrs**

Hadoop Distributed Filesystem: The Design of HDFS, HDFS Concepts, Data Flow – Anatomy of a File Read, Anatomy of File Write, Coherency Model. Data Ingest with Flume and Sqoop. Working with MapReduce: Anatomy of MapReduce, Job Scheduling, Shuffle and Sort, Task Execution. MapReduce Types and Formats – Default Types, Input Formats, Output Formats. MapReduce Features – Counters, Sorting, Joins.

UNIT - V **8 Hrs**

Sqoop: Sqoop Connectors, Imports, Sample Import – Text and Binary File Formats, Working with Imported Data. Hive: Comparison with Traditional Databases – Schema on Read Versus Schema on Write, Updates, Transactions and Indexes. HiveQL, Tables, Querying Data, User – Defined Functions. Case Studies: Hadoop and Hive at Facebook, Nutch Search Engine, Log Processing at Rackspace.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understanding the life cycle of Data Processing.
CO2	:	Explore the concepts of processing different types of Data.
CO3	:	Understand the applications Data Processing.
CO4	:	Use Hadoop related tools such as Sqoop and Hive for big data processing.

Reference Books
1. Jiawei Han and Micheline Kamber, "Data Mining – Concepts and Techniques" 3rd Edition; Morgan Kaufmann Publishers Inc, 2011; ISBN 9789380931913.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", 2nd Edition, EMC education services, Wiley Publishers, 2015, ISBN 978-81-265-3750-1.
3. Shashank Tiwari, "Professional NOSQL", Wiley Publishers, 2011, ISBN: 978-0-470-94224-6.
4. Tom White, Hadoop: The Definitive Guide, Third Edition, O'Reilley, 2012.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE		
Sl.No	**Content**	**Marks**
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE		
Q. No	**Contents**	**Marks**
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20

SEMESTER: II						
Course Code	:	MBT331G	**BIOINSPIRED ENGINEERING**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hr
Faculty Coordinator:			Dr Nagashree Rao and Dr Ashwani Sharma			

UNIT - I	**8 Hrs**
Introduction to Bio-inspired Engineering: Macromolecules, Stem cells; types and applications. Synthetic Biology; Bottom-up' and 'top-down' engineering approaches. Synthetic/ artificial life. Biological Clock, Genetic Algorithms.	
UNIT - II	**9 Hrs**
Principles of bioinspired materials: Biological and synthetic materials, Self-assembly, hierarchy and evolution. Biopolymers, Bio-steel, Bio-composites, multi-functional biological materials. Thermal Properties. Antireflection and photo-thermal biomaterials, Microfluidics in biology, Invasive and non-invasive thermal detection inspired by skin	
UNIT - III	**9 Hrs**
Lessons from Nature:Bioinspired Materials and mechanism: Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf - Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swim suits, Kingfisher beak - Bullet train, Coral - Calera cement, Forest floor / Ecosystem functioning - Flooring tiles, Morpho butterfly- Structural color, Namib beetle- Water collecting, Termite mound passive cooling, Birds/Insects- flights/ aerodynamics, Mosquito inspired micro needle.	
UNIT - IV	**8 Hrs**
Biomedical Inspiration-Concept and applications: Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs. Excretory- Artificial kidney and skin. Artificial Support and replacement of human organs: artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -artificial eye/ bionic eye.	
UNIT - V	**8 Hrs**
Biomimetics: Inventions in nature for Human Innovation: Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. Bio-ink and 3D-Bioprinting. Cellular automata. Biosensors: Artificial tongue and nose. Biomimetic echolation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Arti□cial Intelligence, Neural Networking and bio-robotics.	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Elucidate the concepts and phenomenon of natural processes
CO2	:	Apply the basic principles for design and development of bioinspired structures
CO3	:	Analyse and append the concept of bio-mimetics for diverse applications
CO4	:	Designing technical solutions by utilization of bio-inspiration modules.

Reference Books:

1. D. Floreano and C. Mattiussi, Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, 1st edition, MIT Press, 2008, ISBN: 9780262062718

2. Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. 1st edition, John Wiley, 2018, ISBN: 978-1-119-3903362

3. M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials, 1st edition, Cambridge University Press, 2014, ISBN 978-1-107-01045.

4. Tao Deng. Bioinspired Engineering of Thermal Materials, 1st edtion, Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal
choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

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SEMESTER: II						
Course Code	:	MBT332G	**HEALTH INFORMATICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr A H Manjunatha Reddy			

UNIT - I	**8 Hrs**
Introduction, Healthcare data, information and knowledge: Data types, data conversion, clinical data warehouse, data analytics, challenges, role of informatics in analytics, future trends	
UNIT - II	**8 Hrs**
Electronic health records: Introduction, scope for the e health records, challenges, examples, logical steps to selecting and implementing EHR	
UNIT - III	**8 Hrs**
Data standards and medical coding: Introduction, medical content standards, termonology standards, transport standards, medical coding and reimbursement, future trends,	
UNIT - IV	**9 Hrs**
Healthcare Enterprise: Overview of Health Informatics: Introduction, Key players in HI, organizations involved, barriers, programs, organizations and career, HI Resoruces	
UNIT - V	**9 Hrs**
Health Information privacy and security: Introduction, basic security principles, authentication and identity management, data security in the cloud and client/server management	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Understand the basic principles of Health informatics
CO2	:	Data capture to data transformation and to analysis
CO3	:	Creation of E health records, identify the challenges
CO4	:	Improvise the significant factors as per the spatio-temporal requirements

Reference Books:

1. Robert E. Hoyt Ann K. Yoshihashi, Health Informatics, Practical guide for Healthcare and Information Technology Professionals, 6th edition, Informatics Education, 2014, ISBN: 978-0-9887529-2-4

2. Kathryn J. Hannah Marion J. Ball, Health Informatics, Springer Series edition, Springer, 2005, ISBN: 1-85233-826-1

3. William R Hersh, Health Informatics, a Practical guide, 8th edition. 2022, ISBN 978-1-387-85475-2

4. Pentti Nieminen. Medical informatics and data analysis 1st edition, MDPI AG, 2021, ISBN-13 : 978-3036500980

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal
choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MCS331G	**BUSINESS ANALYTICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Azra Nasreen and Dr. Badarinath K			

UNIT - I	**9 Hrs**

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics
Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling.

UNIT - II	**9 Hrs**

Trendiness and Regression Analysis Modelling 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	**8 Hrs**

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 Modelling, Predictive analytics analysis.

UNIT - IV	**8 Hrs**

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.

UNIT - V	**8 Hrs**

Decision Analysis Formulating Decision Problems, Decision Strategies with and without Outcome, Probabilities, Decision
Trees, The Value of Information, Utility and Decision Making.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Apply the concepts and methods of business analytics to solve business problems
CO2	:	Analyse, model and solve decision problems in different settings
CO3	:	Interpret results/solutions and identify appropriate courses of action for a given business scenario
CO4	:	Demonstrate skills like investigation, effective communication, working in team/Individual and following ethical practices by implementing solutions to decision making problems

Reference Books:

1. Business analytics Principles, Concepts, and Applications FT Press Analytics, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, 1st Edition, 2014, ISBN-13: 978-0133989403, ISBN-10: 0133989402

2. The Value of Business Analytics: Identifying the Path to Profitability, Evan Stubs , John Wiley & Sons, |DOI:10.1002/9781118983881,1st Edition 2014, ISBN:978111898388

3. Business Analytics, James Evans, Pearsons Education 2nd Edition, ISBN-13: 978-0321997821 ISBN-10: 0321997824

4. Predictive Business Analytics Forward Looking Capabilities to Improve Business, Gary Cokins and Lawrence Maisel, Wiley; 1st Edition, 2013, ISBN: 978-1-118-17556-9 .

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

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Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
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2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MCV331G	**INDUSTRIAL AND OCCUPATIONAL HEALTH AND SAFETY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.V.AnanthaRam			

UNIT - I **08Hrs**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.

UNIT - II **09Hrs**

Occupational health and safety: Introduction, Health, Occupational health: definition, Interaction between work and health, Health hazards, workplace, economy and sustainable development, Work as a factor in health promotion. Health protection and promotion Activities in the workplace: National governments, Management, Workers, Workers' representatives and unions, Communities, Occupational health professionals. Potential health hazards: Air contaminants, Chemical hazards, Biological hazards, Physical hazards, Ergonomic hazards, Psychosocial factors, Evaluation of health hazards: Exposure measurement techniques, Interpretation of findings recommended exposure limits. Controlling hazards: Engineering controls, Work practice controls, Administrative controls. Occupational diseases: Definition, Characteristics of occupational diseases, Prevention of occupational diseases.

UNIT - III **09Hrs**

Hazardous Materials characteristics and effects on health: Introduction, Chemical Agents, Organic Liquids, Gases, Metals and Metallic Compounds, Particulates and Fibers, Alkalies and Oxidizers, General Manufacturing Materials, Chemical Substitutes, Allergens, Carcinogens, Mutagens, Reproductive Hazards, Sensitizers and Teratogens, Recommended Chemical Exposure Limits. Physical Agents, Noise and Vibration, Temperature and Pressure, Carcinogenicity, Mutagenicity and Teratogenicity. Ergonomic Stresses: Stress-Related Health Incidents, Eyestrain, Repetitive Motion, Lower Back Pain, Video Display Terminals.

UNIT - IV **08 Hrs**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication,Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT - V **08 Hrs**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, over hauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Course Outcomes: After going through this course the student will be able to:

CO1	:	Explain the Industrial and Occupational health and safety and its importance.
CO2	:	Demonstrate the exposure of different materials, occupational environment to which the employee can expose in the industries.
CO3	:	Characterize the different type materials, with respect to safety and health hazards of it.
CO4	:	Analyze the different processes with regards to safety and health and the maintenance required in the industries to avoid accidents.

Reference Books:
1.Maintenance Engineering Handbook, Higgins & Morrow, SBN 10: 0070432015 / ISBN 13: 9780070432017, Published by McGraw-Hill Education. Da Information Services.
2. H. P. Garg, Maintenance Engineering Principles, Practices & Management, 2009,S. Chand and Company, New Delhi, ISBN:9788121926447
3.Fundamental Principles of Occupational Health and Safety, Benjamin O. ALLI, Second edition,2008 International Labour Office – Geneva: ILO, ISBN 978-92-2-120454-1
4.Foundation Engineering Handbook, 2008, Winterkorn, Hans, Chapman & Hall London. ISBN:8788111925428.

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EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

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choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
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3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II							
Course Code	:	MCV332G	**INTELLIGENT TRANSPORTATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Sunil S			

UNIT - I **8 Hrs**

Introduction: –Historical Background, Definition, Future prospectus, ITS training and educational needs. Fundamentals of Traffic Flow and Control- Traffic flow elements, Traffic flow models, Shock waves in Traffic streams, Traffic signalization and control principles, Ramp metering, Traffic simulation

UNIT - II **9 Hrs**

ITS User services-User services bundles, Travel and Traffic management, Public Transportation Operations, Electronic Payment, Commercial Vehicles Operations, Emergency Management, Advanced Vehicle Control and safety systems, Information Management, Maintenance and construction Management. ITS Architecture-Regional and Project ITS
Architecture, Need of ITS architecture, concept of Operations, National ITS Architecture, Architecture development tool

UNIT - III **9 Hrs**

Technology Building Blocks for ITS-Introduction, Data acquisition, Communication Tools, Data Analysis, and Traveller Information. Various detection, identification and collection methods for ITS. ITS Applications and their benefits-Freeway and incident management systems, Advanced arterial traffic control systems, Advanced Public Transportation Systems,
Multimodal Traveller Information systems

UNIT - IV **8 Hrs**

ITS Planning-Transportation planning and ITS, Planning and the National ITS Architecture, Planning for ITS, Integrating ITS into Transportation Planning, relevant case studies. ITS Standards-Standard development process, National ITS architecture and standards, ITS standards application areas, National Transportation Communications for ITS Protocol, Standards
testing

UNIT - V **8 Hrs**

ITS Evaluation – Project selection at the planning level, Deployment Tracking, Impact Assessment, Benefits by ITS components, Evaluation Guidelines, Challenges and Opportunities. ITS for Law Enforcement: Introduction, Enhance and
support the enforcement traffic rules and regulations, ITS Funding options and ITS case studies

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Identify and apply ITS applications at different levels
CO2	:	Illustrate ITS architecture for planning process
CO3	:	Examine the significance of ITS for various levels
CO4	:	Compose the importance of ITS in implimentions

Reference Books:

1. Pradip Kumar Sarkar and Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Private Limited, Delhi,2018,
ISBN-9789387472068

2. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House publishers (31
March 2003); ISBN-10: 1580531601

3. Bob Williams, "Intelligent transportation systems standards", Artech House, London, 2008. ISBN-13: 978-1-59693-291-3

4. Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola "Intelligent Transport Systems:Technologies and Applications" Wiley Publishing ©2015, ISBN:1118894782 9781118894781

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem.

Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MEC331G	**ELECTRONIC SYSTEM DESIGN**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Ravishankar Holla			

UNIT - I **9 Hrs**

Design Process & its Fundamentals: Life Cycle of Electronic Products, Design and Development Process, Guidance for
Product Planning, Design and Development, Technical Drawings, Circuit Diagrams, Computer-Aided Design (CAD)

UNIT - II **9 Hrs**

System Architecture and Protection Requirements: Introduction - Terminology, Functions
and Structures, Systems Design Architecture, Electronic System Levels, System Protection
Experiential Learning: (4 quizzes on the below mentioned topics other than CIE) Reliability Analysis: Introduction, Calculation Principles, Exponential Distribution, Failure of Electronic, Components, Failure of Electronic Systems, Reliability Analysis of Electronic Systems, Recommendations for Improving Reliability of Electronic Systems

UNIT - III **8 Hrs**

Thermal Management and Cooling: Introduction - Terminology, Temperatures and Power Dissipation, Calculation Principles, Heat Transfer, Methods to Increase Heat Transfer, Application Examples in Electronic Systems, Recommendations for
Thermal Management of Electronic Systems, Cooling systems, liquid, air and non cooling systems.

UNIT - IV **8 Hrs**

Electromagnetic Compatibility (EMC): Introduction, Coupling Between System Components, Grounding Electronic Systems, Shielding from Fields, Electrostatic Discharge (ESD), Recommendations for EMC-compliant Systems Design

UNIT - V **8 Hrs**

Recycling Requirements and Design for Environmental Compliance: Introduction - Motivation and the Circular Economy, Manufacture, Use, and Disposal of Electronic Systems in the Circular Economy, Product Recycling in the Disposal Process, Material Recycling in the Disposal Process, Design and Development for Disassembly, Material Suitability in Design and Development, Recommendations for Environmentally Compliant Systems

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Realize the fundamentals of Design, Architecture, thermal management, EMC and Recycling requirements of Electronic System Design
CO2	:	Analyze the various application wise design requirements in Electronic systems along with the related concepts of implementations, standards and Compliances.
CO3	:	Use modern open source tools to realize the various concepts of Electronic system design
CO4	:	Engage in self-study through assignments, simulations, case studies and projects

Reference Books:

1. Fundamentals of Electronic Systems Design, Jens Lienig, Hans Brümmer 2017, Springer International Publishing, ISBN
978-3-319-55839-4, DOI:10.1007/978-3-319-55840-0

2. “Embedded System Design”, Marwedel, Peter, Springer Nature, 10.1007/978-3-030-60910-8

3. “Electromagnetic Compatibility Engineering”, Henry W. Ott, WILEY Publication, ISBN: 978-0-470-18930-6

4. "Handbook of Electronic Systems Design" by Charles A. Harper, McGraw-Hill Inc.,US , 0070266832, 978-0070266834

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem.

Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MEC332G	**EVOLUTION OF WIRELESS TECHNOLOGIES**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Mahesh A			

UNIT - I	**9 Hrs**
Introduction to cellular systems: Overview of Cellular Systems and evolution 2G/3G/4G/5G, Cellular Concepts – Frequency reuse, Co channel and Adjacent channel Interference, C/I, Handoff, Blocking, Erlang Capacity, Bluetooth, WiFi, WWAN and PAN.	
UNIT - II	**9 Hrs**
Fundamentals of wireless communication: Wireless Channel, Wireless propagation, Link budget, Free-space path loss, Noise figure of receiver, Multipath fading, Shadowing, Fading margin, Shadowing margin, Wireless Channel Capacity, OFDM and LTE, Large Scale Propagation effects and Channel Models	
UNIT - III	**8 Hrs**
Fundamentals of 5G architecture: Difference between 4G and 5G, 5G Architecture, Planning of 5G Network, Quality of Service, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States	
UNIT - IV	**8 Hrs**
mmWave and Visible Light Communications: Back ground and concept of mmWave Communications, Frequency bands, propagation characteristics, channel models, applications and challenges in 5G	
UNIT - V	**8 Hrs**
Future Generations: Future Generations(where is the 6G?), Health Considerations, Identifiers, Interfaces, ,Key Derivation, Location Based Services, Massive Internet of Things, Measurements, Network Functions Virtualization, Network Slicing, Open Source, , User Equipment, Vehicle-to-Vehicle communications (V2V),Virtual Reality (VR/AR/XR). Case study- Bharath Stack	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards
CO2	:	Compare different technologies used for wireless communication systems.
CO3	:	Demonstrate an ability explain recent techniques for Wireless Communication systems
CO4	:	Update the latest trends in wireless communications

Reference Books:

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Pearson, 2nd Edition.

2. Aditya K Jagannatham, "Principles of Modern Wireless Communications", McGraw Hill, 2017

3. Robin Chataut, Robert Akl, "Massive MIMO Systems for 5G and beyond Networks—Overview, Recent Trends, Challenges, and Future Research Direction" Sensors, May 2020

4. A. N. Uwaechia and N. M. Mahyuddin, A Comprehensive Survey on Millimeter Wave, Communications for Fifth-Generation Wireless Networks: Feasibility and Challenges, in IEEE, Access, vol. 8, pp. 62367-62414, 2020

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Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MET331G	**TRACKING AND NAVIGATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Shambulinga .M, Dr. B. Roja Reddy			

UNIT - I **9 Hrs**

An Introduction to Radar: Basic Radar, The simple form of the Radar Equation, Radar Block Diagram, Radar Frequencies,
Application of radar, Types of Radars. Detection of signals in Noise, Receiver Noise and the Signal-to Noise Ratio, Probability of Detection and False alarm, Introduction to Doppler, MTI, UWB Radars

UNIT - II **8 Hrs**

Terrestrial Network based positioning and navigation: General Issues of wireless positions location, Fundamentals, positioning in cellular networks, positioning in WLANs, Positioning in Wireless sensor networks.

UNIT - III **8 Hrs**

Satellite-based navigation systems: Global Navigation satellite systems (GNSS), GNSS receivers.

UNIT - IV **9 Hrs**

LiDAR: Introduction to LiDAR, context and conceptual discussion of LiDAR, Types of LiDARS, LiDARS Detection modes, Flash LiDAR versus Scanning LiDAR, Monostatic versus Bistatic LiDAR, Major Devices in a LiDAR, LiDAR remote sensing,
Basic components and physical principles of LiDAR, LiDAR accuracy and data formats.

UNIT - V **8 Hrs**

SONAR: Underwater acoustics, applications, comparison with radar, submarine detection and warfare, overcoming the
effects of the ocean, sonar and information processing.Transmission of the acoustic signal: Introduction, detection contrast and detection index, transmission equation, equation of passive and active sonar.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Understand the concepts of Radar, LiDAR, Sonar, terrestrial and satellite based navigation system
CO2	:	Apply the concepts of radars, LiDAR, Sonar, cellular networks, WLAN, sensor networks and satellites in determining the user position and navigation.
CO3	:	Analyze the different parameters of satellite and terrestrial networks for navigation systems.
CO4	:	Evaluate the Radar, LiDAR, Sonar systems and satellite and terrestrial network based navigation and tracking systems

Reference Books:

1. M. L Skolnik,Introduction to RADAR Systems,3rd edition, 2017,TATA Mcgraw-Hill, ISBN: 978-0070445338
2. Mark A Richards, James A Scheer, William A Holam,Principles of Modern Radar Basic Principles, 2010, 1st edition,SciTech Publishing Inc, ISBN:978-1891121524 .
3. Davide dardari, Emanuela Falletti, Marco Luise, Satellite and Terrestrial Radio Positioning techniques- A signal processing
perspective, 1st Edition, 2012, Elsevier Academic Press, ISBN: 978-0-12-382084-6.
4. Paul McManamon,LiDAR Technologies and Systems, SPIE press, 2019.
5. Pinliang Dong and Qi Chen,LiDAR Remote Sensing and Applications, CRC Press, 2018, ISBN: 978-1-4822-4301-7
6. Jean-Paul Marage, Yvon Mori, Sonar and Underwater Acoustics, Wiley, 2013, ISBN: 9781118600658

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II							
Course Code	:	MIM331G	**PROJECT MANAGEMENT**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Vikram N Bahadurdesai			

UNIT - I	**8 Hrs**
Introduction: Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS), Introduction to Agile Methodology.	
UNIT - II	**8 Hrs**
Capital Budgeting: Capital Investments: Importance and Difficulties, phases of capital budgeting, levels of decision making, facets of project analysis, feasibility study – a schematic diagram, objectives of capital budgeting	
UNIT - III	**9 Hrs**
Project Costing: Cost of Project, Means of Finance, Cost of Production, Working Capital Requirement and its Financing, Profitability Projections, Projected Cash Flow Statement, Projected Balance Sheet, Multi-year Projections, Financial Modeling, Social Cost Benefit Analysis	
UNIT - IV	**8 Hrs**
Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Critical Path Method (CPM), Computerized project management	
UNIT - V	**9 Hrs**
Project Management and Certification: An introduction to SEI, CMMI and project management institute USA – importance of the same for the industry and practitioners. PMBOK 6 - Introduction to Agile Methodology, hemes / Epics / Stories, Implementing Agile. Domain Specific Case Studies on Project Management: Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Explain project planning activities that accurately forecast project costs, timelines, and quality.
CO2	:	Evaluate the budget and cost analysis of project feasibility.
CO3	:	Analyze the concepts, tools and techniques for managing projects.
CO4	:	Illustrate project management practices to meet the needs of Domain specific stakeholders from multiple sectors of the economy (i.e. consulting, government, arts, media, and charity organizations).

Reference Books:
1. Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 8th Edition, 2010, ISBN 0-07-007793-2.
2. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Edition, 2013, ISBN: 978-1-935589-67-9
3. Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.
4. Rory Burke, Project Management – Planning and Controlling Techniques, John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1
Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100 **QUIZZES:** Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks. **TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks. **EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MIS331G	**DATABASE AND INFORMATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof.Smitha G R			

UNIT - I **8 Hrs**

Advanced Database Models, Systems, and Applications: Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases . Distributed Database Concepts : Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control
and Recovery in Distributed Databases

UNIT - II **8 Hrs**

Introduction to Information Retrieval and Web Search : Information Retrieval (IR) Concepts Retrieval Models, Types of Queries in IR Systems , Text Preprocessing , Inverted Indexing, Evaluation Measures of Search Relevance ,Web Search and Analysis, Trends in Information Retrieval .

UNIT - III **8 Hrs**

Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues, Ethical and Social issues in Information Systems: Understanding ethical and Social issues related to Information Systems, Ethics in an
information society, The moral dimensions of information society. A Case study on business planning.

UNIT - IV **9 Hrs**

Achieving Operational Excellence and Customer Intimacy: Enterprise systems, Supply chain management(SCM) systems, Customer relationship management(CRM) systems, Enterprise application. E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, The mobile digital platform and mobile E-commerce, Building and E-commerce web site. A Case study on ERP.

UNIT - V **9 Hrs**

Managing Knowledge: The knowledge management landscape, Enterprise-wide knowledge management system, Knowledge work systems, Intelligent techniques. Enhancing Decision Making: Decision making and information systems, Business intelligence in the enterprise. Business intelligence constituencies. Building Information Systems: Systems as planned organizational change, Overview of systems development.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Understand the different models for Infromation Retrieval.
CO2	:	Appricieate the technology of Information Retrieval and Web Search
CO3	:	To understand the basic principles and working of information technology.
CO4	:	Describe the role of information technology and information systems in business.

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.

2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 7th Edition, 2016, Published by Pearson,
Copyright © , ISBN-10: 0133970779

3. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN:
978-0072823110.

4. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, 2003, McGraw-Hill, ISBN:
9780071231510

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks.

The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

Reference Books:			**SEMESTER: II**			
Course Code	:	MIS332G	**MANAGEMENT INFORMATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Vanishree K			

UNIT - I	**8 Hrs**
Overview: Introduction: Professional Software Development, Software Engineering Ethics, Case studies. Software Processes: Models, Process activities, Coping with Change, Process improvement. The Rational Unified Process. Computer Aided Software Engineering. Agile Software Development: Introduction to agile methods, Agile development techniques, Agile project management and scaling agile methods. Information Systems in Global Business Today: The role of information systems in business today, Perspectives on information systems, Contemporary approaches to information systems	
UNIT - II	**9 Hrs**
Requirements Engineering and System Modeling: Software Requirements: Functional and Non-functional requirements. Requirements Elicitation, Specification, Validation and Change. System Modeling: Context models, Interaction models, Structural models, Behavioural models, Model driven architecture. Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues	
UNIT - III	**9 Hrs**
Development and Testing: Design and implementation: Object oriented design using UML, Design patterns, Implementation issues, Open-source development. Software Testing: Development testing, Test-driven development, Release testing, User testing. Securing Information Systems: System vulnerability and abuse, Business value of security and control, Establishing Framework for security and control, Technology and tools for protecting information resources. A case study on cybercrime.	
UNIT - IV	**8 Hrs**
Advanced Software Engineering: Dependable systems: Dependability properties, Sociotechnical systems, dependable processes, formal methods and dependability, A15 Availability and reliability, reliability requirements, Reliability measurements E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, A Case study on ERP.	
UNIT - V	**8 Hrs**
Software Management: Project Management: Risk Management, Managing People, Teamwork, Project Planning: Software Pricing, Plan driven development, Project Scheduling, Agile planning, Estimation Techniques, COCOMO cost modeling. Building Information Systems: Systems as planned organizational change, Overview of systems development.	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Understand and apply the fundamental concepts of software engineering for information systems.
CO2	:	Develop the knowledge about software engineering for management of information systems.
CO3	:	Interpret and recommend the use information technology to solve business problems.
CO4	:	Apply a framework and process for aligning organization's IT objectives with business strategy.

1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.

2. Ian Sommerville,— Software Engineering, 9th Edition, Pearson Education, 2013, ISBN: 9788131762165

3. W.S. Jawadekar: Management Information Systems, Tata McGraw Hill, 2006, ISBN: 9780070616349.

4. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN: 978-0072823110

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem.

Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding up to 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II							
Course Code	:	MMA331G	**STATISTICAL AND OPTIMIZATION METHODS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. PRAKASH R				

UNIT - I **9 Hrs**

Random Vectors:
Probability models of N random variables, Vector notation, Marginal probability functions, Independence of random variables and random vectors, Functions of random vectors, Expected value vector and Correlation matrix, Gaussian random vectors, Expected values of sums, Probability density function of the sum of two random variables, Moment Generating Functions (MGF), MGF of the sum of independent random variables, Characteristic function and Probability generating function.

UNIT - II **8 Hrs**

Estimation: Point estimation, Estimator and estimate, Criteria for good estimates - unbiasedness, consistency, efficiency and sufficiency, Variance of a point estimator, Methods of point estimation - Method of moments and Method of maximum
likelihood, Bayesian estimation of parameters.

UNIT - III **9 Hrs**

Inferential Statistics: Principles of Statistical Inference, Formulation of the problems with examples. Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors: level of significance, Rejection regions and power, Standard Normal null distribution (Z-test), Z-tests for means and proportions, Duality: two-sided tests and two-sided confidence intervals, P-value, Inference about variances, Special tests of significance for large and small
samples (F, Chi – square, Z, t – test).

UNIT - IV **8 Hrs**

Fuzzy Optimization:
Basic concepts of fuzzy sets - Operations on fuzzy sets, Fuzzy relation equations, Fuzzy logic control, Fuzzification, Defuzzificatiuon, Knowledge base, Decision making logic, Membership functions, Rule base.
Artificial Neural Networks: Introduction - Neuron model, Multilayer perceptions - Back propagation algorithm and its
variants, Loss functions in artificial neural networks, Stochastic gradient descent method.

UNIT - V **8 Hrs**

Machine Learning Algorithms:
Data mining, Hierarchy Clustering, k-Means Clustering, Distance Metric, Data mining for Big data, Characteristics of Big data, Statistical nature of Big data, Support Vector Machines, Statistical Learning Theory, Linear Support Vector Machine, Kernel functions and Nonlinear Support Vector Machines.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of statistics, random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms.
CO2	:	Derive the solution by applying the acquired knowledge of random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms to the problems of engineering applications.
CO3	:	Evaluate the solution of the problems using appropriate statistical and probability techniques to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of statistics, probability distributions and estimation, tests of hypothesis and optimization gained to engage in life – long learning.

Reference Books:

1. Roy D. Yates, David J. Goodman, "Probability and Stochastic Processes", 3rd Edition, An Indian Adaptation, Wiley, 2021,
ISBN: 9789354243455.

2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 7th Edition, John Wiley
& Sons, 2019, ISBN: 9781119570615.

3. Trevor Hastie Robert Tibshirani Jerome Friedman, "The Elements of Statistical Learning - Data Mining, Inference, and
Prediction", 2nd Edition, Springer, 2009 (Reprint 2017), ISBN-10: 0387848576, ISBN-13: 9780387848570.

4. Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press,
2014, ISBN- 13: 978-1-4822-1410-9.

5. Shai Shalev-Shwartz and Shai Ben-David "Understanding Machine Learning: From Theory to Algorithms", 1st Edition,
Cambridge University Press, 2014, ISBN: 978-1-107-05713-5.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal
choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE		
Sl.No	**Content**	**Marks**
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE		
Q. No	**Contents**	**Marks**
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: II						
Course Code	:	MMA331G	**INDUSTRY 4.0**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective G (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Gopalakrishna H D			

UNIT - I	**8 Hrs**

Fundamentals of Industry 4.0: Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS) Industry 4.0 across the Sectors Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics 4.0 (Implications), Fundamentals of Industry 4.0, Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS), Industry 4.0 across the Sectors

Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics
4.0 (Implications)

UNIT - II	**8 Hrs**

The Concept of the IIoT: Modern Communication Protocols, Wireless Communication Technologies, Proximity Network
Communication Protocols, TCP/IP, API: A Technical Perspective, Middleware Architecture.

UNIT - III	**8 Hrs**

Data Analytics in Manufacturing: Introduction, Power Consumption in manufacturing, Anomaly Detection in Air Conditioning, Smart Remote Machinery Maintenance Systems with Komatsu, Quality Prediction in Steel Manufacturing. Internet of Things and New Value Proposition, Introduction, Internet of Things Examples, IoTs Value Creation Barriers: Standards, Security and Privacy Concerns.

Advances in Robotics in the Era of Industry 4.0, Introduction, Recent Technological Components of Robots, Advanced
Sensor Technologies, Artificial Intelligence, Internet of Robotic Things, Cloud Robotics.

UNIT - IV	**9 Hrs**

Additive Manufacturing Technologies and Applications: Introduction, Additive Manufacturing (AM) Technologies, Stereo lithography, 3DP, Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing, Laser Engineered Net Shaping, Advantages of Additive Manufacturing, Disadvantages of Additive Manufacturing.

Advances in Virtual Factory Research and Applications, The State of Art, The Virtual Factory Software , Limitations of the
Commercial Software.

UNIT - V	**9 Hrs**

Augmented Reality: Definitions and application of AR, VR, MR, Limitations of AR, VR, Hardware devices and Software systems, Technical issues and challenges in AR, Industrial applications, IoT and the Need for Data Rationalization Internet of Things (IoT), Internet of Things Vision, Internet of Things (IoT) Frameworks, Architecture of Internet of Things
(IoT), Visualizing the Internet of Things (IoT), Essential Technologies of the Internet of Things (IoT), Key Technologies Involved in Internet of Things, Enablers of IoT, Collaborative Operations , Training.

Smart Factories: Introduction, Smart factories in action, Importance, Real world smart factories, The way forward.

A Roadmap: Digital Transformation, Transforming Operational Processes, Business Models, Increase Operational Efficiency, Develop New Business Models.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Understand the opportunities, challenges brought about by Industry 4.0 for benefits of organizations and individuals
CO2	:	Analyze the effectiveness of Smart Factories, Smart cities, Smart products and Smart services
CO3	:	Apply the Industrial 4.0 concepts in a manufacturing plant to improve productivity and profits
CO4	:	Evaluate the effectiveness of Cloud Computing in a networked economy

Reference Books:

1. Alasdair Gilchrist, Industry 4.0 The Industrial Internet Of Things, Apress Publisher, ISBN-13 (pbk): 978-1-4842-2046-7

2. Alp Ustundag, Emre Cevikcan, Industry 4.0: Managing The Digital Transformation, Springer, 2018 ISBN 978-3-319-57869-9.

3.Ovidiu Vermesan and Peer Friess, Designing the industry - Internet of things connecting the physical, digital and virtual worlds, Rivers Publishers, 2016 ISBN 978-87-93379-81-7

4.Christoph Jan Bartodziej, The concept Industry 4.0- An Empirical Analysis of Technologies and Applications in Production Logistics, Springer Gabler, 2017 ISBN 978-3-6581-6502-4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

RV Educational Institutions®

SEMESTER: II						
Course Code	:	MIT438L	**API Development and Integration Lab**	CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. G S Mamatha			

Content

Design and develop Java-based RESTful APIs using the latest versions of the Spring MVC and Spring Boot frameworks. This course helps in designing and building a REST application while delving into design principles and best practices for versioning, security, documentation, error handling, paging, and sorting. Also, skills to build sophisticated REST applications using Spring technologies can be developed.

Learnings

- Build Java-based microservices, native cloud, or any applications using Spring REST
- Employ Spring MVC and RESTful Spring
- Build a QuickPoll application example
- Document REST services, as well as versioning, paging, and sorting
- Test, handle errors and secure your application

Examples of API Integration Use Cases

Connect Cloud Apps
Creation of Custom APIs
Ease the Development of Apps
Strategic Team Movement

Multiple Services

Management

Building an Application with Spring Boot

Spring Boot offers a fast way to build applications. It gives focus more on business features and less on infrastructure.

References:

• Modern API Development with Spring and Spring Boot: Design highly scalable and maintainable APIs with REST, gRPC, GraphQL, and the reactive paradigm Kindle Edition by Sourabh Sharma.
• Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot , 2018 by Dinesh rajput • Spring REST: Building Java Microservices and Cloud Applications 2nd ed. Edition
by Balaji Varanasi • Learn Microservices with Spring Boot: A Practical Approach to RESTful Services using RabbitMQ, Eureka, Ribbon, Zuul and Cucumber, January 2018

Course Outcomes: After going through this course the student will be able to:

CO1	:	Learn how to authorize a user with access token
CO2	:	Learn how to configure Auth0 and implement different servlets
CO3	:	Learn how to make a transaction with Stripe
CO4	:	Focus on the unique requirements of an application while outsourcing repetitive complex code to APIs.

Reference Books
1. Modern API Development with Spring and Spring Boot: Design highly scalable and maintainable APIs with REST, gRPC, GraphQL, and the reactive paradigm Kindle Edition by Sourabh Sharma.
2. Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot , 2018 b Dinesh Rajput
3. Spring REST: Building Java Microservices and Cloud Applications 2nd ed. Edition by Balaji Varanasi
4. Learn Microservices with Spring Boot: A Practical Approach to RESTful Services using RabbitMQ, Eureka, Ribbon, Zuul and Cucumber, January 2018

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50. Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40 Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks

RUBRIC FOR CIE			RUBRIC FOR SEE	
Sl.No	Content	Marks	Content	Marks
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions	40
2	Innovative Experiment/Concept Design & Implementation	10		
3	Laboratory Internal	10	Viva Voce	10
	Total Marks	50	Total Marks	50

SEMESTER: II						
Course Code	:	MHS131T	**PROFESSIONAL SKILL DEVELOPMENT- I**	CIE Marks	:	50
Credits L-T-P	:	2-0-0		SEE Marks	:	50
Hours	:	28L	*Common Course to all M.Tech Programs*	SEE Durations	:	2 Hrs
Faculty Coordinator:			Dr. C.Bindu Ashwini			

UNIT - I	4 Hrs
Communication Skills: Basics of Communication, Personal Skills & Presentation Skills – Introduction, Application, Simulation, Attitudinal Development, Self Confidence, SWOC analysis. Resume Writing: Understanding the basic essentials for a resume, Resume writing tips Guidelines for better presentation of facts. Theory and Applications.	
UNIT - II	8 Hrs
Quantitative Aptitude and Data Analysis: Number Systems, Math Vocabulary, fraction decimals, digit places etc. Simple equations – Linear equations, Elimination Method, Substitution method, Inequalities. Reasoning – a. Verbal - Blood Relation, Sense of Direction, Arithmetic & Alphabet. b. Non- Verbal reasoning - Visual Sequence, Visual analogy and classification. Analytical Reasoning - Single & Multiple comparisons, Linear Sequencing. **Logical Aptitude,** - Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. **Verbal Analogies/Aptitude** – introduction to different question types – analogies, Grammar review, sentence completions, sentence corrections, antonyms/synonyms, vocabulary building etc. Reading Comprehension, Problem Solving,	
UNIT - III	6 Hrs
Interview Skills: Questions asked & how to handle them, Body language in interview, and Etiquette – Conversational and Professional, Dress code in interview, Professional attire and Grooming, Behavioral and technical interviews, Mock interviews - Mock interviews with different Panels. Practice on Stress Interviews, Technical Interviews, and General HR interviews	
UNIT - IV	5 Hrs
Interpersonal and Managerial Skills: Optimal co-existence, cultural sensitivity, gender sensitivity; capability and maturity model, decision making ability and analysis for brain storming; Group discussion(Assertiveness) and presentation skills;	
UNIT - V	5 Hrs
Motivation: Self-motivation, group motivation, Behavioral Management, Inspirational and motivational speech with conclusion. (Examples to be cited). Leadership Skills: Ethics and Integrity, Goal Setting, leadership ability.	

Course Outcomes: After going through this course the student will be able to:

CO1	:	Develop professional skill to suit the industry requirement.
CO2	:	Analyze problems using quantitative and reasoning skills
CO3	:	Develop leadership and inter personal working skills.
CO4	:	Demonstrate verbal communication skills with appropriate body language.

Reference Books:
1. The 7 Habits of Highly Effective People, Stephen R Covey Free Press, 2004 Edition, ISBN: 0743272455
2. How to win friends and influence people, Dale Carnegie General Press, 1st Edition, 2016, ISBN: 9789380914787
3. Crucial Conversation: Tools for Talking When Stakes are High, Kerry Patterson, Joseph Grenny, Ron Mcmillan 2012 Edition, McGraw-Hill Publication ISBN: 9780071772204
4. Ethnus, Aptimithra: Best Aptitude Book ,2014 Edition, Tata McGraw Hill ISBN: 9781259058738

Phase *	**Activity**
I	Test 1 is conducted after the completion of 9 hours of training programme (3 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers.
II	Test 2 is conducted after the completion of 18 hours of training programme (6 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers. Total test marks will be reduced to 30 Marks and Total Quiz marks will be 20 Marks. Final CIE would be 50 Marks.
CIE marks 20 Quiz + 30 Test = 50 Marks	
Semester End Examination: SEE is conducted for 50 Marks for a duration of 2 hours.	

SEMESTER: III						
Course Code	:	MIT261T	**BIG DATA ANALYTICS**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Professional Core - 5*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Swetha S			

UNIT - I	**9 Hrs**
Introduction: A Historical Review of Big Data Historical Interpretation of Big Data ,Defining Big Data From 3Vs to 32Vs ,Big Data Analytics and Machine Learning, Big Data Analytics and Cloud Computing,Hadoop, HDFS, MapReduce, Spark, and Flink - ML+CC→BDA **Big Data Analytics for Social Media** :Introduction , NLP and Its Applications,Text Mining , Anomaly Detection	
UNIT - II	**9 Hrs**
Real-Time Analytics : Introduction, Computing Abstractions for Real-Time Analytics, Real-Time Processing for Big Data — Concepts and Platforms, Data Stream Processing Platforms, Data Stream Analytics Platforms, Data Analysis and Analytic Techniques, Finance Domain Requirements and a Case Study, Future Research Challenges **Database Techniques for Big Data :** Background, NoSQL Movement, NoSQL Solutions for Big Data Management, NoSQL Data Models, Future Directions	
UNIT - III	**8 Hrs**
Resource Management in Big Data Processing Systems: Types of Resource Management, Big Data Processing Systems and Platforms, Single-Resource Management in the Cloud, Multi-resource Management in the Cloud, Related Work on Resource Management, Open Problems **System Optimization for Big Data Processing**: Basic Framework of the Hadoop Ecosystem, Parallel Computation Framework: MapReduce, Job Scheduling of Hadoop, Performance Optimization of HDFS, Performance Optimization of HBase, Performance Enhancement of Hadoop System	
UNIT - IV	**8 Hrs**
Big Data Security And Privacy : Background ,Spatial Aspects of Social Networks, Cloud-Based Big Data Infrastructure , Spatial Privacy Case Studies, Security And Privacy In Big Data: Secure Queries Over Encrypted Big Data, Other Big Data Security, Privacy on Correlated Big Data, Future Directions **Location Inferring in Internet of Things and Big Data:** Device-Based Sensing Using Big Data, Device-Free Sensing Using Big Data	
UNIT - V	**8 Hrs**
A Case Study in Big Data Analytics: Exploring Twitter Sentiment Analysis and the Weather : Big Data System Components, Machine-Learning Methodology, System Implementation, Key Findings, Dynamic Uncertainty-Based Analytics for Caching **Performance Improvements in Mobile Broadband Wireless Networks:** Background , Cellular Network and VoD ,Markov Processes ,Related Work , VoD Architecture , Overview , Data Generation ,Edge and Core Components , INCA Caching Algorithm , QoE Estimation ,Theoretical Framework	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Perform analytics on real-time streaming data and design solution
CO2	:	Apply NoSql alternative database models to solve real world problems
CO3	:	Analyze data by utilizing various statistical and data mining approaches
CO4	:	Analyse and apply the peinciples of security and privacy on big data

Reference Books

1. Rajkumar Buyya , R.N. Calheiros,A.Dastjerdi , Big Data: Principles and Paradigms 1st Edition, McGraw Hill, ISBN: 0128053941

2. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012, ISBN: 978-0321826626

3. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, ISBN: 978-1449311520

4. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Osborne Media; 1st edition, ISBN: 978-0-07-179053-6

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MIT362D1	**AUGMENTED REALITY & VIRTUAL REALITY**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	***Elective D (Professional Elective)***	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Ashwini K B			

UNIT - I	**9 Hrs**
Introduction to Virtual Reality and its applications, Geometry of Virtual Worlds: Geometric models, Transforming models, 2D and 3D rotation yaw, pitch, and roll Programming with Unity: Unity Basics, Manipulating the Scene, Code blocks and Methods, Debugging Conditional and looping statements	
UNIT - II	**9 Hrs**
Programming with Unity: Working with objects, Working with Scripts, Player movement, Camera Movement, Menu and UI, Advanced 3D movement Further Learning for Unity: The Asset Store. Mouse-Aimed camera: First Person Controller, Third Person Controller.	
UNIT - III	**8 Hrs**
Augmented Reality Mixed Reality and its applications: Tracking: Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion. Computer Vision for Augmented Reality : Marker-based tracking, Marker-less tracking.	
UNIT - IV	**8 Hrs**
Modeling Tools for AR : An introduction to Blender. Modeling of an object, Sculpting objects, Importing from Blender to Unity, Modifiers, Particle system, Animation.	
UNIT - V	**8 Hrs**
Introduction to WebXR: Entering VR through WebXR, Life cycle of WebXR application, Creating an XR session through WebXR. **Creating an AR website with WebXR:** Object creation, spatial tracking, start AR session, animate, create an event handling function for the end of the session.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Understand the concepts of Virtual Reality/Augmented Reality and its Applications
CO2	:	Identify immersive effects and its usage to experience AR/VR through exploration of its environment
CO3	:	Apply virtual/augmented environment to captivate its experiences
CO4	:	Analyze the technology for unimodal/multimodal user interaction in AR and VR

Reference Books

1. "Virtual Reality", Steven M. LaValle, Copyright Steven M. LaValle 2017 Available for downloading at http://vr.cs.uiuc.edu/

"AR and VR Using the WebXR API", Rakesh Baruah, 2021, ISBN-13 (pbk): 978-1-4842-6317-4 ISBN-13 (electronic): 978-1-4842-6318-1 https://doi.org/10.1007/978-1-4842-6318-1

3. Augmented Reality Principles and Practice", Dieter Schmalstieg Tobias Höllerer, 2016 Pearson Education, Inc., ISBN-13: 978-0-321-88357-5

4. Blender 3D: Designing Objects" , Romain Caudron, Pierre-Armand Nicq, Enrico Valenza, 2016, Packt Publishing Ltd, ISBN 978-1-78712-719-7

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE		
Sl.No	**Content**	**Marks**
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE		
Q. No	**Contents**	**Marks**
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER: III						
Course Code	:	MIT263D2	**NATURAL LANGUAGE PROCESSING**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Rajashekara Murthy S			

UNIT - I	**9 Hrs**

Introduction to Natural Language Processing: The Study of Language, applications of natural language understanding, evaluating language understanding, different levels of language analysis, representations and understanding, organization of natural language understanding systems. **Foundations of Computational Linguistics:** Dictionaries, Thesauri and WordNets, Morphology, POS Tagging, Syntax: Grammars and Parsers, Semantics, Pragmatics , Other Areas of Linguistics

Language Technologies (Indian Scenario): The Text Processing Environment, The Alphabet, The Script Grammar, Fonts, Glyphs and Encoding Standards, Character Encoding Standards, Romanization, Spell Checkers, Optical Character Recognition, Language Identification, Others Technologies for Indian Lanauages, NLP and Sanskrit, Epilogue

UNIT - II	**9 Hrs**

Statistical Machine learning and Approaches to NLP - Statistical Approaches, Corpora, Statistical Approaches to Language, Machine Learning Markov Models:Hidden Markov Models, The three fundamental questions for HMMs, HMMs: Implementation, Properties, and Variants

Part-of-Speech Tagging: The Information Sources in Tagging, Markov Model Taggers, Hidden Markov Model Taggers, Transformation-Based Learning of Tags, Tagging Accuracy and Uses of Taggers

UNIT - III	**8 Hrs**

Text categorization: Why Text Categorization?, Approaches to Automatic Text Categorization, Text Representation, Feature Weighting, Text Classification and Clustering – Hierarchical and Non-Hierarchical, Decision Trees, Maximum Entropy Modeling, Perceptrons, k Nearest Neighbor Classification, Information Retrieval: IR Defined, Documents and Bags-of-words, The Vector Space Model, Performance Evaluation, Measuring Relevance **Challenges in Information Retrieval Information Extraction(IE):** What is Information Extraction? Information Extraction Tasks, Architecture of an IE System. Text Summarization - Why Summarization?, Approaches to Automatic Summarization, Summarization in Relation to Information Extraction, Summarization in Relation to Other Technologies, Evaluation of Summarization Systems , Summarization in the Context of Indian Tradition

UNIT - IV	**8 Hrs**

Machine Translation: Machine Translation is Hard, Deploying Machine Translation, Approaches to Machine Translation, Challenges in Machine Translation, Machine Translation in India Ambiguity Resolution: Selectional restrictions, semantic filtering using selectional restrictions, semantic networks, statistical word sense disambiguation, statistical semantic preferences, combining approaches to disambiguation Statistical Alignment and Machine Translation: Text Alignment, Word Alignment, Statistical Machine Translation

UNIT - V	**8 Hrs**

Basic IR Models - History of IR, IR Models, Term Weighting: tf-idf, Similarity Measures, The Probability Ranking Principle, Performance Evaluation , Towards Intelligent IR - Improving User Queries - Relevance Feedback, Page Ranking, Role of Linguistics, Latent Semantic Indexing, Meta Search Engines, Semantic Web, Speech Recognition and Spoken Language : Issues in Speech Recognition, The sound structure of Language, Signal Processing, Speech Recognition, Speech Recognition and Natural Language Processing, Prosody and Intonation, Text to Speech, Optical Character Recognition

Course Outcomes: After going through this course the student will be able to:		
CO1	:	Describe and implement methods for morphological analysis and tagging of natural language, and evaluate such systems.
CO2	:	Describe and implement some important parsing algorithms, methods for capturing and/or classifying the content of texts in natural language.
CO3	:	Demonstrate mastery of knowledge representation for semantics
CO4	:	Understand of how NLP relates to search engines, text mining and decision support systems.

Reference Books

1. James Allen – Natural Language Understanding, Pearson Education,2nd Edition, ISBN: 978-81-317-0895-8, 1995

2. Christopher D. Manning, Foundations of Statistical Natural Language Processing, The MIT Press; 1st edition, ISBN: 0-262-13360-1, 1999

3. Kavi Narayana Murthy - "Natural Language Processing - An Information Access Perspective", Ess Ess Publications, 1st Edition, ISBN: 81-7000-485-3, 2006

4. Anne Kao and Stephen R. Poteet (Eds), —Natural Language Processing and Text Mining, Springer, 2007, ISBN : 9781846281754

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the

problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MIT264D3	**INFORMATION RETRIEVAL**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28P	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Vanishree K			

UNIT - I	**9 Hrs**
Boolean Retrieval: An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval The term Vocabulary and Postings Lists: Document delineation and character sequence decoding, Obtaining the character sequence in a document, Choosing a document unit, Determining the vocabulary of terms, Tokenization, Dropping common terms: stop words, Normalization (equivalence classing of terms), Stemming and lemmatization, Faster postings list intersection via skip pointers, Positional postings and phrase queries, Bi-word indexes, Positional indexes, Combination schemes	
UNIT - II	**9 Hrs**
Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, General wildcard queries, k-gram indexes for wildcard queries, Spelling correction, Implementing spelling correction, Forms of spelling correction, Edit distance, k-gram indexes for spelling correction, Context sensitive spelling correction, Phonetic correction Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing and Other types of indexes.	
UNIT - III	**8 Hrs**
Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage. Scoring, term weighting and the vector space model: Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight g, Term frequency and weighting, Inverse document frequency, TF-IDF weighting, The vector space model for scoring, Dot products, Queries as vectors, Computing vector scores.	
UNIT - IV	**8 Hrs**
Computing scores in a complete search system: Efficient scoring and ranking, Inexact top K document retrieval, Index elimination, Champion lists, Static quality scores and ordering, Impact ordering, Cluster pruning, Components of an information retrieval system, Tiered indexes, Query-term proximity, Designing parsing and scoring functions. Putting it all together. Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results.	
UNIT - V	**8 Hrs**
XML Retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval. Probabilistic information retrieval: Review of basic probability theory, The Probability Ranking Principle, The Binary Independence Model.	

Course Outcomes: After going through this course the student will be able to:		
CO1	:	Analyze and implement algorithms to extract relevant information from unstructured data usin
CO2	:	Evaluate information retrieval algorithms for document indexing, relevance ranking, web search
CO3	:	Apply various information retrieval techniques to retrieve information.
CO4	:	Create information retrieval applications based on various ranking principles and retrieval methods.

Reference Books

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze: "An Introduction to Information Retrieval", Cambridge University Press, England, 2008, ISBN 13: 9780521865715.

2. Cheng Xiang Zhai, "Statistical Language Models for Information Retrieval", Morgan & Claypool Publishers, 2009, ISBN: 9781598295900

3. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval", Addison Wesley Longman Publishing Co. Inc, 2009, ISBN-10: 0321416910.

4. David A. Grossman, OphirFrieder, Information Retrieval Algorithms and Heuristics; 2ndEdition, Springer Verlag; 2012; ISBN-9788181289179.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

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EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MIT265D4	**FINTECH APPLICATIONS**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. B K Srinivas			

UNIT - I	**9 Hrs**
Introduction : Banking and the E-Book Moment; Why We're so Excited About FinTech; Current Trends in Financial Technology; FinTech Themes; Banks Need to Think Collaboration Rather Than Competition; Global Compliance is Key; Lending (Capital) in the 21st Century; The Next Big Innovation in FinTech - Identity, Tech Giants Becoming Non-Bank Banks; Design is No Longer an Option-User Experience (UX) in FinTech;	
UNIT - II	**9 Hrs**
FinTech Solutions: Rewiring the Deal – The Path Forward for B2B Supply Chains; Payments and Point of Sales (POS) Innovation; Predictive Algorithms – Building Innovative Online Banking Solutions; Big Data is the Cornerstone of Regulatory Compliance Systems; FinTech Solutions in Complex Contracts Optimization; Behavioural Biometrics – A New Era of Security; Ultra-Fast Text Analytics in Trading Strategies; Regulated Crowdfunding Ecosystems; Remittances – International FX Payments at Low Cost; FinTech Solutions for Small Businesses; Payment Solutions Including Apple Pay; FinTech Solutions Benefiting other Sectors; FinTech Innovation for Wearables	
UNIT - III	**8 Hrs**
Technologies That Can Create the New ABC of Fintech : A for Artificial intelligence, Algorithms, Anomaly and Autonomous, B for Big Data, Blockchain and Bitcoin, C for Cloud, Crypto (Ethereum, Smart contracts) and Cybersecurity Crypto-currencies and Blockchains, FinTech + Digital Currency – Convergence or Collision?, Blockchain and Crypto-currencies	
UNIT - IV	**8 Hrs**
The Future of FinTech: How Emerging Technologies Will Change Financial Services, The Future of Financial Services, Banking on Innovation Through Data, Why FinTech Banks Will Rule the World, The FinTech Supermarket – The Bank is Dead, Long Live the Bank!, Banks Partnering with FinTech Start-ups to Create an Integrated Customer Experience, The Rise of BankTech – The Beauty of a Hybrid Model for Banks, FinTech Impact on Retail Banking – From a Universal Banking Model to Banking Verticalization, Embracing the Connected API Economy, Banking Like Water, Eliminating Friction in Customers' Financial Lives, FinTech is the Future Itself, A Future Without Money, Ethics in FinTech	
UNIT - V	**8 Hrs**
FinTech Hubs: Nurturing New FinTech Communities, La (French) FinTech Connection, The Journey Towards an Integrated FinTech Ecosystem – The Netherland, Luxembourg, a Future FinTech Hub?, Vienna as the No. 1 FinTech Hub in Mobile Payments?, India's FinTech Ecosystem, Singapore, the FinTech Hub for Southeast Asia Emerging Markets and Social Impact; FinTech – The Not So Little Engine That Can; Why Am I Not Gonna Be Able to Enter a Bank?; The Rise of the Rest in FinTech; Smartphones, FinTech, and Education – Helping the Unbanked Reach Financial Inclusion, The Social Impact of FinTech in Nigeria, India and the Pyramid of Opportunity,	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Explain the interplay of finance and technology and how the two universes inevitably are colliding into one another
CO2	:	How big data technology can make risk and compliance information systems easier to implement
CO3	:	Understand the role of emerging technologies in securing and leveraging banking services
CO4	:	Analyse the impact of applying trending technologies to financial institutions through real time case studies

Reference Books

1.Susanne Chishti and Janos Barberis, The FinTech Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley, 2016, ISBN: 978-1-119-21887-6

2. Sanjay Phadke, FinTech Future, SAGE, 2020, ISBN: 9789353882488

3. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services, First Edition, De Gruyter, 2018, ISBN: 978-1547417087

4. Steven O'Hanlon, Susanne Christi, FinTech For Dummies, First Edition, Wiley, 2021, ISBN: 978-8126515929

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

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EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	100

SEMESTER III						
Course Code	:	MIT461N	**INTERNSHIP**	CIE Marks	:	50
Credits L-T-P	:	0 - 0 - 6		SEE Marks	:	50
Hours/Week	:	12		SEE Durations	:	3 Hrs

Guidelines:

1. The duration of the internship shall be for a period of 6 weeks on full time basis after II semester final exams and before the commencement of III semester.
2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3. Internship must be related to the field of specialization of the respective PG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. 6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be softbound in Ivory color for PG circuit Programs and Light Blue for Non-Circuit Programs.

Course Outcomes: After going through the internship the student will be able to

CO1: Apply Engineering and Management principles to solve the problems CO2: Analyze real-time problems and suggest alternate solutions
CO3: Communicate effectively and work in teams
CO4: Imbibe the practice of professional ethics and lifelong learning

Scheme of Continuous Internal Evaluation (CIE):

The evaluation committee shall consist of Guide, Professor, Associate Professor/Assistant Professor. The committee shall assess the presentation and the progress reports.

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
I	Application of Engineering knowledge in industries, ability to comprehend the functioning of the Organization/ Departments.	40%
II	Importance of Resource Management, Environment and Sustainability. Demonstration and Presentation of Internship work with Report Submission	60%

Scheme for Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

SEMESTER III						
Course Code	:	MIT461P	**MINOR PROJECT**	CIE Marks	:	50
Credits L-T-P	:	0 - 0 - 6		SEE Marks	:	50
Hours/Week	:	12		SEE Durations	:	3 Hrs

Guidelines:

1. Each project group will consist of maximum of two students.
2. Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The minor project would be performed in-house.
5. The implementation of the project must be preferably carried out using the resources available in the department/college.

Course Outcomes: After completing the course, the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply resource managements skills for projects.
CO4: Synthesize self-learning, team work and ethics.

Scheme of Continuous Internal Examination

Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor and Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Approval of the selected topic, formulation of Problem Statement and Objectives with Synopsis submission	20 %
II	Mid-term seminar to review the progress of the work with documentation	40 %
III	Oral presentation, demonstration and submission of project report	40 %

* Phase wise rubrics to be prepared by the respective departments

CIE Evaluation shall be done with weightage / distribution as follows:

• Selection of the topic & formulation of Problem Statement and Objectives	10 %
• Design and simulation/ Algorithm development/ Experimental setup	25 %
• Conducting experiments/ Implementation / Testing	25 %
• Demonstration & Presentation	25 %
• Report writing	15 %

Scheme of Semester End Examination (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

- Brief write up about the project 05%
- Methodology and Experimental Results & Discussion 20%
- Presentation / Demonstration of the Project 25%
- Report 20%
- Viva Voce 30%

SEMESTER IV						
Course Code	:	MIT491P	**MAJOR PROJECT**	CIE Marks	:	100
Credits L-T-P	:	0 - 0 - 18		SEE Marks	:	100
Hours/Week	:	36		SEE Durations	:	3 Hrs

Guidelines:

1. Major Project is to be carried out for a duration of 18 weeks
2. Students must adhere to the Project Presentation Schedule, report to their guide on a weekly basis and get their Project diary signed by their guide 4. Students must execute the Major Project individually and not in teams.
5. It is mandatory for the students to present/publish their project work in National/International Conferences or Journals
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be soft bound and in Ivory color for PG circuit Programs and Light Blue for Non-Circuit Programs

Course Outcomes: After completing the course, the students will be able to

CO1: Conceptualize, Design and Implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics and societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination

Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor, Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Selection of Project Title, Formulation of Problem Statement and Objectives	20 %
II	Design, Implementation and Testing	40 %
II	Experimental Result & Analysis, Conclusions and Future Scope of Work, Report Writing and Paper Publication	40 %

* Phase wise rubrics to be prepared by the respective departments

Scheme for Semester End Evaluation (SEE):

Major Project SEE evaluation shall be conducted in two stages. This is initiated after fulfilment of submission of Project Report and CIE marks.

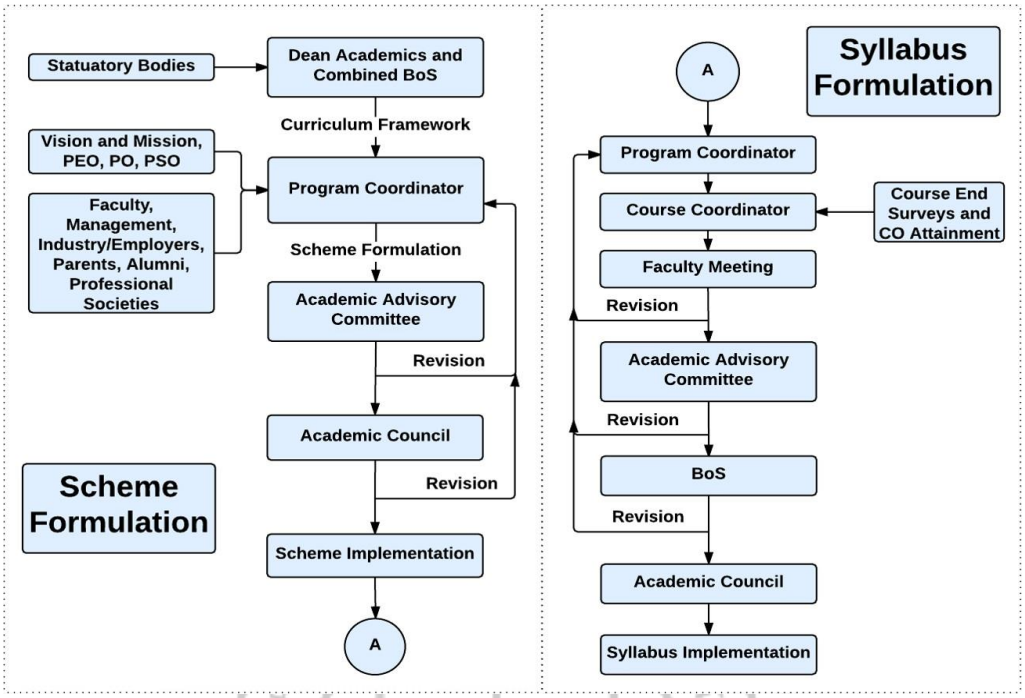
Stage-1 Report Evaluation: Evaluation of Project Report shall be done by the Guide and an External examiner.

Stage-2 Project Viva-voce: Major Project Viva-voce examination is conducted after receipt of evaluation reports from Guide and External examiner.

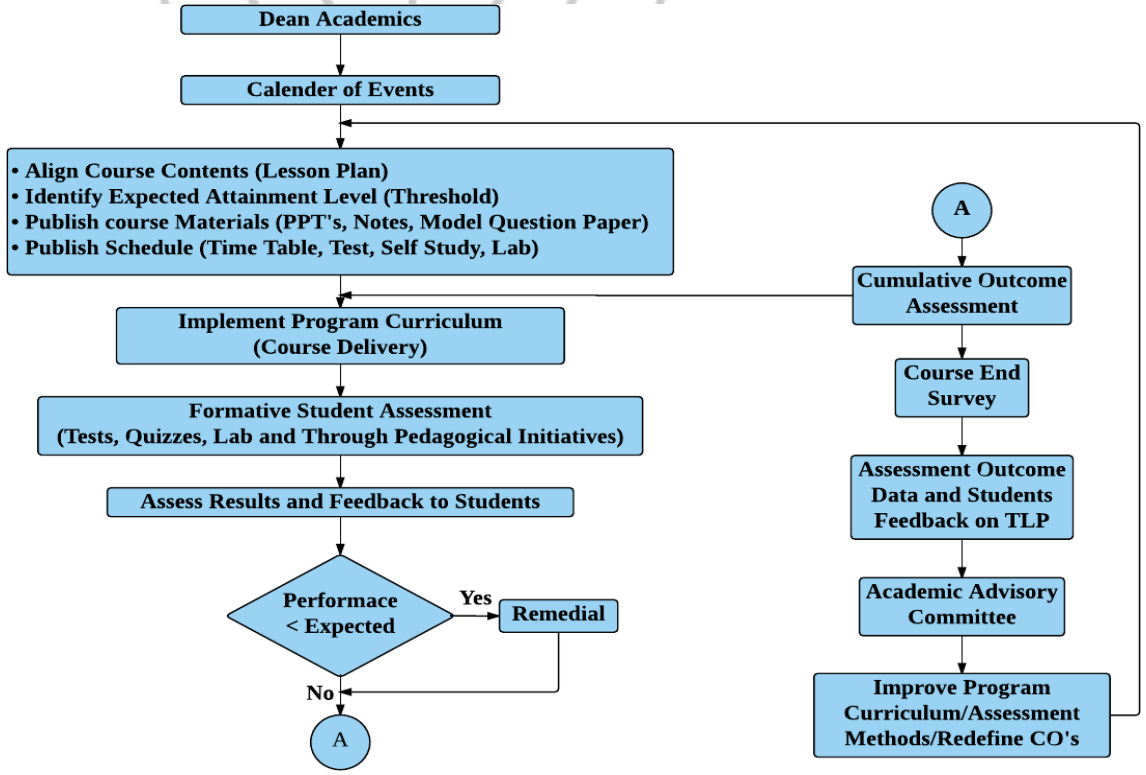
SEE procedure is as follows:

Report Evaluation	Internal Examiner: 100 Marks	**= 200**	
	External Examiner: 100 Marks	200 / 2 = **100**	**A**
Viva-Voce	Jointly evaluated by Internal Guide & External Evaluator	**= 100**	**B**
Total Marks = (A + B) / 2 =		**100**	

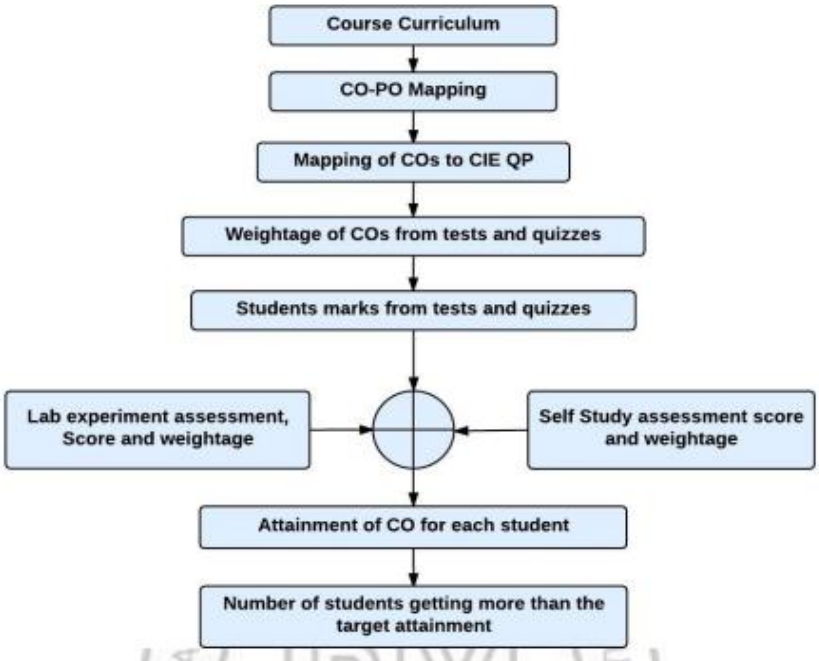
Curriculum Design Process



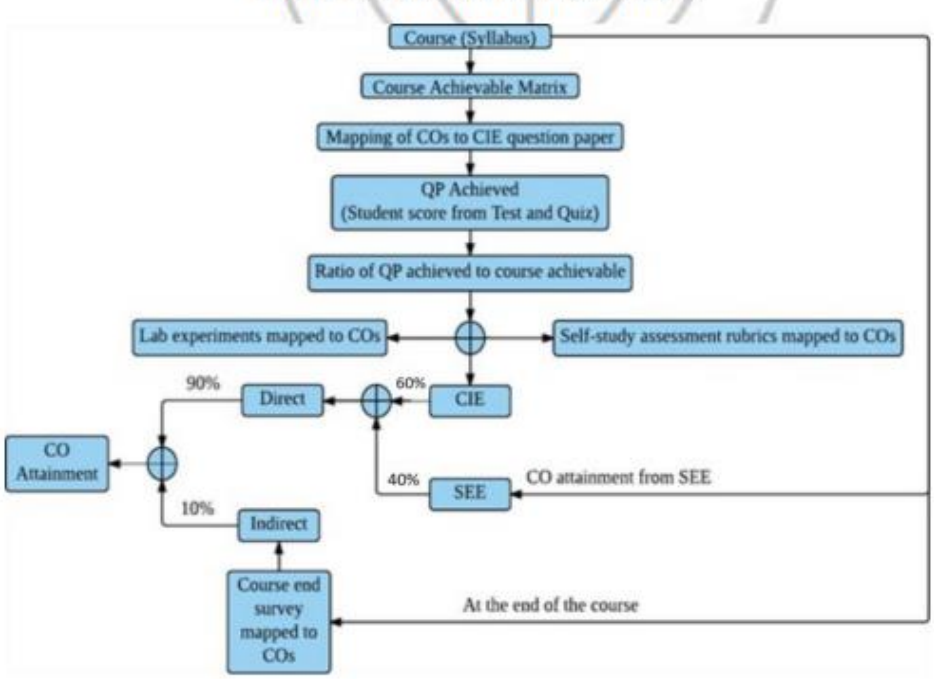
Academic Planning And Implementation



Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process