RV College of Engineering®

Computer Science & Engineering

Bachelor of Engineering (B.E)

Scheme And Syllabus Of V & VI Semester
(2022 Scheme)

B.E. Programs : AS, BT, CH, CS, CS - AI, CS - CD, CS - CY, CV, EC, EE, ET, IM, IS, ME.
M. Tech (13) MCA, M.Sc. (Engg.)
Ph.D. Programs : All Departments are recognized as Research Centres by VTU Except AI & AS

2024

99TH
NIRF RANKING IN ENGINEERING (2024)

TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023
1501+
TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023 (ASIA)
501-600

EDUFUTURE EXCELLENCE AWARD
BEST PRIVATE ENGINEERING UNIVERSITY (SOUTH)
BY ZEE DIGITAL

1001+
SUBJECT RANKING (ENGINEERING)

801+
SUBJECT RANKING (COMPUTER SCIENCE)

IIRF 2023
ENGINEERING RANKING INDIA
NATIONAL RANK-10
STATE RANK - 2
ZONE RANK - 5

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

*ABILITY ENHANCEMENT COURSES (AEC), UNIVERSAL HUMAN VALUES (UHV), INDIAN KNOWLEDGE SYSTEM (IKS), YOGA.

17
Centers of Excellence

11
Centers of Competence

212
Publications On Web Of Science

669
Publications Scopus (2023 - 24)

1093
Citations

70
Patents Filed

39
Patents Granted

61
Published Patents

11
Skill Based Laboratories Across Four Semesters

MOUS: 90+WITH INSDUSTRIES / ACADEMIC INSTITUTIONS IN INDIA & ABROAD

EXECUTED MORE THAN RS.40 CRORES WORTH SPONSORED RESEARCH PROJECTS & CONSULTANCY WORKS SINCE 3 YEARS

RV College of Engineering®

Computer Science & Engineering

Bachelor of Engineering (B.E)

Scheme And Syllabus Of V & VI Semester
(2022 Scheme)

B.E. Programs : AS, BT, CH, CS, CS - AI, CS - CD, CS - CY, CV, EC, EE, ET, IM, IS, ME.
M. Tech (13) MCA, M.Sc. (Engg.)
Ph.D. Programs : All Departments are recognized as Research Centres by VTU Except AI & AS

2024

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology.

MISSION

1. To deliver outcome-based Quality education, emphasizing on experiential learning with the state-of-the-art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics, and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT VISION

To achieve leadership in the field of Computer Science& Engineering by strengthening fundamentalsand facilitating interdisciplinary sustainable research to meet the ever growing needs of the society.

DEPARTMENT MISSION

- To evolve continually as a centre of excellence in quality education in computers and allied fields.
- To develop state-of-the-art infrastructure and create environment capable for interdisciplinary research and skill enhancement.
- To collaborate with industries and institutions at national and international levels to enhance research in emerging areas.
- To develop professionals having social concern to become leaders in top-notch industries and/or become entrepreneurs with good ethics.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

PEO1: Develop Graduates capable of applying the principles of mathematics, science, core engineering and Computer Science to solve real-world problems in interdisciplinary domains.

PEO2: To develop the ability among graduates to analyze and understand current pedagogical techniques, industry accepted computing practices and state-of-art technology.

PEO3: To develop graduates who will exhibit cultural awareness, teamwork with professional ethics, effective communication skills and appropriately apply knowledge of societal impacts of computing technology.

PEO4: To prepare graduates with a capability to successfully get employed in the right role /become entrepreneurs to achieve higher career goals or takeup higher education in pursuit of lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	**System Analysis and Design** The student will be able to: 1. Recognize and appreciate the need of change in computer architecture, data organization and analytical methods in the evolving technology. 2. Learn the applicability of various systems software elements for solving design problems. 3. Identify the various analysis & design methodologies for facilitating development of high quality system software products with focus on performance optimization. 4. Display team participation, good communication, project management and document skills.
PSO2	**Product Development** The student will be able to: 1. Demonstrate the use of knowledge and ability to write programs and integrate them with the hardware/software products in the domains of embedded systems, databases/data analytics, network/web systems and mobile products. 2. Participate in planning and implement solutions to cater to business – specific requirements displaying team dynamics and professional ethics. 3. Employ state-of-art methodologies for product development and testing / validation with focus on optimization and quality related aspects.

Lead Society: Institute of Electrical and Electronics Engineers (IEEE)

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	PE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	PY	Physics
9.	CY	Chemistry
10.	MA	Mathematics
11.	AS	Aerospace Engineering
12.	AI & ML	Artificial Intelligence & Machine Learning
13.	BT	Biotechnology
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	CV	Civil Engineering
17.	EC	Electronics & Communication Engineering
18.	EE	Electrical & Electronics Engineering
19.	EI	Electronics & Instrumentation Engineering
20.	ET	Electronics & Telecommunication Engineering
21.	IM	Industrial Engineering & Management
22.	IS	Information Science & Engineering
23.	ME	Mechanical Engineering

INDEX

Bachelor of Engineering in Computer Science & Engineering [CS] FIFTH SEMESTER

Slo. No.	BoS	Course Code	Course Title	Credit Allocation				Category	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
				L	T	P	Total		Theory	Lab	Hours	Theory	Lab
1	HS	HS251TA	Principles of Management and Economics	3	0	0	3	Theory	100	----	3	100	----
2	CD	CD252IA	Database Management Systems (Common to CS & IS, AI, CD, CY)	3	0	1	4	Theory + Practice	100	50	3	100	50
3	IS	IS353IA	Artificial Intelligence and Machine Learning Common to CS, CY, CD & IS)	3	0	1	4	Theory + Practice	100	50	3	100	50
4	CS	CS354TA	Theory of Computation (Common to CS, CY, CD & IS)	3	1	0	4	Theory	100	----	3	100	----
5	CS	XX355TBX	Professional Core Elective-I (Group-B)	3	0	0	3	Theory	100	----	3	100	----
6	CS	XX256TCX	Professional Core Elective-II (Group C)	2	0	0	2	NPTEL	----	----	2	50	
				Total			20						

Professional Core Elective-I (Group-B)		
Sl. No.	**Course Code**	**Course Title**
1	CS355TBA	Soft Computing
2	CS355TBB	Advanced Algorithms (Common to CS, IS & AI)
3	IS355TBC	Natural Language Processing (Common to CS,CD & IS)
4	IS355TBD	Cloud Computing (Common to CS,CD &**IS**)
5	CS355TBE	Quantum Computing
6	CS355TBF	Linux Internals

Professional Core Elective-II (Group-C)		
Sl. No.	**Course Code**	**Course Title**
1	AI256TCA	Information Security - 5 - Secure Systems Engineering (Common to CS,CD,CY,IS & AI)
2	CS256TCB	AI: Constraint Satisfaction (Common to CS,CD & CY)
3	CS256TCC	Foundation of Cloud IoT Edge ML (Common to CS,CD,CY & IS)
4	CS256TCD	Edge Computing (Common to CS,CD,CY & AI)
5	IS256TCE	Introduction To Soft Computing (Common to CS,CD,CY & IS)
6	CS256TCF	Wireless AdHoc and Sensor Networks

Bachelor of Engineering in Computer Science & Engineering [CS] SIXTH SEMESTER

Slo. No.	BoS	Course Code	Course Title	Credit Allocation				Category	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
				L	T	P	Total		Theory	Lab	Hours	Theory	Lab
1	HS	HS361TA	Entrepreneurship and Intellectual Property Rights	3	0	0	3	Theory	**100**	**----**	**3**	**100**	**----**
2	CS	CS362IA	Network Programming and Security	3	0	1	4	Theory + Practice	**100**	**50**	**3**	**100**	**50**
3	CS	CS363IA	Compiler Design (Common to CS & IS)	3	0	1	4	Theory + Practice	**100**	**50**	**3**	**100**	**50**
4	IS	IS364TA	Software Engineering with Agile Technologies (Common to CS, IS, CD & CY)	4	0	0	4	Theory	**100**	**----**	**3**	**100**	**----**
5	CS	XX365TDX	Professional Core Elective-III (Group- D)	3	0	0	3	Theory	**100**	**----**	**3**	**100**	**----**
6	XX	XX266TEX	Institutional Electives – I (Group E)	3	0	0	3	Theory	**100**	**----**	**3**	**100**	**----**
7	CS	CS367P	Interdisciplinary Project	0	0	3	3	Project	**----**	**100**	**3**	**----**	**100**
					Total		**24**						

Professional Core Elective-III (GROUP-D)		
Sl. No.	**Course Code**	**Course Title**
1.	CS365TDA	Computer Vision (Common to CS & CD)
2.	CS365TDB	Operations Research
3.	CS365TDC	Web Frameworks (Common to CS & IS)
4.	AI365TDD	Generative Artificial Intelligence (Common to AI, CS, CD & IS)
5.	CS365TDE	Big Data Systems
6.	CS365TDF	Cryptography & Network Security

Institutional Elective-I (GROUP-E)		
Sl. No.	**Course Code**	**Course Title**
1.	AS266TEA	Fundamentals of Aerospace Engineering
2.	BT266TEB	Healthcare Analytics
3.	CH266TEC	Industrial Safety Engineering
4.	CS266TED	Robotics Process Automation
5.	CV266TEE	Intelligent Transport Systems
6.	CV266TEF	Integrated Health Monitoring of Structures
7.	CM266TEG	Advanced Energy Storage for E-Mobility
8.	EC266TEH	Human Machine Interface (HMI)
9.	EE266TEJ	Energy Auditing and Standards
10.	EI266TEK	Biomedical Instrumentation
11.	ET266TEM	Telecommunication Systems
12.	ET266TEN	Mobile Communication Networks and Standards
13.	IS266TEO	Mobile Application Development
14.	IM266TEQ	Elements of Financial Management
15.	IM266TER	Optimization Techniques
16.	ME266TES	Automotive Mechatronics
17.	MA266TEU	Mathematical Modelling
18.	MA266TEV	Mathematics of Quantum Computing
19.	HS266TEW	Applied Psychology for Engineers
20.	HS266TEY	Universal Human Values

Semester : V						
PRINCIPLES OF MANAGEMENT & ECONOMICS (Theory)						
Course Code	**:**	HS251TA		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45 Hrs		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**06 Hrs**
Introduction to Management: Management Functions – POSDCORB – an overview, Management levels & Skills, Management History - **Classical Approach:** Scientific Management, Administrative Theory, **Quantitative Approach:** Operations Research, **Behavioral Approach:** Hawthorne Studies, **Contemporary Approach:** Systems Theory, Contingency Theory. **Caselets / Case studies**	
Unit – II	**10 Hrs**
Foundations of Planning: Types of Goals & Plans, Approaches to Setting Goals & Plans, Strategic Management Process, Corporate strategies – types of corporate strategies, BCG matrix, Competitive Strategies – Porters Five force Model, types of Competitive Strategies. **Caselets / Case studies** **Organizational Structure & Design:** Overview of Designing Organizational Structure - Work Specialization, Departmentalization, Chain of Command, Span of Control, Centralization & Decentralization, Formalization, Mechanistic & Organic Structures. **Caselets / Case studies**	
Unit –III	**10 Hrs**
Motivation: Early Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Theory Y, Herzberg's Two Factor Theory. Contemporary Theories of Motivation: Adam's Equitytheory, Vroom's Expectancy Theory. **Caselets / Case studies** **Leadership:** Behavioral Theories: Blake & Mouton's Managerial Grid, Contingency Theories of Leadership: Hersey & Blanchard's Situational Leadership, Contemporary Views of Leadership: Transactional & Transformational Leadership. **Caselets / Case studies**	
Unit –IV	**10 Hrs**
Introduction to Economics: Microeconomics and Macroeconomics, Circular flow model of economics, An Overview of Economic Systems. **Essentials of Microeconomics:** Demand, Supply, and Equilibrium in Markets for Goods and Services, Price Elasticity of Demand and Price Elasticity of Supply, Elasticity and Pricing, Numericals on determining price elasticity of demand and supply. Changes in Income and Prices Affecting Consumption Choices, Monopolistic Competition, Oligopoly.	
Unit –V	**09 Hrs**
Macroeconomic Indicators: Prices and inflation, Consumer Price Index, Exchange rate, Labor Market, Money and banks, Interest rate. Gross Domestic product (GDP) - components of GDP, Measures of GDP: Outcome Method, Income method and Expenditure method, Numericals on GDP Calculations, ESG an overview. **Macroeconomic models**- The classical growth theory, Keynesian cross model, IS-LM-model, The AS-AD model, The complete Keynesian model, The neo-classical synthesis. National Budgeting process in India	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Elucidate the principles of management theory & recognize the characteristics of an organization.
CO2	Demonstrate the importance of key performance areas in strategic management and design appropriate organizational structures and possess an ability to conceive various organizational dynamics.
CO3	Compare and contrast early and contemporary theories of motivation and select and implement the right leadership practices in organizations that would enable systems orientation.
CO4	Demonstrate an understanding on the usage and application of basic economic principles.
CO5	Appreciate the various measures of macro-economic performance and interpret the prevailing economic health of the nation.

Reference Books:	
1.	Management, Stephen Robbins, Mary Coulter &NeharikaVohra, 15th Edition, 2021, Pearson Education Publications, ISBN: 13: 978-0-13-558185-8
2.	Management, James Stoner, Edward Freeman & Daniel Gilbert Jr, 6th Edition, 2009, PHI, ISBN: 81-203-0981-2.
3.	Principles of Microeconomics, Steven A. Greenlaw, David Shapiro, 2nd Edition, 2017, ISBN:978-1-947172-34-0
4.	Macroeconomics: Theory and Policy, Dwivedi D.N, 5th Edition, 2021, McGraw Hill Education; ISBN : 9789353163334

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding up to 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Some of the Experiential learning topics may include Reading Leadership books and summarizing, Analysis and interpretation of various economic reports, Visit to various organizations to understand organizational mechanics. Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**)** **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
DATABASE MANAGEMENT SYSTEMS **Category: PROFESSIONAL CORE COURSE** **(Theory and Lab)** (Common to CS & IS, AI, CD)						
Course Code	**:**	**CD252IA**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**45L+30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Introduction to Database Systems -Databases and Database users: Introduction, An example, Characteristics of Database Approach,Data Models, Schemas and Instances, Three-schema Architecture and Data Independence, The Database System Environment. **Data Modeling Using the Entity-Relationship Model-** High-Level Conceptual Data Models for Database Design; A Sample Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types.	
Unit – II	**09 Hrs**
Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues, ER- to-Relational Mapping. **Relational Model and Relational Algebra-**Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and Dealing with Constraint Violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION ; Examples of Queries in Relational Algebra.	
Unit –III	**09 Hrs**
Introduction to SQL- SQL Data Definition, Specifying Constraints in SQL, Basic Queries in SQL; Insert, Delete and Update Statements in SQL More Complex SQL Retrieval Queries. **Relational Database Design -** Functional Dependencies – Definition, Inference Rules, Equivalence of sets of FD's, Minimal Set of FD's ; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form;Properties of Relational Decompositions.	
Unit –IV	**09 Hrs**
Transaction Processing Concepts- Introduction to transaction processing, Transaction states and additional operations, Desirable properties of transaction, Schedules of transactions. Characterizing schedules based on Serializability: Serial, Non serial and Conflict- Serializable schedules, Testing for Conflict serializability of schedule **Concurrency Control Techniques:** Two phase locking techniques for concurrency control, types of locks and system lock tables	
Unit –V	**09 Hrs**
Introduction to NoSQL: Aggregate data models: aggregates, key-value and document data models. Distribution models: sharding , master-slave replication, peer-peer replication – combining sharding and replication. Big Data : Types of data: Structured, semi structured, unstructured. Distributed Architectures : Hadoop, Map Reduce Programming Model	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand and explore the needs and concepts of relational, NoSQL database and Distributed Architecture
CO 2	Apply the knowledge of logical database design principles to real time issues.
CO 3	Analyze and design data base systems using relational, NoSQL and Big Data concepts
CO 4	Develop applications using relational and NoSQL database
CO 5	Demonstrate database applications using various technologies.

Reference Books	
1.	Elmasri and Navathe: Fundamentals of Database Systems, 6 th Edition, Pearson Education, 2011, ISBN-13: 978-0136086208.
2.	Pramod J Sdalage, Martin Fowler: NoSQL A brief guide to the emerging world of Polyglot Persistence, Addison-Wesley, 2012, ISBN 978-0-321-82662-6,
3.	Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems, 3thEdition, McGraw-Hill, 2003 ISBN : 978-0072465631.
4.	Seema Acharya and Subhashini Chellappan. *Big Data and Analytics*. Wiley India Pvt. Ltd. Second Edition

LABORATORY COMPONENT

PART – A

Open Ended Mini Project should be implemented and shall be carried out in a batch of two students. The students will finalize a topic in consultation with the faculty. The mini project must be carried out in the college only.

The Mini Project tasks would involve:

- Understand the complete domain knowledge of application and derive the complete data requirement specification of the Mini Project
- Design of the project with Integrated database solution (SQL and NOSQL)
- Normalization of the Relational design up to 3NF.
- Appreciate the importance of security for database systems.
- Documentation and submission of report.
- Recent Trends used (Blockchain, NLP, AI, ML, AR, VR etc) and Societal Concern issues addressed

General Guidelines :

- Database management for the project- MySQL, DB2, Oracle, SQL Server, MongoDB (Any NoSQL DB) server or any database management tool.
- Front End for the project – Java , VC++, C#, Python , Web Interface (HTML, Java Script)
  Use database Programming such as Embedded SQL,/Dynamic SQL/SQLJ.

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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 **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: V						
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING **Category: PROFESSIONAL CORE COURSE** **(Theory and Lab)** (Common to CS, CD,CY & IS)						
Course Code	**:**	**IS353IA**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**45L + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Introduction: What is AI? Intelligent agents: Intelligent Agents: Agents and environment; Rationality; the nature of environments; the structure of agents **Problem Solving & Uninformed Search Strategies:** Problem-solving agents, Breadth-first Search, Depth-first Search, Depth-limited Search and Iterative Deepening Depth First Search.	
Unit – II	**09 Hrs**
Informed (Heuristic) Search Strategies: A*Search, Heuristic Functions **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Hill-climbing Search, Simulated Annealing, Local-beam Search, Genetic Algorithms **Adversarial search:** Games, Optimal decision in games, Alpha-Beta Pruning	
Unit –III	**09 Hrs**
Supervised Learning: Basic Concepts, General Framework for Classification **Decision Tree Classifier**-A Basic Algorithm to Build a Decision Tree, Methods for Expressing Attribute Test Conditions, Measures for Selecting an Attribute Test Condition, Algorithm for Decision Tree Induction, Characteristics of Decision Tree Classifiers, **Model Overfitting-** Reasons for Model Overfitting **Model Selection -** Using a Validation Set, Incorporating Model Complexity, Estimating Statistical Bounds, Model Selection for Decision Trees, Model Evaluation	
Unit –IV	**09 Hrs**
Nearest Neighbor Classifiers-Characteristics of Nearest Neighbor Classifiers **Naive Bayes Classifier**-Basics of Probability Theory, Naive Bayes assumption **Logistic Regression**-Logistic Regression as a Generalized Linear Model, Learning Model Parameters, Characteristics of Logistic Regression **Ensemble Methods** – Methods for constructing Ensemble classifier, Bagging, Boosting, Random Forests	
Unit –V	**09 Hrs**
Unsupervised Learning- Overview, What Is Cluster Analysis, Different Types of Clustering's, Different Types of Clusters **K-means**-The Basic K-means Algorithm, Additional Issues, Bisecting K-means, K-means and Different Types of Clusters, Strengths and Weaknesses, K-means as an Optimization Problem **Cluster Evaluation**-Overview, Unsupervised Cluster Evaluation Using Cohesion and Separation, Unsupervised Cluster Evaluation Using the Proximity Matrix, Determining the Correct Number of Clusters, Supervised Measures of Cluster Validity, Assessing the Significance of Cluster Validity Measures, Choosing a Cluster Validity Measure	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain and apply AI and ML algorithms to address various requirements of real-world problems
CO 2	Design and develop AI and ML solutions to benefit society, science, and industry.
CO 3	Use modern tools to create AI and ML solutions.
CO 4	Demonstrate effective communication through team presentations and reports to analyze the impact of AI and ML solutions on society and nature.
CO 5	Conduct performance evaluation, modeling, and validation of AI and ML solutions benefiting lifelong learning

Reference Books	
1.	AI – A Modern Approach ,Stuart Russel, Peter Norvig, 3rd Edition, 2010, Pearson, ISBN-13: 978-0136042594
2.	Artificial Intelligence Basics: A Self Teaching Introduction, Neeru Gupta and Ramita Mangla, Mercury Learning and Information, 1st Edition, 2020, ISBN: 978-1-68392-516-3
3.	Machine Learning ,Tom M. Mitchell, Indian Edition, 2013, McGraw Hill Education, ISBN – 10 – 1259096955
4.	Introduction to Data Mining ,Pang-Ning Tan, Michael Steinbach, Vipin Kumar,2nd edition, 2019,Pearson , ISBN-10-9332571406, ISBN-13 -978-9332571402

LABORATORY COMPONENT

PART – A	
Sl. No.	· Implement the following algorithms (5 to 8) using required statistical formulae and · do not use direct API's. · Demonstrate the working of the algorithms by considering appropriate datasets · Display the values of all the model parameters
1	Solve the Tic-Tac-Toe problem using the Depth First Search technique
2	Demonstrate the working of Alpha-Beta Pruning.
3	Solve the 8-Puzzle problem using the A* algorithm
4	Implement a Hill-climbing search algorithm to maximize a single variable function f(x).
5	Logistic regression algorithm.
6	Naïve Bayes Classifier
7	KNN algorithm.
8	K- means algorithm

PART – B

Two students from the same batch must develop a Machine Learning model on the problem statements chosen from Agriculture, Health Care, Manufacturing, Automobiles and Process Control/Automation Domains preferably for Indian Scenarios. (Point No. 3 and 4 are optional)

1. The data collected should be cleansed and pre-processed.

2. The complete EDA process has to be demonstrated

3. Selection of the suitable algorithms and model-building

4. Model evaluation has to be carried out by selecting the proper metrics

   a) Prediction/classification results have to be obtained

   b) GUI should be created for demonstrating the results

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: V						
THEORY OF COMPUTATION **Category: PROFESSIONAL CORE COURSE** **(Theory)** (Common to CS, CD, CY & IS)						
Course Code	**:**	**CS354TA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L + 30T**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Regular Languages and Regular Expressions, Memory Required to Recognize a Language, Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (NFA), Non Deterministic Finite Automata with ϵ -transitions (NFA-ϵ), Equivalence, Regular Expressions and Finite Automata, Applications of Regular Expressions, Algebraic laws of Regular Expressions, Minimization of Finite Automata.	
Unit – II	**09 Hrs**
Pumping Lemma for Regular Languages, Closure properties of Regular Languages, Decision properties of Regular languages. Context-free grammars (CFG), Parse trees, Applications, Ambiguity in grammars & languages, Simplification of CFG, Normal forms of CFGs. Regular Grammars, Equivalence of Regular Grammars and Finite Automata.	
Unit –III	**09 Hrs**
Push Down Automata (PDA): Definition, the languages of a PDA, Equivalence of PDA's & CFG's, Deterministic PDA. The Pumping Lemma for Context Free Languages (CFL), Closure properties of CFLs, Decision properties of CFLs	
Unit –IV	**09 Hrs**
Context Sensitive Languages (CSL) and Linear Bounded Automata (LBA), Turing Machines (TM): Definitions and Examples, TM as a Language Accepter, Computing Partial Functions with Turing Machine, Variations of Turing Machines, Combining Turing Machines, Non Deterministic TM, Universal TM.	
Unit –V	**09 Hrs**
Recursively Enumerable Languages (REL) and Recursive Languages. Properties of REL and Recursive Languages. More General Grammars: Context Sensitive Grammar and Unrestricted Grammar, Chomsky Hierarchy, Not all languages are Recursively Enumerable, Unsolvable Problem, Reducing One problem to another, The halting problem of TM, Post's Correspondence Problem (PCP), Time and Space Complexity of TM.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the fundamental concepts of theory of computations.
CO 2	Analyze the tools of finite automata to various fields of computer science.
CO 3	Design solution model for complex problems, using the appropriate skills of automata theory for better results.
CO 4	Apply automata skills in situations that describe computation effectively and efficiently.

Reference Books	
1.	Introduction to Languages & Theory of Computation, John C Martin, Tata McGraw-Hill, 4th Edition, 2011 ISBN: 978-0-07-319146-1.
2.	Introduction to Automata Theory, Languages & Computation, J.P.Hopcroft, Rajeev Motwani, J.D.Ullman, Pearson Education., 3rd Edition, 2008,ISBN:81-3172-047-0.
3.	An Introduction To Formal Languages & Automata, Peter Linz, Narosa Publishing House, 6th Edition, 2007, ISBN: 07-6371-422-4.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
SOFT COMPUTING **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)**						
Course Code	**:**	**CS355TBA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction to soft computing: Introduction, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. **Introduction to Fuzzy logic**: Introduction, Fuzzy membership functions, Operations on Fuzzy sets, Membership value Assignments, Intuition, Inference, Features of the Membership Function.	
Unit – II	**09 Hrs**
Fuzzy Relations and Defuzzification: Fuzzy Relations, Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian product and Composition, Fuzzy Tolerance and equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method **Fuzzification and Defuzzification:** Fuzzification, defuzzification to crisp sets, Lambda-cuts for fuzzy relations, Defuzzification to Scalars	
Unit –III	**09 Hrs**
Fundamentals of Artificial Neural Networks: Introduction, learning & acquisition of knowledge, features of artificial neural networks (ANN), Back Propagation networks, fundamentals of connectionist Modeling. **Major classes of Neural Networks:** Introduction, the multilayer perceptron, radial basis function network, Kohonen's self-organizing network, the Hopfield network,Industrial and commercial applications of ANN	
Unit –IV	**09 Hrs**
Genetic Algorithms: Introduction to genetic algorithms (GA), Traditional Optimization and Search Techniques vs Genetic Algorithm, GA operators**,** Problem solving using GA, Integration of GA with neural networks, integration of GA with fuzzy logic, known issues in GA, Population based incremental learning, Applications of Genetic algorithms, Applications of GA in Machine Learning, Introduction to Hybrid Systems.	
Unit –V	**09 Hrs**
Tools of soft computing in real world applications: Soft computing tools for solving a class of facilities layout planning problem, mobile position estimation using an RBF network in CDMA cellular systems, learning-based resource optimization in ATM networks. FL in database systems, fuzzy relation data models and its operations.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Apply the principles and components of soft computing in solving problems.
CO 2	Explore and understand basic concepts of of fuzzy sets and relations, fuzzy logic extension principle in the field of computer science and Engineering.
CO 3	Develop program systems using approaches of these theories for solving various real-world problems.
CO 4	Evaluate and compare solutions by various soft computing approaches for a given problem.
CO 5	Develop intelligent systems through case studies, simulation examples and experimental results

Reference Books	
1.	Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
2.	Soft Computing and Intelligent Systems Design – Theory Tools and Applications, Fakhreddine O Karray & Clarence De Silva, 2009, PEARSON Education, ISBN: 978-81-317-2324-1.
3.	Neural Networks and Learning Machines Simon Haykin (PHI)
4.	Fuzzy and Soft Computing; A Computational Approach to Learning and Machine Intelligence, J S R Jang, C-T Sun, E Mizatani, Neurp, 1997, Prentice Hall, ISBN: 10:0132610663.
5.	Soft Computing and its Applications, K A Thev & RR Aliev, 2001, World Scientific Publishing Co., Inc. River Edge, NJ, USA, ISBN: 98102 47001.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
ADVANCED ALGORITHMS **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)** (Common to CS, IS & AI)						
Course Code	**:**	**CS355TBB**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Analysis techniques: Growth of functions: Asymptotic notation, Standard notations and common functions, Substitution method for solving recurrences, Recursion tree method for solving recurrences, Master theorem. **AmortizedAnalysis :** Aggregate analysis, The accounting method, The potential method.	
Unit – II	**09 Hrs**
Sorting in Linear Time: Lower bounds for sorting, Counting sort, Radix sort, Bucket sort. **Dynamic Programming:** Matrix-chain multiplication. **Greedy Algorithms:** An activity-selection problem, Elements of the greedy strategy.	
Unit –III	**09 Hrs**
Graph Algorithms: Bellman-Ford Algorithm, Shortest paths in a DAG, Johnson‟s Algorithm for sparse graphs. **Maximum Flow:** Flow networks, Ford Fulkerson method and Maximum Bipartite Matching.	
Unit –IV	**09 Hrs**
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, RSA cryptosystem. **String Matching Algorithms:** Naïve algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm.	
Unit –V	**09 Hrs**
Advanced Data structures: Structure of Fibonacci heaps, Mergeable-heap operations, Decreasing a key and deleting a node, Binomial Queues. **Polynomials and the FFT :** Representing polynomials, The DFT and FFT, FFT circuits.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Analyze various algorithms for their time and space complexity.
CO 2	Demonstrate a familiarity with major algorithms and data structures
CO 3	Apply appropriate design techniques for solving real world problems.
CO 4	Design and implement solutions using appropriate mathematical techniques.

Reference Books	
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein; Introduction to Algorithms; Columbia University, 4th Edition; 2022, ISBN 9780262046305.
2.	Mark Allen Weiss; Data Structures and Algorithm Analysis in C++, Addison-Wesley; 4th Revised edition; 2014, ISBN-13: 978-0-13-284737-7.
3.	Kozen DC, The design and analysis of algorithms , Springer Science & Business Media, 2012, ISBN: 978-0387976877
4.	Kenneth A. Berman, Jerome L. Paul,Algorithms, Cengage Learning, 2002. ISBN: 978- 8131505212

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
NATURAL LANGUAGE PROCESSING **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)** (Common to CS, CD & IS)						
Course Code	**:**	**IS355TBC**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	08 Hrs
Introduction to NLP: NLP in the Real-world, NLP Tasks, what is Language: Building Blocks of Language, Why NLP is Challenging, Machine Learning, Deep Learning, and NLP: An Overview, Approaches to NLP: Heuristic based NLP, Machine Learning for NLP, Deep Learning for NLP, Why Deep Learning is not Yet the Silver Bullet for NLP, An NLP Walkthrough: Conversational Agents **NLP Pipeline:** Data Acquisition, Text Extraction and Cleanup: HTML Parsing and Cleanup, Unicode Normalization, Spelling Correction, System-Specific Error Correction, Pre-Processing: Preliminaries, Frequent Steps, Other Pre-Processing Steps	
Unit – II	**08 Hrs**
Accessing Text Corpora Accessing Text Corpora, Brown Corpus, Loading your own corpus, Annotated text corpus, Conditional Frequency Distributions, WordNet. **Processing Raw Text** : Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text ,Regular Expressions for Tokenizing Text **Extracting Information from the text :** Information Extraction, Chunking, Developing, Named Entity Recognition, Term weighting, Inverse document frequency	
Unit –III	**07 Hrs**
Analyzing Sentence Structure: Some Grammatical Dilemmas, What‘s the Use of Syntax?, Context-Free Grammar, Parsing with Context-Free Grammar. **Analyzing the Meaning of words and Sentences :** The semantics of English sentences, Representing Meaning, Semantic Analysis, Lexical semantics, Word- sense disambiguation.	
Unit –IV	**08 Hrs**
Transformers Basics The Encoder-Decoder Framework, Attention Mechanisms, Transfer Learning in NLP, Hugging Face Transformers: Bridging the Gap, A Tour of Transformer Applications: Text Classification, Named Entity Recognition, Question Answering, Summarization, Translation, Text Generation, The Hugging Face Ecosystem: The Hugging Face Hub, Hugging Face Tokenizers, Hugging Face Datasets, Hugging Face Accelerate, Main Challenges with Transformers. **Text Classification** The Dataset: A First Look at Hugging Face Datasets, From Datasets to Data Frames, looking at the Class Distribution, How Long Are Our Tweets? From Text to Tokens: Character Tokenization, Word Tokenization, Subword Tokenization, Tokenizing the Whole Dataset, Training a Text Classifier: Transformers as Feature Extractors, Fine-Tuning Transformers	

Unit –V	08 Hrs
NLP Applications: Machine translation, Basic issues in MT. Statistical translation, Sentiment Analysis, Chat-Bot, Question Answering System, Text Classification, Spell Checking and Market Intelligence. **Information Retrieval:** Vector space model, term weighting	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the approaches to syntax and semantics in Natural Language Processing, the various types of language processors, the elements of formal language theory, the types of grammar, and the computational morphology.
CO 2	Understand the basic parsing technique for context-free grammars, the data structures and algorithms for parsing, and the approaches to ambiguity resolution.
CO 3	Design and Develop agents that use Transformers for natural language understanding and generation
CO 4	Comprehend and compare different natural language models.

Reference Books	
1.	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems,SowmyaVajjala, BodhisattwaMajumder, Anuj Gupta &HarshitSurana ,1st Edition, 2020, O'Reilly, ISBN: 978-1-492-05405-4
2.	StevenBird,EwanKlein,EdwardLoper,―NaturalLanguageProcessingwithPython,‖ Publisher: O'Reilly Media, June 2009, ISBN :9780596516499
3.	Python 3 Text Processing with NLTK 3 Cookbook, Jacob Perkins 2014, 1st Edition, Packt Publishing, ISBN 978-1-78216-785-3
4.	Natural Language Processing with Transformers: Building Language Applications with Hugging Fac,LewisTunstall, Leandro von Werra, and Thomas Wolf, 2022, 1st Edition, O'Reilly Media, ISBN: 978-1-098-10324-8

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
CLOUD COMPUTING **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)** **(Common to CS, CD & IS Programs)**						
Course Code	**:**	**IS355TBD**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08 Hrs**
Defining Cloud Computing Cloud Types, Examining the Characteristics of Cloud Computing, Assessing the Role of Open Standards **Understanding Services and Applications by Type** Defining Infrastructure as a Service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS)	
Unit – II	**08 Hrs**
Understanding Cloud Architecture Exploring the Cloud Computing Stack, Connecting to the Cloud **Understanding Service Oriented Architecture** Introducing Service Oriented Architecture, Defining SOA Communications, Managing and Monitoring SOA, Relating SOA and Cloud Computing	
Unit –III	**09 Hrs**
Cloud Computing Technology Hardware and Infrastructure: Clients, Security, Network, Services Accessing the Cloud: Platforms, Web Applications, Web APIs, Web Browsers Cloud Storage: Overview, Cloud Storage Providers Standards: Application, Client, Infrastructure, Service	
Unit –IV	**09 Hrs**
Understanding Abstraction and Virtualization Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications **Capacity Planning** Capacity Planning, Defining Baseline and Metrics, Network Capacity, Scaling	
Unit –V	**08 Hrs**
Developing Applications Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the basics of cloud computing models and virtualization.
CO2	Analyse the issues related to the development of cloud applications.
CO3	Apply the concepts to design cloud based simple applications.
CO4	Identify solutions through cloud based software for real world case studies.

Reference Books	
1.	Barrie Sosinsky,"Cloud computing bible", CRC Press, 2010, ISBN: 978-0-470-90356-8.
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A practical Approach", Wiley India, 2011, ISBN: 0071626948.
3.	George Reese, "Cloud Application Architectures", Wiley India 2011, ISBN: 978-0596156367.
4.	1. Eugene Ciurana, "Developing with Google App Engine" Wiley India 2011 ISBN: 978-1430218319.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
QUANTUM COMPUTING **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)**						
Course Code	**:**	**CS355TBE**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Quantum Building Blocks: Quantum mechanics of Photon Polarization, Single Quantum bits, Single Qubit Measurement, A Quantum key Distribution Protocol, State Space of a Single-Qubit System, Direct Sums and Tensor Products of Vector Spaces, State Space of an n-Qubit System, Entangled States, MultiQubit Measurement, QKD using Entangled states.	
Unit – II	**09 Hrs**
Multiple-Qubit States Measurements: Dirac Bra/Ket Notation for Linear Transformation, Projection Operators for Measurement, Hermitian Operator Formalism for Measurement, EPR Paradox and Bell's Theorem.	
Unit –III	**09 Hrs**
Quantum State Transformations: Unitary transformations, No-Cloning Principle, Some Simple Quantum Gates, Pauli transformations, Hadamard Transformations, Multiple-Qubit Transformations, ControlledNOT and other singly controlled gates, Applications of Simple Gates, Dense coding, Quantum teleportation	
Unit –IV	**09 Hrs**
Introduction To Quantum Algorithms: Computing with Superpositions, Walsh-Hadamard transformation, Quantum Parallelism, Notions of Complexity, Query Complexity, Communication Complexity, Simple Quantum Algorithm- Deutsch's Problem.	
Unit –V	**09 Hrs**
Simple Quantum Algorithms: Deutsch-Jozsa Problem, Bernstein-Vazirani Problem, Simon's Problem, Machine Models and Complexity Classes, Shor's factoring Algorithm, Example illustrating Shor's Algorithm	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the various essentials of quantum computation, Qubits, and Quantum operators.
CO 2	Analyze the working of quantum transformations and quantum gates.
CO 3	Describe the principle of working of some of the quantum algorithms and conduct simulations using open-source quantum simulators.
CO 4	Investigate the applications of quantum computing algorithms and quantum cryptography in realworld applications.
CO 5	Appraise the knowledge and potential in quantum computing to build a successful career, work in teams, and communicate their ideas effectively.

Reference Books	
1.	Quantum Computing: A Gentle Introduction, Eleanor Rieffel and Wolfgang Polak, 2011, The MIT Press, ISBN 9780262015066.
2.	An introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, Muchele Mosca, Oxford University Press, 2007, ISBN-13: 978-0198570493, ISBN-10: 019857049X
3.	Quantum Computing for Computer Scientists, 1st Edition, Noson S. Yanofsky and Mirco A. Mannucci, Cambridge University Press, 2008, ISBN 978-0-521-879965.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V						
LINUX INTERNALS **Category: PROFESSIONAL CORE COURSE ELECTIVE-I** **(Group-B)** **(Theory)**						
Course Code	**:**	**CS355TBF**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction to the Linux Kernel History of Unix, Along Came Linus: Introduction to Linux, Overview of Operating Systems and Kernels, Linux Versus Classic Unix Kernels, Linux Kernel Versions, The Linux Kernel Development Community **Process Management** The Process, Process Descriptor and the Task Structure, Process Creation, The Linux Implementation of Threads, Process Termination	
Unit – II	**09 Hrs**
Process Scheduling Multitasking, Linux's Process Scheduler, Policy, The Linux Scheduling Algorithm, The Linux Scheduling Implementation, Process Selection, Preemption and Context Switching, Real-Time Scheduling Policies, Scheduler-Related System Calls **System Calls** Communicating with the Kernel, APIs, POSIX, and the C Library, Syscalls, System Call Handler, System Call Implementation, System Call Context	
Unit –III	**09 Hrs**
Interrupts and Interrupt Handlers Interrupts, Interrupt Handlers, Top Halves Versus Bottom Halves, Registering an Interrupt Handler, Writing an Interrupt Handler, Interrupt Context, Implementing Interrupt Handlers, /proc/interrupts, Interrupt Control. **Bottom Halves and Deferring work** Bottom Halves, A World of Bottom Halves, Softirqs, Tasklets, Work Queues, Which Bottom Half Should I Use	
Unit –IV	**09 Hrs**
Memory Management Pages, Zones, Getting Pages, kmalloc() , vmalloc() , Slab Layer, Statically Allocating on the Stack, High Memory Mappings, Per-CPU Allocations, The New percpu Interface, Reasons for Using Per-CPU Data, Picking an Allocation Method. **The virtual File System** Common Filesystem Interface, Filesystem Abstraction Layer, Unix Filesystems	
Unit –V	**09 Hrs**
Kernel Synchronization Methods Atomic Operations, Spin Locks, Reader-Writer Spin Locks, Semaphores, Reader-Writer Semaphores, Mutexes, Completion Variables, BKL: The Big Kernel Lock **Devices and Modules** Device types, Modules.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explore the fundamental concepts of Linux, kernel-level data-structure and Linux kernel development environments
CO 2	Illustrate the use of data structures for process, memory, interrupt management and system calls within the Linux kernel
CO 3	Integrate the operating system concepts with relevant design issues associated with Linux kernel
CO 4	Develop kernel modules using Linux Processes and Interrupt handling techniques with process synchronization
CO 5	Implement real world applications using Linux OS.

Reference Books	
1.	Robert Love; Linux Kernel Development; Pearson Education; 3rd Edition; 2010, ISBN8131758182.
2.	M. Beck et.al ; Linux Kernel Programming; Pearson Education; 3rd Edition; 2002, ISBN-110-201-71975-4
3.	Daniel Bovet ; Understanding the Linux Kernel, O'Reilly, 3rd Edition, 2005, ISBN-10: 0596005652.
4.	Michael kerrish; Linux Programming Interface; 1st Edition, 2010, ISBN-10159327220
5	Bovet, Daniel P., and Marco Cesati. Understanding the Linux Kernel: from I/O ports to process management. " O'Reilly Media, Inc.", 2005.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
ENTREPRENEURSHIP & INTELLECTUAL PROPERTY RIGHTS (Theory)						
Course Code	**:**	**HS361TA**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08Hrs**
Introduction to Entrepreneurship: Definition and Scope of Entrepreneurship, Importance of Entrepreneurship in Engineering Innovation and Economic Growth, Techniques for Identifying Entrepreneurial Opportunities, Types of Entrepreneurs: Innovative, Imitative, Fabian, Characteristics and Traits of Successful Entrepreneurs. **Role in economic development**- Emerging Trends in Entrepreneurship, Entrepreneur and Entrepreneurship, characteristics of Entrepreneur, Myths about Entrepreneurship, Entrepreneur vs Intrapreneur, Role of Entrepreneurial Teams **Activities**: Case study on Entrepreneurship in Indian Scenario, Ideation Workshops and Hackathons,	
Unit – II	**08 Hrs**
Entrepreneurial Opportunity Evaluation: Identifying Market Opportunities and Trends, Integration of Engineering Principles in Ideation Process, Cross-Disciplinary Collaboration for Technological Innovation, Assessing Market Feasibility and Demand Analysis, Evaluating Technical Feasibility: Prototype Development, Proof of Concept, Financial Feasibility Analysis: Cost Estimation, Revenue Projection, Break-Even Analysis**.** **Business Planning and Strategy Development**: Elements of a Business Plan, Executive Summary, Company Description, Market Analysis, writing a Business Plan: Structure and Components, Strategic Planning: Vision, Mission, Goals, Objectives, SWOC Analysis, Competitive Strategy: Porter's Generic Strategies, Differentiation, Cost Leadership, Focus Strategy, Growth Strategies: Organic Growth, Mergers and Acquisitions, Strategic Alliances **Activities**: Writing a Business Plan on given templates, Developing Business Models and Prototypes Based on Generated Ideas	
Unit –III	**08Hrs**
Entrepreneurial Marketing and Sales: Basics of Marketing: Product, Price, Place, Promotion (4Ps), Market Segmentation, Targeting, and Positioning (STP), Branding and Product Development Strategies, Creating a Unique Value Proposition (UVP) Digital Marketing: Social Media Marketing, Content Marketing, SEO, SEM, Sales Techniques and Customer Relationship Management (CRM). Entrepreneurial Finance and Resource Management: Sources of Financing: Equity Financing, Debt Financing, Venture Capital, Angel Investors, Crowdfunding, Financial Management: Budgeting, Cash Flow Management, Financial Statements Analysis, Risk Management and Insurance, Human Resource Management: Recruitment, Training, Performance Evaluation, Legal and Ethical Issues in Entrepreneurship: Intellectual Property Rights, Contracts, Corporate Governance Activities: Case Studies and Practical Applications	
Unit –IV	**09Hrs**
Introduction to IP : Types of Intellectual Property **Patents:** Introduction, Scope and salient features of patent; patentable and non-patentable inventions, Patent Procedure - Overview, Transfer of Patent Rights; protection of traditional knowledge, Infringement of patents and remedy, Case studies, Patent Search and Patent Drafting, Commercialization and Valuation of IP. **Trade Marks:** Concept, function and different kinds and forms of Trade marks, Registrable and non-registrable marks. Registration of Trade Mark; Deceptive similarity; Transfer of Trade Mark, ECO Label, Passing off, Infringement of Trade Mark with Case studies and Remedies.	

Unit –V	09 Hrs
Trade Secrets: Definition, Significance, Tools to protect Trade secrets in India. **Industrial Design:** Introduction of Industrial Designs Features of Industrial, Design. Procedure for obtaining Design Protection, Revocation, Infringement and Remedies, Case studies. **Copy Right:** Introduction, Nature and scope, Rights conferred by copy right, Copy right protection, transfer of copy rights, right of broad casting organizations and performer's rights, Exceptions of Copy Right, Infringement of Copy Right with case studies.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Understand the concepts of entrepreneurship and cultivate essential attributes to become an entrepreneur or Intrapreneur and demonstrate skills such as problem solving, team building, creativity and leadership.
CO 2	Comprehend the process of opportunity identification of market potential and customers while developing a compelling value proposition solutions.
CO 3	Analyse and refine business models to ensure sustainability and profitability and build a validated MVP of their practice venture idea and prepare business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture.
CO 4	Apply insights into the strategies and methods employed to attain a range of benefits from these IPs and deliver an investible pitch deck of their practice venture to attract stakeholders
CO 5	Knowledge and competence related exposure to the various Legal issues pertaining to Intellectual Property Rights with the utility in engineering perspectives.

Reference Books	
1.	Donald F. Kuratko ,"Entrepreneurship: Theory, Process, and Practice", South-Western Pub publishers, 10th edition, 2016,978-ISBN-13: 1305576247
2.	Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses", Crown Currency Publishers,1st Edition, 2011, ISBN-13: 978-0307887894.
3.	Dr B L Wadehra, Law Relating to Intellectual Property, universa Law publishers 05th edition, ISBN : 9789350350300 .
4	Intellectual Property Rights: Unleashing Knowledge Economy, Prabuddha Ganguly, 1st Edition, 2001, Tata McGraw Hill Publishing Company Ltd., New Delhi, ISBN: 0074638602.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks adding up to 20 Marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test consisting of 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 up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar / presentation / demonstration (20**). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
NETWORK PROGRAMMING AND SECURITY **Category: PROFESSIONAL CORE COURSE** **(Theory and Lab)**						
Course Code	**:**	**CS362IA**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**45L+30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
The Transport Layer and introduction to sockets: Introduction to TCP, UDP and SCTP, The big picture, Difference between UDP, TCP, SCTP, TCP connection establishment and termination, TIME_WAIT state, TCP port numbers and concurrent servers, Buffer sizes and limitation. Socket address structure, value result arguments, byte ordering functions, byte manipulation functions, inet_aton, inet_addr and inet_ntoa functions, inet_pton and inet_ntop functions.	
Unit – II	**09 Hrs**
TCP client/server: Socket function, connect function, bind, listen, accept, fork, exec functions, concurrent servers, close function, getsockname and getpeername functions, TCP Echo server – main – str_echo , TCP Echo client - main – str_echo, Normal startup, Normal termination.	
Unit –III	**09 Hrs**
UDP client/server and Name server: Socket options introduction, getsockopt and setsockopt functions. recvfrom and sendto functions, UDP Echo server & UDP Echo client, lost datagrams. DNS, Gethostbyname function, gethostbyaddr function, getservbyname and getservbyport functions, getaddrinfo function, gai_strerror function, freeaddrinfo function, getaddrinfo function: example, host_serv function.	
Unit –IV	**09 Hrs**
Traditional Block Cipher and Public Key Cryptosystem: Stream Ciphers and Block Ciphers, Feistel Cipher Structure. The Data Encryption Standard-Encryption and Decryption. Principles of Public Cryptosystems- Public-Key Cryptosystems, Applications for Public-Key Cryptosystems Requirements for Public-Key Cryptosystems, Public-Key Cryptanalysis. The RSA algorithm-Algorithm, Computational Aspects. The security of RSA, Other Public key Cryptosystems: Diffie-Hellman Key Exchange.	
Unit –V	**09 Hrs**
Transport Layer Security and Wireless Network Security: Web Security Considerations, Secure Socket Layer, Transport Layer security, HTTPS. Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN overview, IEEE 802.11i Wireless LAN Security – Services, Phases of operation.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Analyze the OSI reference model and a variety of network concepts and protocols.
CO 2	Analyze network Protocols interoperability and application.
CO 3	Design and demonstrate client/server programs on Unix platforms to create robust real-world sockets-based applications.
CO 4	Apply appropriate cryptographic algorithms to ensure security of information through wired and wireless medium.

Reference Books	
1.	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, UNIX Network Programming – The sockets networking API, Vol.I , Third edition, PHI. ISBN-13: 978-0131411555 ISBN-10: 9780131411555.
2.	William Stallings, "Cryptography and Network Security", 6th Edition, ISBN-13: 978-0-13-335469-0.
3.	Comer, Stevens, Internetworking with TCP/IP, Vol. III, Second Edition, PHI, ISBN-13: 978-0132609692 ISBN-10: 013260969X.
4.	Richard M Reese, Learning Network Programming with Java, First Published: December 2015, Packet Publishing Ltd., ISBN-13: 978-0123742551, ISBN-10: 0123742552.

LABORATORY COMPONENT

PART – A

1. Implement a client and server communication using sockets programming.
2. Write a program to implement distance vector routing protocol for a simple topology of routers.
3. Write a program to implement error detection and Correction concepts using Checksum and Hamming code.
4. Implement a simple multicast routing mechanism.
5. Write a program to implement a concurrent chat server that allows current logged in users to communicate one with another.
6. Implementation of concurrent and iterative echo server using both connection and connectionless socket system calls.
7. Implementation of remote command execution using socket system calls.
8. Write a program to encrypt and decrypt the data using RSA and Exchange the key securely using Diffie-Hellman Key exchange protocol.

PART – B

1. Setup an IEEE 802.3 network with a) hub b) switch c) Hierarchy of switch. Apply the FTP, Telnet applications between nodes. Vary the number of nodes. Vary the bandwidth, queue size and observe the packet drop probability.

2. Setup a wireless sensor networks with atleast two device co-coordinators and nodes. Provide Constant Bit Rate (CBR), Variable Bit Rate (VBR) application between several nodes. Increase the number of co-coordinators and nodes in the same area and observe the performance at physical and MAC layers.

3. Setup an IEEE 802.11 network with at least two access points. Apply the CBR, VBR applications between devices belonging to same access points and different access points. Provide roaming of any device. Vary the number of access points and devices. Find out the delay in MAC layer, packet drop probability.

4. Case Study on Configuring Routers using CISCO-Packet tracer.

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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 **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: VI						
COMPILER DESIGN **Category: PROFESSIONAL CORE COURSE** **(Theory and Lab)** (Common to CS & IS)						
Course Code	**:**	**CS363IA**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**45L+30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**09 Hrs**
Introduction to Compilation Process: Language Processors, The structure of Compiler, Evolution of programming Languages. **Lexical Analysis:** The Role of Lexical Analyzer, Input Buffering, Specifications of Tokens, Recognition of Tokens	
Unit – II	**09 Hrs**
Syntax Analysis : Introduction,Top-down Parsing, Bottom-up Parsing, Introduction to LR Parsing: Simple LR, Most powerful LR parsers (Excluding efficient construction and compaction of parsing tables), Using ambiguous grammars	
Unit –III	**09 Hrs**
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation orders for SDD, Application of Syntax Directed Translation **Run-Time Environments:** Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management	
Unit –IV	**09 Hrs**
Intermediate Code Generation: Variants of Syntax trees, Three address code, Types and Declaration-Type Expressions, Type Equivalence, Declaration, Translation of Expressions Control flow, Back patching, Intermediate Code for Procedures	
Unit –V	**09 Hrs**
Code Generation: Issues in the design of Code Generator, Basic Blocks and Flow graphs, Optimization of Basic blocks, A Simple Code Generator, Peephole Optimization **Machine-Independent Optimizations:** Principal Sources of Optimization, Introduction to Data-Flow Analysis	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Demonstrate the ability to design a compiler given a set of language features
CO 2	Analyze various constructs of the language and develop lexical analyser , parser to transform input to an appropriate representation
CO 3	Apply the knowledge of computing and mathematics to generate the intermediate representation of the code and to optimize the code
CO 4	Design or develop solutions using modern compiler construction tools to build a compiler that converts from a non-trivial high level language to machine code.
CO 5	Exhibit skills like investigation, effective communication, working in team/Individual, following ethical practices through experiential learning by implementing various phases of compiler and engage in lifelong learning

Reference Books	
1.	Compilers- Principles, Techniques and Tools, Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman; 2nd Edition, 2023, Pearson Education, ISBN-10 -9357054111, ISBN-13 - 978-9357054119
2.	Compiler Design, Santanu Chattopadhyay, 1st Edition, 2011, PHI Learning, ISBN-978-81-203-2725-2C
3.	Compiler Construction Principles & Practice, Kenneth C Louden; Cengage Learning, 1st Edition, 2009. ISBN – 0534939724
4.	Crafting a Compiler with C, Charles N. Fischer, Richard J. leBlanc, Jr., 1st Edition, 2009, Pearson Education, ISBN-13:978-0136067054, ISBN-10: 0136067050

LABORATORY COMPONENT

PART – A

Student should be able to design phases of compiler by incorporating following features:

1. Writing a scanner, lexical analyzers for tokenizing code snippet written in programming languages such as C, C++ ,etc.

2. Experiment with scanner (LEX/FLEX) and parser (YACC/BISON) generators

3. Writing a predictive parser parsing for simple language constructs.

4. Translation of the language constructs to an intermediate form (e.g. three-address code),

5. Implementation of three address code using quadruple,triple and indirect triples.

PART – B

1. Writing simple compiler using compiler construction using tools such as Flex/lex, Bison,LLVM
2. Generation of target code (in assembly language) using compiler construction tool
3. Parsing sample code snippet written using programming languages such as C/C+ Objective C code and translating it into a representation using CLANG suitable for optimization
4. Code improvement and optimization using tools such as LLVM compiler.

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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 **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing &Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: VI						
SOFTWARE ENGINEERING WITH AGILE TECHNOLOGIES **Category: PROFESSIONAL CORE COURSE** **(Theory)** (Common to CS, IS, CD & CY)						
Course Code	**:**	**IS364TA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**4:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**60L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**12 Hrs**
Overview: Introduction: Professional Software Development, Software Engineering Ethics, Case studies. **Software Processes**: Models, Process activities, Coping with Change, Process improvement. **Requirements Engineering and System Modeling**: Software Requirements: Functional and Non-functional requirements. Requirements Elicitation, Specification, Validation and Change	
Unit – II	**12 Hrs**
System Modeling: Context models, Interaction models, Structural models, Behavioural models, Model driven architecture. Architectural Design: Design decisions, Architectural views, Architectural patterns and architectures Design and implementation: Object oriented design using UML, Design patterns, Implementation issues, Open-source development	
Unit –III	**12 Hrs**
Software Testing: Development testing, Test-driven development, Release testing, User testing. **Software Evolution**: Evolution processes. Legacy system evolution, Software maintenance Component based software engineering: Components and component models, CBSE processes, component composition	
Unit –IV	**12 Hrs**
Project Management: Risk Management, Managing People, Teamwork, Project Planning: Software Pricing, Plan driven development, Project Scheduling, Agile planning, Estimation Techniques, COCOMO cost modeling	
Unit –V	**12 Hrs**
Agile Software Development: Introduction to agile methods, Agile development techniques, Agile project management and scaling agile methods. **Kanban, Flow, and Constantly Improving:** The Principles of Kanban, Improving Your Process with Kanban, Measure and Manage Flow , Emergent Behavior with Kanban **The Agile Coach :** Coaches Understand Why People Don't Always Want to Change , Coaches Understand How People Learn , Coaches Understand What Makes a Methodology Work , The Principles of Coaching	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand and apply key concepts and stages of the software development lifecycle, including requirements analysis, design, implementation, testing, deployment, and maintenance.
CO2	Demonstrate an ability to use the techniques and tools in the area of software engineering necessary for engineering practice
CO3	Examine the various software design and development solutions using appropriate techniques
CO4	Students will be able to apply various Agile methodologies such as Scrum, Kanban, or XP effectively in software development projects.

Reference Books	
1.	Ian Sommerville," Software Engineering", 9th Edition, Pearson Education, 2013, ISBN: 9788131762165
2.	Learning Agile- Understanding Scrum, XP, Lean and Kanban, Andrew Stellman& Jennifer Greene, O'Reilly Media, 2015, ISBN 978-1-449-33192-4
3.	Roger.S.Pressman," Software Engineering-A Practitioners Approach", 7th Edition, Tata McGraw Hill, 2007, ISBN: 9780071267823
4.	Pankaj Jalote," An Integrated Approach to Software Engineering", 3rd Edition, Narosa Publishing House, 2013, ISBN: 9788173197024
5	Rajib Mall, Fundamentals of Software Engineering, 3rd Edition, Prentice-hall Of India Pvt Ltd., 2012, ISBN: 9788120348981.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
COMPUTER VISION **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)** **(Common to CS & CD)**						
Course Code	**:**	**CS365TDA**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction to Digital Image Fundamentals What is Digital Image Processing? The origin of Digital Image processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sampling and Quantization, Some Basic Relationships between Pixels. **Histogram Processing:** Histogram Equalization, Histogram Matching (Specification Local Histogram Processing. Fundamentals Of Spatial Filtering the Mechanics of Linear Spatial Filtering, Spatial Correlation and Convolution, Separable Filter Kernels.	
Unit – II	**09 Hrs**
Image Segmentation: Fundamentals, Thresholding: The Basics of Intensity Thresholding, The Role of Noise in Image Thresholding, The Role of Illumination and Reflectance in Image Thresholding. Basic Global Thresholding Optimum Global Thresholding Using Otsu's Method Segmentation by Region Growing and By Region Splitting and Merging Region Growing Region Splitting and Merging.	
Unit –III	**09 Hrs**
Region Segmentation Using Clustering and Super pixels: Region Segmentation Using K-Means Clustering, Region Segmentation Using Super pixels, Slic Superpixel Algorithm. **Object Recognition:** Image Pattern Classification: Priori by A Human Designer, Patterns and Pattern Classes, Pattern Vectors, Structural Patterns, Pattern Classification by Prototype Matching.	
Unit –IV	**09 Hrs**
Object Recognition: Minimum-Distance Classifier Using Correlation for 2-D Prototype Matching Sift Feature Matching Structural Prototypes. **Tracking:** Tracking as an Abstract Inference Problem, Independence Assumptions, Tracking as Inference. **Data Association**: Choosing the Nearest- Global Nearest Neighbours, Gating and Probabilistic Data Association, Applications and Examples, Vehicle Tracking, Finding and Tracking People.	
Unit –V	**09 Hrs**
Applications: Finding Faces Using Frame Invariance, Multilocal Visual Events, finding: Annotation and segmentation, Template matching, Shape and correspondence, Video I**mage-Based Rendering:** Constructing 3D Models from Image Sequences, Scene Modelling from Registered Images, Scene Modelling from Unregistered Images Transfer-Based Approaches to Image-Based Rendering Affine View Synthesis.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the fundamental concepts such as image acquisition, pre-processing and post processing operations and fundamentals of Computer Vision.
CO 2	Analyze the difficulties of the pattern recognition problems which include classification techniques, Feature detection and Histogram equalization process. in feature extraction methods, which help identify meaningful patterns and structures in images.
CO 3	Apply appropriate image processing methods for image filtering, image restoration, image reconstruction, segmentation, classification and representation.
CO 4	Designing and implement a Computer Vision system as part of an experiential learning initiative in teams to solve societal and environmental problems using pattern recognition in images and videos

Reference Books	
1.	David Forsyth and Jean Ponce, "Computer Vision: A Modern Approach", Prime student, 2nd edition, ISBN-13: 978-0136085928
2.	Rafael C. Gonzalez, Richard E. Woods;" Digital Image Processing"; Pearson Education; 3rd Edition; 2012; ISBN 978-93-325-7032-0.
3.	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision". 3rd edition, CL Engineering, ISBN-13: 978-0495082521.
4.	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag : http://szeliski.org/Book/.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester:						
OPERATION RESEARCH **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)**						
Course Code	**:**	**CS365TDB**		**CIE Marks**	**:**	**100**
Credits: L:T:P	:	**3:0:0**		**SEE Marks**	**:**	**100**
Total Hours	:	**45L**		**SEE Duration**	**:**	**3 Hrs**

Unit – I	**9 Hrs**
Introduction to Operation Research: Definition and scope of operation research, Multidisciplinary nature of operation research, Distinction between operation research and operations management. ***Applications of operation research in various fields:*** Manufacturing, Logistics and transportation, Finance and economics, Healthcare, Energy and environment. ***Phases of an operation research:*** Study Problem formulation and definition, Data collection and analysis, Model development and selection, Solution techniques and algorithms, Validation and sensitivity analysis, Implementation and monitoring.	
Unit – II	**9 Hrs**
Linear Programming: *Formulation of linear programming problems*: Decision variables and their interpretation, Objective function, Constraints, assumptions and limitations of linear programming models. *Graphical method for solving linear programming problems with two variables:* Feasible region and corner point solutions, Identifying the optimal solution graphically, Sensitivity analysis. *Simplex method for solving linear programming problems*: Standard form and canonical form of linear programming problems, Basic feasible solutions and their properties Simplex algorithm (iterative process), Pivot operations and tableau updates, Duality in linear programming. ***Transportation and assignment problems:*** Problem formulation and special structures, Solution methods for transportation problems, Northwest corner method, Least-cost method, Vogel's approximation method, Transportation algorithm (modified simplex method) Solution methods for assignment problems Hungarian method Branch-and-bound algorithm.	
Unit – III	**9 Hrs**
Queuing Theory: ***Characteristics of queuing systems***: Arrival process (Poisson, general, etc.) Service process (exponential, general, etc.), Queue discipline (FIFO, LIFO, priority, etc.), System capacity (single-server, multi-server), Performance measures (waiting time, queue length, utilization). ***Single-server queuing models:*** M/M/1 model (Poisson arrivals, exponential service times), Steady-state analysis and performance measures, Little's law and its applications, M/G/1 model (Poisson arrivals, general service times) Pollaczek-Khintchine formula Numerical methods for evaluation, ***Multi-server queuing models:*** M/M/c model (Poisson arrivals, exponential service times, c servers) Steady-state analysis and performance measures Erlang's delay formula, M/G/c model (Poisson arrivals, general service times, c servers) Numerical methods for evaluation. ***Queuing decision models:*** Cost analysis and optimization, determining optimal service rates, Determining optimal number of servers, Priority queuing models and applications	
Unit – IV	**9 Hrs**
Decision Theory: ***Decision making under certainty:*** Optimization techniques, Linear programming Dynamic programming Integer programming Applications in resource allocation, scheduling, and planning. ***Decision making under risk:*** Expected value criterion, Expected utility theory, Utility functions and risk	

attitudes, Certainty equivalents and risk premiums, Decision trees and their evaluation.
Decision making under uncertainty: Maximin, maximax, and minimax regret criteria, Bayesian decision theory, Prior and posterior probabilities, Value of information and value of perfect information.
Decision tree analysis: Constructing and evaluating decision trees, Incorporating probabilities and utilities, Decision tree rollback and optimal decision selection, Influence diagrams and their applications.

Unit – V	**9 Hrs**

Project Management:
PERT (Program Evaluation and Review Technique): Network construction and analysis, Activity-on-node (AON) and activity-on-arc (AOA) representations, Identifying critical paths, Time estimation and probability calculations, Beta and normal distributions for activity time estimation, Calculating project completion time distributions.
CPM (Critical Path Method): Differences and similarities with PERT, Resource allocation and levelling, Resource-constrained project scheduling, Resource levelling techniques (heuristics and optimization methods).
Project crashing and time-cost trade-offs: Identifying critical activities, Determining optimal crushing strategy, Linear programming and dynamic programming approaches, Project compression and resource allocation.
Case Studies and Applications: Real-world examples and case studies from various industries like-Manufacturing, Logistics and transportation, Finance and economics, Healthcare etc.

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
CO 2:	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
CO 3:	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
CO 4:	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

Reference Books:	
1.	**S D Sharma, Operations Research (Theory Methods & Applications), January 2014.**
2.	Hamdy A Taha, Operations Research: An Introduction, 10e, Pearson, August 2019.
3.	J K Sharma, Operation Research (Theory and Applications), 4th Edition, 2019.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
WEB FRAMEWORKS **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)** (Common to CS & IS)						
Course Code	**:**	**CS365TDC**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
The Basics of JavaScript: Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements. **JavaScript (continued):**Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts	
Unit – II	**09 Hrs**
JavaScript and HTML Documents: The JavaScript execution environment; The Document Object Model; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The DOM 2 event model; The navigator object. **Dynamic Documents with JavaScript:** Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click; Slow movement of elements; Dragging and dropping elements.	
Unit –III	**09 Hrs**
Introduction to PHP: Origins and uses of PHP; overview of PHP; General syntactic characteristics; Primitives, Operations and Expressions; Output; Control statements; Arrays; Functions; Pattern Matching; Form Handling; Cookies; Session Tracking. **XML**: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets.	
Unit –IV	**09 Hrs**
Web Development Framework: AngularJS Angular JS: Introduction, Angular JS Expressions, Modules, Data Binding, Controllers, DOM, Events, Forms, Validations. **Introduction to Node JS** Node JS and its advantages, Traditional Web Server Model, Node JS Process Model, Installation of Node JS, Node JS Basics, Modules Event Loop. **Introduction to React JS** Advantages of React JS, Understanding Components and Props, Handling Events, Working with Forms.	
Unit –V	**09 Hrs**
Ajax: Overview of Ajax; History of Ajax; Ajax Technology; Implementing Ajax, Basics of Ajax: The Application; The Form Document; The Request Phase; The Response Document; The Receiver Phase; Cross-Browser Support. **Introduction to Django** What is Django, Django and Python, Django Model View Template , Installation of Django, Form Classes, Validation.	

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

CO 1	Understand the basic syntax and semantics of web technology tools such as JavaScript, PHP and XML.
CO 2	Appy web technology tools for designing static and dynamic web pages.
CO 3	Investigate & web based design solution to a given problem using different modern web tools and appropriate techniques.
CO 4	Implement Client and Server side web based real-time applications using JavaScript, PHP , AJAX, Angular JS ,Node JS, React JS and Django.
CO 5	Demonstrate good coding practices for web applications engaging in lifelong learning.

Reference Books	
1.	Programming the World Wide Web – Robert W. Sebesta, 7th Edition, Pearson Education, 2013, ISBN-13:978-0132665810.
2.	Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006, ISBN: 978-81-265-1290-4.
3.	Internet & World Wide Web How to H program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004, ISBN-10: 0-130-89550-4
4.	The Complete Reference to HTML and XHTML- Thomas A Powell, 4th Edition, Tata McGraw Hill, 2003, ISBN: 978-0-07-222942-4.
5.	Chris Northwood, 'The Full Stack Developer': Your Essential Guide to Everyday Skills, Apress, 2018, ISBN:484241525, 9781484241523

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
GENERATIVE ARTIFICIAL INTELLIGENCE **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)** (**Common to AI, CS, CD & IS)**						
Course Code	**:**	**AI365TDD**		**CIE**	**:**	**100 Marks**
Credits: L: T: P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**9Hrs**
Introduction to Generative Deep Learning, Generative Modeling What Is Generative Modeling? Historical perspective on Generative AI, Generative Versus Discriminative Modeling, Introduction to Large Language Models (LLMs), Applications of Large Language Models, Limitations and Risks of Large Language Models	
Unit – II	**9Hrs**
Variational Autoencoders Introduction, Autoencoders, The Autoencoder Architecture the Encoder, The Decoder, Joining the Encoder to the Decoder, Analysis of the Autoencoder **Building a Variational Autoencoder** The Encoder The Loss Function Analysis of the Variational Autoencoder Using VAEs to Generate Faces, Training the VAE, Analysis of the VAE, Generating New Faces, Latent Space Arithmetic, Morphing Between Faces	
Unit –III	**9Hrs**
Generative Adversarial Networks Introduction to GAN (GAN), The Discriminator, TheGenerator **Cycle GAN** Overview, The Generators (U-Net) The Discriminators Compiling the Cycle GAN Training the Cycle GAN Analysis of the Cycle GAN Creating a Cycle GAN to Paint Like Monet the Generators (ResNet) Analysis of the Cycle GAN. **Neural Style Transfer** Content Loss Style Loss Total Variance Loss Running the Neural Style Transfer Analysis of the Neural Style Transfer Model	
Unit -IV	**9Hrs**
Diffusion Models Introduction Denoising Diffusion Models (DDM), The Flowers Dataset, The Forward Diffusion Process, The Reparameterization Trick, Diffusion Schedules, the Reverse Diffusion Process. **Energy-Based Models** Introduction Energy-Based Models, The MNIST Dataset, The Energy Function Sampling, Using Langevin Dynamics	
Unit -V	**9Hrs**
Bias and Fairness in Generative AI: Understanding Bias in AI Types of biases (algorithmic, data, societal) Fairness Metrics Statistical parity, equal opportunity, disparate impact Mitigation Strategies Pre-processing, in-processing, and post-processing techniques **Ethical Design and Deployment of Generative** AI Ethical AI Design Principles Human-centered design, ethical by design Deployment Challenges Real-world implementation, monitoring, and feedback loops Responsible AI Frameworks Guidelines and best practices for ethical deployment	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the concepts and principles of Generative Artificial Intelligence to engineering requirements.
CO2:	Design and demonstrate proficiency in implementing and training various generative AI models using modern tools.
CO3:	Investigate the need for Generative AI techniques to solve real-world problems in diverse domains.
CO4:	Explore advanced topics and research directions in Generative AI and critically evaluate their potential applications.
CO5	Equip students with the knowledge to identify and address ethical issues in Generative AI, focusing on fairness, accountability, transparency, and human rights.

Reference Books	
1	"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster,2nd Edition, 2023. ISBN: 978-1492041948. Publisher: O'Reilly Media.
2	'Deep Learning" by Ian Good fellow, Yoshua Bengio, and Aaron Courville.2nd Edition 2016, ISBN: 978-0262035613. Publisher: MIT Press.
3	"Fairness and Machine Learning: Limitations and Opportunities"; Author(s) Solon Barocas, Moritz Hardt, Arvind Narayanan, 2023, ISBN-10/ASIN: 0262048612, Publisher: MIT Press
4	"Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" by Virginia Dignum , 1st Edition, 2021,ISBN 9783030303716, Publisher: MIT Press

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
BIG DATA SYSTEMS **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)**						
Course Code	**:**	**CS365TDE**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Different Types of Data and Storage for Data: Structured Data (Relational Databases) , Semi-structured data (Object Stores), and Unstructured Data (File systems), Characteristics of Big Data.Systems perspective - Processing: In-memory vs. (from) secondary storage vs. (over the) network **Locality of Reference**: Principle, examples **Impact of Latency**: Algorithms and data structures that leverage locality, data organization on disk for better locality	
Unit – II	**09 Hrs**
Parallel and Distributed Processing: Motivation (Size of data and complexity of processing); Storing data in parallel and distributed systems: Shared Memory vs. Message Passing; Strategies for data access: Partition, Replication, and Messaging. **Distributed Systems:** Motivation (size, scalability, cost-benefit), Client-Server vs. Peer-to-Peer models, Cluster Computing: Components and Architecture **Big Data Analytics**: Requirements, constraints, approaches, and technologies. **Big Data Systems – Characteristics:** Failures; Reliability and Availability; Consistency – Notions of Consistency. **CAP Theorem and implications for Big data Analytics**	
Unit –III	**09 Hrs**
Hadoop: Introduction, Architecture, and Map-reduce Programming on Hadoop,Hadoop Distributed File System (HDFS), Scheduling in Hadoop (using YARN). Example – Hadoop application,**Hadoop Ecosystem:** Databases and Querying (HBASE, Pig, and Hive) **Hadoop Ecosystem:** Integration and coordination (Sqoop, Flume, Zookeeper & Oozie)	
Unit –IV	**09 Hrs**
Distributed Architecture and Computing-HPCC Systems HPCC System functions, Data Lake Architecture, The HPCC Systems design, Thor Vs ROXIE, Hadoop V/s HPCC Systems, ECL programming An activity Declaration, A Record Declaration, Schema on Read (RECORD) explained, A Function Declaration, A MODULE, ECL File(s), Importing files, Spraying and Reading a file Data Shaping (Transforming) : Function, Module and Project, Iterate and Rollup ,Sort, Join and Dedup ,Normalize and Denormalize ,Distribute and Reading The Execution Graph, GROUP and functions (SUM, AVE, COUNT…), TABLE and AGGREGATE	
Unit –V	**09 Hrs**
Spark: Introduction, Architecture and Features, **Programming on Spark:** Resilient Distributed Datasets, Transformation, Examples, **Machine Learning (on Spark):** Regression, Classification, Collaborative Filtering, and Clustering, **Streaming on Spark:** Architecture of Spark Streaming, Stream Processing Model, Example.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Interpret/explore popular distributed systems architectures, emphasizing their significance in addressing Big Data challenges through scalable, fault-tolerant, and efficient data processing solutions.
CO 2	Apply distributed computing principles using Hadoop, MapReduce, or HPCC Systems to design and implement scalable solutions for real-world Big Data challenges.
CO 3	Identify and use suitable tools and techniques for efficient Big Data storage and database management, leveraging advanced querying mechanisms and interfaces to enable optimized data retrieval, analysis, and performance.
CO 4	Demonstrate in-memory processing and stream processing techniques for building Big Data systems.
CO 5	Demonstrate skills in investigation, effective communication, teamwork/individual work, and ethical practices by implementing Big Data solutions for diverse applications.

Reference Books	
1.	Seema Acharya and Subhashini Chellappan. Big Data and Analytics. Wiley India Pvt. Ltd. Second Edition , ISBN-13 978-8126579518
2.	Kai Hwang, Jack Dongarra, and Geoffrey C. Fox. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things. Morgan Kauffman 2011 ISBN-13 978-0123858801
3.	Tom White , The Definitive Guide , 4th Edition, 2012, O'reilly Publications, ISBN: 9780596521974
4.	https://cdn.hpccsystems.com/releases/CE-Candidate9.0.10/docs/EN_US/ECLLanguageReference_EN_US-9.0.10-1.pdf

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
CRYPTOGRAPHY & NETWORK SECURITY **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)**						
Course Code	**:**	**CS365TDF**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction: Security Goals, Cryptographic Attacks, Services and Mechanism, Techniques. Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence.	
Unit – II	**09 Hrs**
Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transpositional Ciphers, Stream and Block Ciphers. **Data Encryption Standard (DES):** Introduction, DES Structure, DES Analysis, Security of DES. **Advanced Encryption Standard:** Introduction, Transformations, Key Expansion, The AES Ciphers, Examples, Analysis of AES.	
Unit –III	**09 Hrs**
Encipherment using Modern Symmetric-Key Ciphers: Use of Modern Block Ciphers, Use of Stream Ciphers. **Asymmetric Key Cryptography:** Introduction, RSA Cryptosystem, Rabin Cryptosystem. Elgamal Cryptosystem.	
Unit –IV	**09 Hrs**
Message authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes. SHA-3, MD5.**Digital signatures:** Digital Signatures, Digital Signature Algorithm.**Key management and distribution:** Distribution of public keys, X.509 certificates, Kerberos.	
Unit –V	**09 Hrs**
Transport level security: Web Security considerations, Secure Sockets Layer.**IP Security:** IP Security overview, IP Security policy, Encapsulating Security payload.**Wireless Network Security:** IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explore fundamental concepts of cryptography, including symmetric and asymmetric encryption, hash functions, and digital signatures.
CO 2	Apply cryptographic algorithms to secure data in transit and at rest, ensuring confidentiality, integrity, and authenticity.
CO 3	Analyze and implement network security protocols (e.g., SSL/TLS, IPsec) to protect data communications.
CO 4	Demonstrate modern security mechanisms for protection of data and networks

Reference Books	
1.	Behrouz A. Forouzan, Debdeep Mukhopadhyay; Cryptography and Network Security; 2e, McGraw-Hill; 2010, ISBN: 007070208x
2.	**Cryptography and Network Security**: Principles and Practice, 7 th Edition, ISBN 978-0-13-444428-4, by **William Stallings** published by Pearson Education © 2017.
3.	Douglas Stinson; Cryptography Theory and Practice; Chapman & Hall; 3rd Edition; 2005, ISBN 9781584885085
4.	Josef Pieprzyk, Thomas Hardjono, Jennifer Serberry Fundamentals of Computer Security, Springer ISBN: 9783642077135, ISBN: 9783662073247 (eBook).

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: V

FUNDAMENTALS OF AEROSPACE ENGINEERING **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**AS266TEA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**09 Hrs**
Basics of Flight Vehicles: History of aviation, International Standard atmosphere (ISA), Temperature, pressure and altitude relationships, Simple Problems on Standard Atmospheric Properties, Classification of aircrafts, Anatomy of an aircraft & Helicopters, Basic components and their functions.	
Unit – II	**10 Hrs**
Aircraft Aerodynamics: Bernoulli's theorem, Centre of Pressure, Lift and Drag, Types of Drag, Aerodynamic Coefficients, Aerodynamic Centre, Wing Planform Geometry, Airfoil Nomenclature, Basic Aerodynamic characteristics of Airfoil, Simple Numericals on Lift and Drag.	
Unit –III	**12 Hrs**
Aerospace Propulsion: Introduction, Turbine Engines: Brayton Cycle, Operation of Turbojet, Turboprop, Turbofan, Turboshaft, RAMJET and SCRAMJET Engines, Rocket Engines: Principles of operation of Solid, Liquid, Hybrid, Nuclear and Electric Rockets. **Introduction to Space Mechanics:** Basic Orbital Mechanics-Types of Trajectories, Escape and Orbital Velocities, Kepler's Laws of Planetary Motion, Simple Numericals.	
Unit –IV	**06 Hrs**
Aerospace Structures and Materials: General types of construction-Monocoque, Semi-Monocoque & Geodesic, Structure of Wing and Fuselage, Metallic and Composite Materials.	
Unit –V	**08 Hrs**
Aircraft Systems & Instruments: Instrument Displays, Basic Air data systems & Pitot Probes- Mach meter, Air speed indicator, Vertical speed indicator, Altimeter. **Basics of Aircraft Systems:** Hydraulic and pneumatic systems, Electrical System, Aircraft Fuel System, Environmental Control System.	

Course Outcomes: At the end of this course the student will be able to :	
CO1:	Identify the fundamental nuances of Aerospace Engineering and appreciate their significance on the Flight Vehicles design and performance
CO2:	Interpret the design parameters that influence the design of the Aerospace Vehicles systems and its sub-systems
CO3:	Evaluate critically the design strategy involved in the development of Aerospace vehicles
CO4:	Categorically appraise the operation of the Aerospace Vehicles for different operating conditions

Reference Books	
1	Introduction to Flight, John D. Anderson, 7th Edition, 2011, McGraw-Hill Education, ISBN 9780071086059.
2	Fundamentals of Aerodynamics, Anderson J .D, 5th Edition, 2011, McGraw-Hill International Edition, New York ISBN:9780073398105.
3	Rocket Propulsion Elements, Sutton G.P., 8th Edition, 2011, John Wiley, New York, ISBN: 1118174208, 9781118174203.
4	Aircraft structural Analysis, T.H.G Megson, 2010, Butterworth-Heinemann Publications, ISBN: 978-1-85617-932-4
5	Ian Moir, Allan Seabridge, "Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration", John Wiley & Sons, 3rd edition, 2011, ISBN: 9781119965206

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks adding up to 20 Marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test consisting of 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 up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
HEALTHCARE ANALYTICS **Category: INSTITUTIONAL ELECTIVES-I (Group-E)** **(Theory)**						
Course Code	**:**	**BT266TEB**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 Hrs**		**SEE Duration**	**:**	**3Hours**

Unit-I	**09 Hrs**
Introduction to tools and databases: Introduction to Bioinformatics, Goals, Scope, Applications, Sequence databases, Structure databases, Special databases – genome and microarray, Applications of these databases, examples, Database similarity search: Unique requirements of database searching, Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA, Comparison of FASTA and BLAST, Database Searching with Smith-Waterman Method	
Unit – II	**09 Hrs**
Sequence Analysis: Types of Sequence alignment -Pairwise and Multiple sequence alignment, Alignment algorithms, Scoring matrices, Statistical significance of sequence alignment. Multiple Sequence Alignment: Scoring function, Exhaustive algorithms, Heuristic algorithms, Profiles and Hidden Markov Models: Position-Specific scoring matrices, Profiles, Markov Model and Hidden Markov Model, Scoring matrices – BLOSSUM and PAM **Molecular Phylogenetics:** Introduction, Terminology, Forms of Tree Representation. Phylogenetic Tree Construction Methods - Distance-Based, Character-Based Methods and Phylogenetic Tree evaluation.	
Unit –III	**09 Hrs**
Introduction to Next-Generation Sequencing (NGS) analysis: Sanger sequencing principles - history and landmarks, of Sequencing Technology Platforms, A survey of next-generation sequencing technologies, A review of DNA enrichment technologies, Base calling algorithms, Base quality, phred values, Reads quality checks, Interpretations from quality checks. Adapter and primer contamination. Processing reads using clipping of reads-Advantages and disadvantages of processing of reads, automation in NGS analysis and advantages (shell scripting)	
Unit –IV	**09 Hrs**
Structural analysis & Systems Biology: Gene prediction programs – ab initio and homology-based approaches. ORFs for gene prediction. Detection of functional sites and codon bias in the DNA. Predicting RNA secondary structure, Protein structure basics, structure visualization, comparison and classification. Protein structure predictive methods using protein sequence, Protein identity based on composition. Structure prediction - Prediction of secondary structure, tertiary structure prediction methods, Scope, Applications. Concepts, implementation of systems biology, Mass spectrometry and Systems biology, Flux Balance analysis.	
Unit –V	**09 Hrs**
Drug Screening: Introduction to Computer-aided drug discovery, target selection, ligand preparation and enumeration, molecular docking, post-docking processing, molecular dynamics simulations, applications and test cases, AI/ML in Drug discovery	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Gain proficiency in utilizing a range of bioinformatics tools and databases for comprehensive sequence and structural analysis.
CO2	Investigate and apply innovative sequencing technologies and analytical methods to solve complex biological questions and advance research in genomics and molecular biology.
CO3	Demonstrate expertise in NGS technologies, including performing data quality assessments, read processing, and managing large-scale data.
CO4	Apply bioinformatics tools for modeling and simulating biological processes, with a focus on gene prediction using both ab initio and homology-based approaches.

Reference Books

1.	Xiong J. Essential bioinformatics. Cambridge University Press; 2006 Mar 13.
2.	Buehler LK, Rashidi HH, editors. Bioinformatics basics: applications in biological science and medicine. CRC Press; 2005 Jun 23.
3.	Ghosh Z, Mallick BM. Bioinformatics principles and Applications. Oxford University Press; 2018 Jun 13.
4.	Low L, Tammi MT. Introduction to next generation sequencing technologies. Bioinformatics. WORLD SCIENTIFIC. 2017 Jul 26:1-21.
5.	Bioinformatics: Sequence and Genome Analysis; D W Mount; 2014; CSHL Press; 2nd edn; ISBN: 9780879697129.
6.	Computational Systems Biology; A Kriete and R Eils; 2006; Academic Press; Illustrated edn; ISBN: 978-01-208-87866.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI

INDUSTRIAL SAFETY ENGINEERING
Category: INSTITUTIONAL ELECTIVES-I
(Group-E)
(Theory)

Course Code	**:**	**CH266TEC**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**	**SEE Duration**	**:**	**3Hours**

Unit-I	**09 Hrs**

Introduction Safety:
Introduction to industrial safety engineering, major industrial accidents, safety and health issues, key concepts and terminologies, Hazard theory, Hazard triangle, Hazard actuation, Actuation transition, Causal factors, problems on OSHA

Unit – II	**09 Hrs**

Risk assessment and control: Risk assessment, Risk perception, acceptable risk, problems on net present value, internal rate of return, payback period concepts including real life examples.
Hazard Identification Methods: Preliminary Hazard List (PHL), worksheets, case study. Preliminary Hazard Analysis (PHA), Fault tree and Event tree analysis. Design and development of fault tree and event tree for high pressure reactor system.

Unit –III	**09 Hrs**

Hazard analysis: Hazard and Operability Study (HAZOP): Guide words, HAZOP matrix, Procedure, HAZOP studies on reactors, heat exchanger, design of HAZOP table, Failure Modes and Effects Analysis (FMEA) concept, methodology, problems of FMEA, examples.

Unit –IV	**09 Hrs**

Risk analysis on capital budgeting: Risk adjusted discount rate (RADAR) method, certainty equivalent approach, scenario analysis, probability distribution, quantification of risk using statistical parameters and associated problems.

Unit –V	**09 Hrs**

Safety in process industries and case studies: Personnel Protection Equipment (PPE): Safety glasses, face shields, welding helmets, absorptive lenses, hard hats, types of hand PPE, types of foot PPE, types of body PPE. Bhopal gas tragedy, Chernobyl nuclear disaster, Chemical plant explosion and fire.

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the risk assessment techniques used in process industry
CO2	Interpret the various risk assessment tools.
CO3	Use hazard identification tools for safety management.
CO4	Analyze tools and safety procedures for protection in process industries.

Reference Books

1. Functional Safety in the Process Industry: A Handbook of practical Guidance in the application of IEC61511 and ANSI/ISA-84, Kirkcaldy K.J.D Chauhan, 2012, North corolina,Lulu publication, ISBN:1291187235.
2. Safety Instrumented Systems Verification Practical probabilistic calculations, Goble and William M., 2005, Pensulvania ISA publication, ISBN:155617909X.
3. Industrial safety and risk Management, Laird Wilson and Doug Mc Cutche, 1st Edition, 2003,The University of alberta press,Canada, ISBN: 0888643942.
4. Industrial Safety, Health and Environment Management Systems, R K Jain, Sunil S Rao, 4th Edition, 2005, Khanna Publishers, New Delhi, ISBN: 8174092102.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
ROBOTIC PROCESS AUTOMATION **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**CS266TED**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Duration	**:**	**45L**		**SEE Duration**	**:**	**3 Hrs**

Unit – I	**9 Hrs**
RPA Concepts: RPA Basics, History of Automation, what is RPA? RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated? Types of Bots, Workloads that can be automated. **RPA Advanced Concepts**: Standardization of processes, Setting up the Centre of Excellence, RPA Development methodologies, Difference from SDLC, RPA journey, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.	
Unit – II	**9 Hrs**
RPA Tool Introduction: Introduction to UiPath - the User Interface, Types of Variables, Variables in UiPath, Managing Arguments, The Arguments Panel, Namespaces; Control flow statements in UiPath, Sequences and Flowcharts, Control Flow Activities Data Manipulation Introduction, Data Manipulation Operations, Types of data storing variables, Text Manipulation, main string methods. **UiPath Recording:** Basic, Desktop and Web Recording, Image and Native Citrix Recording, Input/output methods, Types of OCR, Data Scraping, Advanced Scraping techniques.	
Unit – III	**9 Hrs**
Advanced Automation Concepts: Selectors, Types of Selectors (Full, partial, dynamic), Defining and Assessing Selectors, Customization, Debugging. Image, Text & Advanced Citrix Automation – Introduction, Keyboard based automation, Information Retrieval, Best Practices Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table, Extracting Data from Data Table, Anchors, Using anchors in PDF	
Unit – IV	**9 Hrs**
Email Automation, Exceptions and Deploying Bots: Introduction to Email Automation, Key concepts of email, email protocols, email automation in UiPath, email as input and output. Debugging and Exception Handling, Types of exception, Debugging Tools, Strategies for solving issues, Catching errors. Overview of orchestration Server, orchestrator functionalities, Connecting Bot to orchestrator	
Unit – V	**9 Hrs**
Hyperautomation: Components and application of Hyperautomation, Automation versus hyperautomation, Benefits and challenges of hyperautomation, use cases, Phases (Integration, Discover, Orchestration and Governance), Trends in Hyperautomation (low-code/no-code platform, HaaS)	

	Course Outcomes: After completing the course, the students will be able to
CO1	Understand RPA principles, its features and applications
CO2	Demonstrate proficiency in handling variables and decision making inside a workflow and data manipulation techniques
CO3	Gain insights into recording, Email Automation and exception handling and orchestrator.
CO4	Analyze the trends in automation and chose business strategy to design a real-world automation workflow.

Reference Books:	
1.	Alok Mani Tripathi, "Learning Robotic Process Automation, Publisher: Packt Publishing, Release Date: March 2018 ISBN: 9781788470940
2.	PASCAL BORNET, Intelligent automation: Welcome to the world of hyperautomation, World Scientific Publishing Company, ISBN-13: 978-9811235481 December 2020
3.	UiPath pdf manuals
4.	https://www.uipath.com/rpa/robotic-process-automation
5.	https://www.ibm.com/topics/hyperautomation
6.	https://www.pega.com/hyperautomation

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
INTELLIGENT TRANSPORTATION SYSTEMS **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**CV266TEE**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3Hours**

Unit-I	**09 Hrs**
Introduction to Intelligent Transportation Systems **(**ITS): Historical background, Urbanisation, Motorisation, Transport system characteristics, Transport problems and issues, Challenges and opportunities in ITS: ITS-Today and tomorrow, ITS training and education needs, Role and importance of ITS in context of Indian Transport system and opportunity for sector growth of ITS.	
Unit – II	**09 Hrs**
ITS Architecture: introduction, Functionalities required for User service, Logical architecture, Physical architecture, Equipment and Market packages, Need of ITS Architecture to solve problems in Urban area. Technology building blocks for ITS: Introduction, Data acquisition, Communication tools, Data analysis and Traveller information. Various detection, Identification and collection methods for ITS.	
Unit –III	**09 Hrs**
Traffic management system components and ITS: Introduction, objectives, traffic management measures, ITS for traffic management, Development of traffic management system, Traffic Management Centre, Advance Traffic Management System, Advanced Traveller Information System, Advance Vehicle Control Systems, Advance Public Transport System, Commercial Vehicle Operations, ITS For Intermodal Freight Transport.	
Unit –IV	**09 Hrs**
ITS Evaluation – Project selection at the planning level, Deployment Tracking, Impact Assessment, Benefits by ITS components, Evaluation Guidelines. ITS for Law Enforcement: Introduction, Enhance and support the enforcement traffic rules and regulations, ITS Funding options.	
Unit –V	**09 Hrs**
ITS Standards-Standard development process, National ITS architecture and standards, ITS standards application areas, National Transportation Communications for ITS Protocol, Standards testing. ITS for smart cities and Case studies.	

Course Outcomes: After completing the course, the students 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 implementations

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,
5	R.P Roess, E.S. Prassas, W.R. McShane. Traffic Engineering, Pearson Educational International, Third Edition, 2004, ISBN-13: 978-0-13-459971-7.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
INTEGRATED HEALTH MONITORING OF STRUCTURES **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**CV266TEF**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3Hours**

Unit-I	**09 Hrs**
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance, Importance of maintenance **Structural Health Monitoring**: Concepts, Various Measures, Analysis of behavior of structures using remote structural health monitoring, Structural Safety in Alteration.	
Unit – II	**09 Hrs**
Materials: Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique, Sensor technologies used in SHM **Structural Audit**: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures, SHM using Artificial Intelligence	
Unit –III	**09 Hrs**
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.	
Unit –IV	**09 Hrs**
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.	
Unit –V	**09 Hrs**
Remote Structural Health Monitoring: Introduction, Hardware for Remote Data Acquisition Systems, Advantages, Case studies on conventional and Remote structural health monitoring **Case studies:** Structural Health Monitoring of Bridges, Buildings, Dams, Applications of SHM in offshore Structures- Methods used for non-destructive evaluation (NDE) and health monitoring of structural components	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Diagnose the distress in the structure understanding the causes and factors.
CO2	Understand safety aspects, components and materials used in Structural Health Monitoring.
CO3	Assess the health of structure using static field methods and dynamic field tests.
CO4	Analyse behavior of structures using remote structural health monitoring

Reference Books	
1	Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes,2006, John Wiley and Sons, ISBN: 978-1905209019
2	Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, 2007,John Wiley and Sons, ISBN:9780470033135
3	Structural Health Monitoring and Intelligent Infrastructure, J. P. Ou, H. Li and Z. D. Duan, Vol1,2006,Taylor and Francis Group, London, UK. ISBN: **978-0415396523**
4	Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, 2007,Academic Press Inc, ISBN: 9780128101612

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
ADVANCED ENERGY STORAGE FOR E-MOBILITY **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**CM266TEG**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the fundamentals and technologies of energy storage in electric vehicles
2	Analyze and compare advanced battery technologies for e-mobility
3	Impart the principles of electrochemistry for analyzing issues in electric/hybrid vehicles.
4	Develop solutions for battery management systems and recycling of advanced storage devices.

Unit-I	**09 Hrs**

Energy storage in electric vehicles

Introduction to E-mobility, background of alternative energy sources and sustainability. Types of electric vehicles and their salient features along with their energy requirement. Fundamentals of advanced battery technology. Battery characteristics. Specification of advanced battery for e mobility.

Unit – II	**09 Hrs**

Advanced lithium-ion batteries

Basic concepts of lithium batteries. Types of advanced cathode and anode materials employed in lithium batteries. Construction, working and future applications of lithium cobalt oxide, lithium iron phosphate, Lithium air, lithium sulfur and lithium polymer batteries with their advancement in vehicle electrification.

Unit –III	**09 Hrs**

Non lithium batteries for e mobility

Limitations of lithium batteries. Overview of non-lithium battery technology. Construction and working of advanced non-Lithium batteries such as Lead acid, Nickel Metal Hydride, Redox flow, Zebra, Sodium and Magnesium batteries. Electrode materials and electrolyte considerations in non lithium batteries. Performance comparison with lithium-ion batteries. Battery requirement in charging infrastructure.

Unit –IV	**09 Hrs**

Chemistry of alternative storage devices

Introduction to super capacitor. Construction, working and applications of supercapacitors along with the materials used in electrodes. Types of advanced supercapacitors. Application of supercapacitors in regenerative braking. Advancement in battery-supercapacitor hybrid, Battery-fuel cell hybrid, and Battery-solar cell hybrid electric vehicles with their advantages and limitations.

Unit –V	**09 Hrs**

Battery management and recycling:

Battery management systems (BMS): Fundamentals of battery management systems and controls, State-of-charge (SoC), state-of-health (SoH) and Cell balancing techniques.

Battery Thermal Management: Passive and active cooling systems. Safety mechanisms, thermal runaway and thermal management.

Battery recycling: Economic aspects, environmental safety and process of recycling of advanced batteries.

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Implement the fundamentals of chemistry in advanced energy storage and conversion devices.
CO2	Apply the chemistry knowledge used for hybridization of various energy storage and conversion devices.
CO3	Analyze the different battery system for achieving maximum energy storage for vehicle electrification
CO4	Evaluation of efficiency of a battery with respect to cost, environmental safety, material, energy consumption and recycling.

Reference Books	
1	Battery reference book, T. R. Crompton., 3rd edition, NEWNES Reed Educational and Professional Publishing Ltd 2000, ISBN: 07506 4625 X.
2	Batteries for Electric Vehicles, D. A. J. Rand, R. Woods, and R. M. Dell, Society of Automotive Engineers, Warrendale PA, 2003. ISBN 10: 0768001277.
3	Lithium Batteries, Science and Technology, GA. Nazri and G. Pistoa, Kluwer Academic Publisher, 2003, ISBN 978-0-387-92675-9.
4	Battery Technology Handbook, H. A. Kiehne, Marcel Dekker, NYC, 2003. ISBN: 0824742494 9780824742492.
5	Electric Vehicle Technology Explained, James Larminie and John Lowry. 2nd Edition, Wiley, ISBN-13: 978-1118505429.
6	Electric Vehicle Technology and Design, Antoni Gandia. CRC Press, ISBN-13: 978-1138551912.
7	Sustainable Transportation: Problems and Solutions. William R. Black, The Guilford Press, ISBN-13: 978-1462532072.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
HUMAN MACHINE INTERFACE (HMI) **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)** **Industry Assisted Elective-BOSCH**						
Course Code	**:**	**EC266TEH**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hrs**

Unit-I	**09 Hrs**
Foundations of HMI: The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, Processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms. **Introduction to HMI and Domains**: Automotive, Industrial, CE, Medical, ECUs within car and their functionalities. Interaction between ECUs. Communication protocols for ECUs(CAN, LIN, Most, FlexRay, Ethernet etc)	
Unit – II	**09 Hrs**
Automotive Human-Machine Interfaces: Automotive infotainment system - Evolution road map, Feature sets, System architecture, Trends, Human factors and ergonomics in automotive design, Automotive User Experience (UX) Design Principles, In-Vehicle Information Systems (IVIS), Driver-Assistance Systems (DAS) Interfaces, HMI design for adaptive cruise control, Voice and Gesture Recognition in Automotive HMIs, Touchscreen Interfaces and Controls, Usability Testing and Evaluation in Automotive HMIs, Safety Considerations and Regulations in Automotive HMIs, Emerging Technologies in Automotive HMIs, Human-Machine Interfaces for Autonomous Vehicles	
Unit –III	**09 Hrs**
UX and Guidelines: Introduction to UX design - stages, theory, Design thinking, UX Study, Interaction concepts, Graphic design tools - Adobe Photoshop, Adobe XD, Blender, GIMP, Asset Design - Overview, Guidelines and norms, 2D/3D rendering, OpenGL, OSG.	
Unit –IV	**09 Hrs**
HMI User Interface: User-centered HMI development process, Basics of Web-Server. Web-based HMI: Basics of TwinCAT and HTML, CSS, JavaScript. **HMI on Mobile**: Four Principles of Mobile UI Design, Benefits of Mobile HMIs, Mobile HMI Development Suites.	
Unit –V	**09 Hrs**
HMI Control Systems: Introduction to Voice-Based HMI, Gesture-Based HMI, Sensor-Based UI controls. **Haptics in Automotive HMI**: Kinesthetic Feedback Systems, Tactile Feedback Systems, Haptics in Multimodal HMI, Automotive Use-Cases **HMI Testing**: Limitations of Traditional Test Solutions, Case - Study: Bosch's HMI validation tool - Graphics Test Systems (GTS). **UI analytics**: Usage patterns, Debugging, Performance Profiling, Use Cases.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understanding the application of HMIs in various domain.
CO2	Comparison of various communication protocols used in HMI development.
CO3	Apply and analyse the car multimedia system free software and hardware evolution.
CO4	Design and evaluate the graphic tools and advanced techniques for creating car dashboard multimedia systems.

Reference Books	
1.	Touch based HMI; Principles and Applications, Shuo gao, Shuo Yan, Hang Zhao, Arokia Nathan, Springer Nature Switzerland AG, 1st Edition.
2.	Unity 2020 by Example: A Project based guide to building 2D, 3D augmented reality and Virtual reality games from sratch, Robert Wells, Packt Publishing ltd, 2020.
3.	GUI Design and Android Apps, Ryan Cohen, Tao Wang, Apress, Berkley, CA,2014.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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 up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	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
	TOTAL	**100**

Semester: VI						
ENERGY AUDITING AND STANDARDS **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**EE266TEJ**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
Types of Energy Audit and Energy-Audit Methodology: Definition of Energy Audit, Place of Audit, Energy – Audit Methodology, Financial Analysis, Sensitivity Analysis, Project Financing Options, Energy Monitoring and Training. **Survey Instrumentation:** Electrical Measurement, Thermal Measurement, Light Measurement, Speed Measurement, Data Logger and Data Acquisition System, **Energy Audit of a Power Plant:** Indian Power Plant Scenario, Benefit of Audit, Types of Power Plants, Energy Audit of Power Plant.	
Unit – II	**10 Hrs**
Electrical-Load Management: Electrical Basics, Electrical Load Management, Variable Frequency Drives, Harmonics and its Effects, Electricity Tariff, Power Factor, Transmission and Distribution Losses. **Energy Audit of Motors:** Classification of Motors, Parameters related to Motors, Efficiency of a Motor, Energy Conservation in Motors, BEE Star Rating and Labelling. **Energy Audit of Pumps, Blowers and Cooling Towers:** Pumps, Fans and Blowers, Cooling Towers	
Unit –III	**09 Hrs**
Communication & Standards: **Wireless technologies:** WPANs, LAN, Wireless metropolitan area network, cellular network, satellite communication, Zigbee, Bluetooth, LAN, NAN **Wireline communication:** Phone line technology, powerline technology, coaxial cable technology; Optical communication, TCP/IP networks	
Unit –IV	**10 Hrs**
Energy Audit of Boilers: Classification of Boilers, Parts of Boiler, Efficiency of a Boiler, Role of excess Air in Boiler Efficiency, Energy Saving Methods. **Energy Audit of Furnaces:** Parts of a Furnace, classification of Furnaces, Energy saving Measures in Furnaces, Furnace Efficiency **Energy Audit of Steam-Distribution Systems :** S team as Heating Fluid, Steam Basics, Requirement of Steam, Pressure, Piping, Losses in Steam Distribution Systems, Energy Conservation Methods	
Unit-V	**10 Hrs**
Energy Audit of Lighting Systems: Fundamentals of Lighting, Different Lighting Systems, Ballasts, Fixtures (Luminaries), Reflectors, Lenses and Louvres, Lighting Control Systems, Lighting System Audit, Energy Saving Opportunities. **Energy Audit Applied to Buildings:** Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the need for energy audit, prepare a flow for audit and identify the instruments needed.
CO 2	Design and perform the energy audit process for electrical systems.
CO 3	Design and perform the energy audit process for mechanical systems
CO 4	Propose energy management scheme for a building

Reference Books	
1.	Handbook of energy audit, Sonal Desai, Kindle Edition, 2015, McGraw Hill Education, ISBN: 9339221346, 9789339221348.
2.	Energy management handbook, Wayne C Turner and Steve Doty, 6th Edition, 2015, CRC Press, ISBN: 0-88173-542-6.
3.	Energy management, Sanjeev Singh and Umesh Rathore, 1st Edition, 2016, Katson Books, ISBN 10: 9350141019, ISBN 13: 9789350141014.
4.	Energy audit of building systems, Moncef Krarti, 2nd Edition, 2010, CRC Press ISBN: 9781439828717

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
BIOMEDICAL INSTRUMENTATION **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**EI266TEK**		**CIE**	:	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	:	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	:	**03 Hrs**

Unit-I	**09 Hrs**
Fundamentals: Sources of Biomedical signals, Basic medical instrumentation system, General constraints in design of medical instrumentation systems. **Bioelectric Signals and Electrodes**: Origin of bioelectric signals, Types of bioelectric signals, Recording electrodes, Electrode-tissue interface, Polarization, Skin contact impedance, Silver-silver chloride electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes.	
Unit – II	**09 Hrs**
Electrocardiograph: Electrical activity of heart, Genesis and characteristics of Electrocardiograph (ECG), Block diagram description of an Electrocardiograph, ECG lead systems, Multi-channel ECG machine. **Electroencephalograph:** Genesis of EEG, Block diagram description of an EEG, 10-20 Electrode system, Computerized analysis of EEG.	
Unit –III	**09 Hrs**
Patient Monitoring System: Bedside monitors, Central Monitors, Measurement of Heart Rate, Average Heart Rate meter, Instantaneous heart rate meter, Measurement of pulse rate, Blood Pressure measurement, Direct and indirect method, Automatic blood pressure measuring apparatus using Korotkoff's method. **Oximeters:** Oximetry, ear oximeter, pulse oximeter, skin reflectance oximeter and intravascular oximeter.	
Unit –IV	**09 Hrs**
Blood Flow Meters: Electromagnetic blood flow meter, Types of electromagnetic blood flow meters, Ultrasonic blood flow meters, NMR blood flow meters, Laser Doppler blood flow meters. **Cardiac Pacemakers and Defibrillators:** Need for Cardiac pacemaker, External Pacemaker, Implantable Pacemaker, Types of Implantable Pacemaker, Ventricular Synchronous Demand Pacemaker and Programmable Pacemaker. Need for a defibrillator, DC defibrillator, Defibrillator electrodes, DC defibrillator with synchronizer.	
Unit –V	**09 Hrs**
Advances in Radiological Imaging: X-rays-principles of generation, Conventional X-ray radiography, Fluoroscopy, Angiography, Digital radiography, Digital subtraction angiography (DSA). Basic principle of computed tomography, magnetic resonance imaging system and Ultrasonic imaging system.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the sources of biomedical signals and basic biomedical instruments.
CO2	Apply concepts for the design of biomedical devices
CO3	Analyze the methods of acquisition and signal conditioning to be applied to the physiological parameters.
CO4	Develop instrumentation for measuring and monitoring biomedical parameters.

Reference Books	
1.	Handbook of Biomedical Instrumentation, R. S. Khandpur,3rd Edition, Reprint 2016, Tata McGraw-Hill, ISBN: 9780070473553.
2.	Biomedical Instrumentation and Measurements, Leslie Cromwell & others, 2nd Edition, Reprint 2015, ISBN: 9780130771315.
3.	Medical instrumentation: Application and Design, J. G. Webster, 3rd Edition, Reprint 2015, Wiley Publications, ISBN: 9788126511068.
4.	Principles of Medical Imaging, K.Kirk Shung, Michael B. Smith and Banjamin Tsui, Academic Press, 2016, ISBN: 978-0126409703.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**). Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	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
	TOTAL	**100**

Semester: VI

TELECOMMUNICATION SYSTEMS

Category: INSTITUTIONAL ELECTIVES-I
(Group-E)
(Theory)

Course Code	**:**	**ET266TEM**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**8 Hrs**
Introduction to Electronic Communication: The Significance of Human Communication, Communication Systems, Types of Electronic Communication, Modulation and Multiplexing, Electromagnetic Spectrum, Bandwidth, A Survey of Communication Applications. **The Fundamentals of Electronics:** Gain, Attenuation, and Decibels. **Radio Receivers:** Super heterodyne receiver.	
Unit – II	**10 Hrs**
Modulation Schemes: Analog Modulation: AM, FM and PM- brief review. **Digital Modulation:** PCM, Line Codes, ASK, FSK, PSK & QAM (Architecture). **Wideband Modulation:** Spread spectrum, FHSS, DSSS.	
Unit –III	**10 Hrs**
Satellite Communication: Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground Stations, Satellite Applications, Global Positioning System.	
Unit –IV	**9 Hrs**
Optical Communication: Optical Principles, Optical Communication Systems, Fiber-Optic Cables, Optical Transmitters and Receivers, Wavelength-Division Multiplexing, Passive Optical Networks.	
Unit –V	**8 Hrs**
Cell Phone Technologies: Cellular concepts, Frequency allocation, Frequency reuse, Internet Telephony. **Wireless Technologies:** Wireless LAN, PANs and Bluetooth, Zig Bee, Mesh Wireless Networks, WiMax, and Wireless Metropolitan Area Networks.	

Course Outcomes: After completing the course, the students will be able to :-	
CO1	Describe the basics of communication systems.
CO2	Analyze the importance of modulation and multiple access schemes for communication systems.
CO3	Analyze the operational concept of cell phone and other wireless technologies.
CO4	Justify the use of different components and sub-system in advanced communication systems.

Reference Books	
1.	Principles of Electronic Communication Systems, Louis E. Frenzel, 4th Edition, 2016, Tata McGraw Hill, ISBN: 978-0-07-337385-0.
2.	Electronic Communication Systems, George Kennedy,3rd Edition, 2008, Tata McGraw Hill, ISBN: 0-02-800592-9.
3.	Introduction to Telecommunications, Anu A. Gokhale, 2nd Edition, 2008, Cengage Learning ISBN: 981-240-081-8

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
MOBILE COMMUNICATION NETWORKS AND STANDARDS **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**ET266TEN**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Principle of Cellular Communication: Cellular Terminology, Cell Structure and Cluster, Frequency Reuse Concept, Cluster size and System Capacity, Method of Locating Co-channel cells, Frequency Reuse distance, Co-channel Interference and Signal Quality, Co-channel interference Reduction Methods.	
Unit – II	**9 Hrs**
Basic Cellular system: Consideration of components of a cellular system- A basic cellular system connected to PSTN, Main parts of a basic cellular system, Operation of a Cellular system, Performance criteria- Voice quality, Trunking and Grade of Service, Spectral Efficiency of FDMA and TDMA systems	
Unit –III	**9 Hrs**
Second generation Cellular Technology: GSM: GSM Network Architecture, Identifiers used in GSM System, GSM channels, Authentication and Security in GSM, GSM Call Procedure, GSM Hand-off Procedures.	
Unit –IV	**9 Hrs**
3G Digital Cellular Technology: GPRS: GPRS technology, GPRS NetworkArchitecture, GPRS signalling, Mobility Management in GPRS. **UMTS:** UMTS Network Architecture, UMTS Interfaces, UMTS Air Interface Specifications, UMTS Channels**.**	
Unit –V	**9 Hrs**
Wireless Personal Area Networks: Network architecture, components, Bluetooth, Zigbee, Applications. **Wireless Local Area networks:** Network Architecture, Standards, Applications. Wireless Metropolitan Area Networks: IEEE 802.16 standards, advantages, WMAN Network architecture, Protocol stack	

Course Outcomes: After completing the course, the students will be able to :-	
CO1	Describe the concepts and terminologies for Cellular Communication.
CO2	Analyze the Architecture, Hand-off and Security aspects in 2G and 3G Networks.
CO3	Compare the performance features of 2G and 3G Cellular Technologies.
CO4	Analyze and Compare the architectures of various Wireless technologies and standards.

Reference Books	
1.	Wireless Communications, T.L. Singal, 2nd Reprint 2011,Tata McGraw Hill Education Private Limited, ISBN: 978-0-07-068178-1
2.	Wireless and Mobile Networks Concepts and Protocols, Dr.Sunil Kumar SManvi, 2010, Willey India Pvt. Ltd., ISBN: 978-81-265-2069-5.
3.	Wireless Communication, Upena Dalal, 1st Edition, 2009, Oxford higher Education, ISBN-13:978-0-19-806066-6.
4	Wireless Communications Principles and practice, Theodore S Rappaport, 2nd Edition, Pearson, ISBN 97881-317-3186-4

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
MOBILE APPLICATION DEVELOPMENT **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**IS266TEO**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
TotalHours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

Prerequisite: - Programming in Java.

Unit-I	**09 Hrs**
Introduction: Smart phone operating systems and smart phones applications. Introduction to Android, Installing Android Studio, creating an Android app project, deploying the app to the emulator and a device. UI Design: Building a layout with UI elements, Layouts, Views and Resources, Text and Scrolling Views. Activities and Intents, The Activity Lifecycle, Managing State, Activities and Implicit Intents, The Android Studio Debugger, Testing the Android app, The Android Support Library.	
Unit–II	**09 Hrs**
User experience: User interaction, User Input Controls, Menus, Screen Navigation, Recycler View, Delightful user experience, Drawables, Styles, and Themes, Material Design, Testing app UI, Testing the User Interface	
Unit–III	**09 Hrs**
Working in the background: Async Task and Async Task Loader, Connect to the Internet, Broadcast Receivers and Services. Scheduling and optimizing background tasks – Notifications, Scheduling Alarms, and Transferring Data Efficiently	
Unit–IV	**09 Hrs**
All about data: Preferences and Settings, Storing Data, Shared Preferences. Storing data using SQLite, SQLite Database. Sharing data with content providers. Advanced Android Programming: Internet, Entertainment and Services. Displaying web pages and maps, communicating with SMS and emails, Sensors.	
Unit–V	**09 Hrs**
Hardware Support & devices: Permissions and Libraries, Performance and Security. Fire base and AdMob, Publish and Polish, Multiple Form Factors, Using Google Services.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Comprehend the basic features of android platform and the application development process. Acquirefamiliarity with basic building blocks of Android application and its architecture.
CO2:	Apply and explore the basic framework, usage of SDK to build Android applications incorporating Android features in developing mobile applications.
CO3:	Demonstrate proficiency in coding on a mobile programming platform using advanced Android technologies, handle security issues, rich graphics interfaces, using debugging and troubleshooting tools.
CO4:	Create innovative applications, understand the economics and features of the app marketplace by offering the applications for download.

Reference Books	
1	Android Programming, Phillips, Stewart, Hardyand Marsicano, Big Nerd Ranch Guide, 2nd Edition, 2015, ISBN-13 978-0134171494
2	AndroidStudioDevelopmentEssentials-Android6, NeilSmyth,2015, Create space Independent Publishing Platform, ISBN:9781519722089
3	Android Programming–Pushing the limits, EricHellman,2013, Wiley, ISBN-13:978-1118717370
4	Professional Android2ApplicationDevelopment, RetoMeier, Wiley India Pvt. Ltd, 1st Edition, 2012, ISBN-13:9788126525898
5	BeginningAndroid3, Mark Murphy, A press Springer India Pvt Ltd,1st Edition,2011, ISBN-13:978-1-4302-3297-1
6	AndroidDeveloperTraining-https://developers.google.com/training/android/ AndroidTestingSupportLibrary-https://google.github.io/android-testing-support-library/

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
ELEMENTS OF FINANCIAL MANAGEMENT **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**IM266TEQ**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**06 Hrs**
Financial Management-An overview: Financial Decisions in a firm, Goals of a firm, Fundamental principle of finance, Organization of finance function and its relation to other functions, Regulatory framework. **The financial System:** Functions, Assets, Markets, Market returns, Intermediaries, regulatory framework, Growth and trends in Indian financial system.	
Unit – II	**10 Hrs**
Financial statements, Taxes and cash flow: Balance sheet, statement of profit and loss, items in annual report, manipulation of bottom line, Profits vs Cash flows, Taxes. **(Conceptual treatment only)** **Time Value of Money:** Future value of a single amount, future value of an annuity, present value of a single amount, present value of an annuity. **Valuation of securities:** Basic valuation model, bond valuation, equity valuation-dividend capitalization approach and other approaches.	
Unit –III	**10 Hrs**
Risk and Return: Risk and Return of single assets and portfolios, measurement of market risk, relationship between risk and return, implications. **Techniques of Capital Budgeting:** Capital budgeting process, project classification, investment criteria, Net present value, Benefit-Cost ratio, Internal Rate of return, Payback period, Accounting rate of return. **(Conceptual and Numerical treatment)**	
Unit –IV	**10 Hrs**
Long term finance: Sources- Equity capital, Internal accruals, preference capital, term loans, debentures. Raising long term finance- Venture capital, Initial Public Offer, Follow on Public Offer, Rights Issue, Private Placement, Term Loans, Investment Banking **Securities Market:** Primary market vs Secondary market, Trading and Settlements, Stock market quotations and Indices, Govt. securities market, Corporate debt market.	
Unit –V	**09 Hrs**
Working Capital – Policy and Financing: Factors influencing working capital requirements, Current assets financing policy, operating cycle and cash cycle. Accruals, trade credit, banks, public deposits, inter-corporate deposits, short term loans, right debentures, commercial paper, Factoring **(Conceptual treatment only)**	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Explain the features and elements of a financial system.
CO2	Recognize the relevance basic principles of financial management in decision making.
CO3	Describe the processes and techniques of capital budgeting and working capital financing by organizations.
CO4	Demonstrate an understanding of various sources of finance.

Reference Books:	
1.	Fundamentals of Financial Management, Prasanna Chandra, 6th Edition, 2018, McGraw Hill Education(India) Pvt. Ltd, ISBN: 978-93-392-0313-9, 93-392-0313-5
2.	Financial Management ,I M Pandey, 12th edn, 2021, Pearson, ISBN-939057725X, 978-9390577255
3.	Financial Management-Text, Problems and Cases, Khan M Y & Jain P K, 8th Edition, 2018, McGraw Hill Education(India) Pvt. Ltd, ISBN: 9353162181 , 9789353162184
4.	Fundamentals of Financial Management, Eugene F Brigham, Joel F Houston, 8th Edition, 2014, Cengage Learning, ISBN : 9781285065137, 1285065131.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI

OPTIMIZATION TECHNIQUES
Category: INSTITUTIONAL ELECTIVES-I
(Group-E)
(Theory)

Course Code	**:**	**IM266TER**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

UNIT – I **08 Hrs**

Introduction: OR Methodology, Definition of OR, Application of OR to Engineering and Managerial problems, Features of OR models, Limitations of OR.

Linear Programming: Definition, Mathematical Formulation, Standard Form, Solution Space, Types of solution – Feasible, Basic Feasible, Degenerate, Solution through Graphical Method. Problems on Product Mix, Blending, Marketing, Finance, Agriculture and Personnel.

Simplex methods: Variants of Simplex Algorithm – Use of Artificial Variables.

UNIT – II **09 Hrs**

Simplex Algorithm: How to Convert an LP to Standard Form, Preview of the Simplex Algorithm, Direction of Unboundedness, Why Does an LP Have an Optimal basic feasible solution, The Simplex Algorithm, Using the Simplex Algorithm to Solve Minimization Problems, Alternative Optimal Solutions, Degeneracy and the Convergence of the Simplex Algorithm, The Big M Method, The Two-Phase Simplex Method.

UNIT – III **09 Hrs**

Transportation Problem: Formulation of Transportation Model, Basic Feasible Solution using North-West corner, Least Cost, Vogel's Approximation Method, Optimality Methods, Unbalanced Transportation Problem, Degeneracy in Transportation Problems, Variants in Transportation Problems.

Assignment Problem: Formulation of the Assignment problem, solution method of assignment problem-Hungarian Method, Variants in assignment problem, Travelling Salesman Problem (TSP).

UNIT – IV **09 Hrs**

Project Management Using Network Analysis: Network construction, CPM & PERT, Determination of critical path and duration, floats. Crashing of Network. Usage of software tools to demonstrate N/W flow problems

UNIT – V **09 Hrs**

Game Theory: Introduction, Two person Zero Sum game, Pure strategies, Games without saddle point - Arithmetic method, Graphical Method, The rules of dominance

Course Outcomes: After going through this course the student will be able to	
CO1	Understand the characteristics of different types of decision – making environments and the appropriate decision making approaches and tools to be used in each type.
CO2	Build and solve Transportation Models and Assignment Models.
CO3	Design new simple models, like: CPM, PERT to improve decision –making and develop critical thinking and objective analysis of decision problems.
CO4	Implement practical cases, by using TORA, WinQSB, Excel, GAMS.

Reference Books:

1. Operation Research An Introduction, Taha H A, 10th Global Edition, 2017, Pearson Education Limited, ISBN 13: 978-1-292-16554-7
2. Principles of Operations Research – Theory and Practice, Philips, Ravindran and Solberg, 2nd Edition, 2007, John Wiley & Sons (Asia) Pvt Ltd, ISBN 13: 978-8126512560
3. Introduction to Operation Research, Hiller, Liberman, Nag, Basu, 10th Edition, 2017, McGraw Hill Education, ISBN 13: 978-9339221850
4. Operations Research Theory and Application, J K Sharma, 6th Edition, 2009, Trinity Press, ISBN : 978-93-85935-14-5

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
AUTOMOTIVE MECHATRONICS **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**ME266TES**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**03 Hours**

Unit-I	**09 Hrs**
Automobile Engines Classifications of Internal Combustion Engines**.** Engine nomenclature and mechanics. Mixture formation – External, internal, quality and quantity control – homogeneous and stratified injection. Thermodynamic principles of Otto and Diesel cycle. Characteristics – pressure curve and energy yield, engine speed, torque, and power	
Unit-II	**10 Hrs**
Engine Auxiliary Systems: Turbocharger, Intercooler, Exhaust manifold, 3-way catalytic convertor, Exhaust Gas Recirculation system. **Common Rail Fuel Injection system**- Low pressure and high pressure fuel systems, Return line, Quantity control valve and Injectors.	
Unit-III	**10 Hrs**
Vehicular Auxiliary Systems: Vehicle frame and body classification- Hatchback, Sedan, SUV, Coupe, Roadster. Adaptive Brakes - Disc and drum brakes, Antilock Braking Systems, ESP, TCS. Wheels and Tyres- Toe-In, Toe-Out, Caster and Camber angle. Classification of tyres, Radial, Tubeless. **Supplemental Restraint System**: Active and passive safety, Vehicle structure, Gas generator and air bags, Belt Tensioner, Acceleration sensor, Rollover sensor, Seat occupancy recognition.	
Unit-IV	**09 Hrs**
EV Technology: Types of EV's, ICE vs EV torque output, Architecture and Working of EV's. Battery Thermal Management System, Regenerative braking, Safety system and Impacts of EV on the environment.	
Unit-V	**07 Hrs**
Telematics in vehicles – Radio Transmission, Exchange of information, signal path & properties, Concept of radio waves. **Sensors:** Oxygen sensors, Crankshaft/Cam shaft Sensor, Boost Pressure Sensor, Coolant Temperature Sensor, Hot Film Air Mass flow Sensor, Throttle Position Sensor, Rain/Light sensor	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Describe the functions of Mechatronic systems in a modern automobile
CO2:	Evaluate the performance of an engine by its parameters
CO3:	Analyse the automotive exhaust pollutants as per emission norms
CO4:	Demonstrate communication of control modules using a On-Board Diagnostic kit

Reference Books	
1.	Automotive Technology – A systems approach, Jack Erjavec, 5th Edition, Delamr Cengage Learning, ISBN-13: 978-1428311497
2.	Automotive Engineering Fundamentals, Richard Stone and Jeffrey K. Ball, 2004, SAE International, ISBN: 0768009871
3.	Bosch Automotive Handbook, Robert Bosch, 9th Edition, 2004, ISBN: 9780768081527
4.	Understanding Automotive Electronics, William B Ribbens, 5th Edition, Butterworth–Heinemann, ISBN 0-7506-7008-8

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding up to 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: (Internal Choice)	16
5 & 6	Unit 3: (Internal Choice)	16
7 & 8	Unit 4: (Internal Choice)	16
9 & 10	Unit 5: (Internal Choice)	16
	TOTAL	**100**

Semester: VI						
MATHEMATICAL MODELLING **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**MA266TEU**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives: The students will be able to	
1	Understand the basic procedure of mathematical modeling.
2	Use the concepts of continuous and discrete process models to the problems arising in various fields.
3	Apply the concepts of Markov modelling to stochastic problems.
4	Demonstrate demonstrate the practical importance of graph theoretic models, variational problem and dynamic programming.

Unit-I	**09 Hrs**
Introduction to Mathematical Modelling: Basic concepts, steps involved in modelling, classification of models, assorted simple mathematical models from diverse fields.	
Unit – II	**09 Hrs**
Mathematically Modelling Discrete Processes: Difference equations - first and second order, Introduction to Difference equations, Introduction to discrete models-simple examples, Mathematical modelling through difference equations in economics, finance, population dynamics, genetics and other real world problems.	
Unit –III	**09 Hrs**
Markov modelling: Mathematical foundations of Markov chains, application of Markov Modelling to problems.	
Unit –IV	**09 Hrs**
Modelling through graphs: Graph theory concepts, Modelling situations through different types of graphs.	
Unit –V	**09 Hrs**
Variational Problem and Dynamic Programming: Optimization principles and techniques, Mathematical models of variational problem and dynamic programming, Problems with applications.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explore the fundamental concepts of mathematical models arising in various fields engineering.
CO2:	Apply the knowledge and skills of discrete and continuous models to understand various types of analysis.
CO3:	Analyze the appropriate mathematical model to solve the real world problem and to optimize the solution.
CO4:	Distinguish the overall knowledge gained to demonstrate the problems arising in many practical situations.

Reference Books	
1	Mathematical Modeling, J. N. Kapur, 1st Edition, 1998, New Age International, New Delhi, ISBN: 81-224-0006-X.
2	Mathematical Modeling: Models, Analysis and Applications, Sandip Banerjee, 2014, Chapman and Hall/CRC Textbook, ISBN 9781439854518.
3	Case studies in mathematical modeling, D. J. G. James and J. J. Mcdonald, 1981, Stanly Thames, Cheltonham, ISBN: 0470271779, 9780470271773.
4	Modeling with difference equations, D. N. Burghes, M. S. Borrie, Ellis Harwood, 1981, ISBN 13: 9780853122869.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
	COMPONENTS	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
MATHEMATICS FOR QUANTUM COMPUTING **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**MA266TEV**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the basic principles of Quantum Computing.
2	Use the concepts of Quantum gates to build quantum algorithms
3	Apply the Quantum algorithms to solve the problems arising in various fields.
4	Demonstrate the practical importance of Quantum computing.

Unit-I	**09 Hrs**
Introduction to Quantum Computing: Quantum superposition, Qubits, Linear algebra for quantum computing, Inner products and Tensor products of vector spaces, Quantum states in Hilbert space, The Bloch sphere, Generalized measurements, No-cloning theorem.	
Unit – II	**09 Hrs**
Quantum Gates: Universal set of gates, quantum circuits, Dirac formalism, superposition of states, entanglement Bits and Qubits. Qubit operations, Hadamard Gate, CNOT Gate, Phase Gate, Z-Y decomposition, Quantum Circuit Composition, Basic Quantum circuits.	
Unit –III	**09 Hrs**
Quantum Algorithm - I: Deutsch Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazarani Algorithm, Simon periodicity algorithm, Phase estimation algorithm, Quantum Fourier transform.	
Unit –IV	**09 Hrs**
Quantum Algorithm - II: Grover search algorithm, Shor quantum factoring algorithm, Harrow-Hassidim-Lloyd (HHL) algorithm for solving linear system problems.	
Unit –V	**09 Hrs**
Applications of Quantum Computing: Application to: order-finding, discrete logarithm, quantum counting, Boolean satisfiability problems(SAT), graph theory problems.s	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explore the fundamental concepts of quantum computing.
CO2:	Apply the knowledge and skills of quantum computing to understand various types of problems arising in various fields engineering
CO3:	Analyze the appropriate quantum algorithm to solve the real-world problem and to optimize the solution.
CO4:	Distinguish the overall knowledge gained to demonstrate the problems arising in many practical situations.

Reference Books	
1	An introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, 2007, Oxford University press.
2	Quantum Computing for Everyone, Chris Bernhardt, 2020, The MIT Press, Cambridge.
3	Quantum Computation and Quantum Information, M. A. Nielsen & I. Chuang, 2013, Cambridge University Press.
4	Quantum Computing for the quantum curious, Cirian Hughes et. al., 2021, Springer, ISBN 978-3-030-61600-7.
5	Concise guide to quantum computing, Sergei Kurgalin, Sergei Borzunov, 2021, Springer, ISBN 978-3-030-65051-3, ISBN 978-3-030-65052-0 (eBook).

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
	COMPONENTS	**MARKS**
1.	**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.**	**20**
2.	**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.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
APPLIED PSYCHOLOGY FOR ENGINEERS **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**HSS266TEW**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 Hrs**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08 Hrs**
Introduction to Psychology: Definition and goals of Psychology: Role of a Psychologist in the Society: Today's Perspectives (Branches of psychology- Clinical, Industrial). Psychodynamic, Behavioristic, Cognitive, Humanistic, Psychological Research and Methods to study Human Behavior: Experimental, Observation, Questionnaire and Clinical Method.	
Unit – II	**08 Hrs**
Intelligence and Aptitude: Concept and definition of Intelligence and Aptitude, Nature of Intelligence. Theories of Intelligence – Spearman, Thurston, Guilford Vernon. Characteristics of Intelligence tests, Types of tests. Measurement of Intelligence and Aptitude, Concept of IQ, Measurement of Multiple Intelligence – Fluid and Crystallized Intelligence.	
Unit –III	**10 Hrs**
Personality: Concept and definition of personality, Approaches of personality- psychoanalytical, Socio-Cultural, Interpersonal and developmental, Humanistic, Behaviorist, Trait and type approaches. Assessment of Personality: Self- report measures of Personality, Questionnaires, Rating Scales and Projective techniques, its Characteristics, advantages & limitations, examples. Behavioral Assessment.	
Unit –IV	**10 Hrs**
Learning: Definition, Conditioning – Classical Conditioning, Basics of Classical Conditioning (Pavlov), the process of Extinction, Discrimination and Generalization. Operant Conditioning (Skinner expt). The basics of operant conditioning, Schedules of reinforcement. Cognitive – Social approaches to learning – Latent Learning, Observational Learning, Trial and Error Method, Insightful Learning.	
Unit –V	**09 Hrs**
Application of Psychology in Working Environment: The present scenario of information technology, the role of psychologist in the organization, Selection and Training of Psychology Professionals to work in the field of Information Technology. **Psychological Stress**: a. Stress- Definition, Symptoms of Stress, Extreme products of stress v s Burnout, Work Place Trauma. Causes of Stress – Job related causes of stress.Sources of Frustration, Stress and Job Performance, Stress Vulnerability-Stress threshold, perceived control. Type A and Type B.**Psychological Counseling** - Need for Counseling, Types – Directed, Non-Directed, Participative Counseling.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Describe the basic theories, principles, and concepts of applied psychology as they relate to behaviors and mental processes.
CO2	Define learning and compare and contrast the factors that cognitive, behavioral, and Humanistic theorists believe influence the learning process.
CO3	Develop understanding of psychological attributes such as intelligence, aptitude, creativity, resulting in their enhancement and apply effective strategies for self-management and self-improvement.
CO4	Apply the theories into their own and others' lives in order to better understand their personalities and experiences.
CO5	Understand the application of psychology in engineering and technology and develop a route to accomplish goals in their work environment.

Reference Books	
2.	Understanding Psychology Feldman R. S, IV edition, (1996) McGraw Hill India
2.	Psychology Robert A. Baron, III edition (1995) Prentice Hall India.
3.	Organizational Behaviour , Stephen P Robbins Pearson Education Publications, 13th Edition, ISBN – 81-317 – 1132 – 3
4.	Organisational Behaviour : Human Behaviour at Work ,John W.Newstrem and Keith Davis. Tata McGraw Hill India, 10th Edition, ISBN 0-07-046504-5
5	Psychology-themes and variations , Wayne Weiten, IV edition, Brooks / Cole Publishing Co.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

Semester: VI						
Universal Human Values - II **Category: INSTITUTIONAL ELECTIVES-I** **(Group-E)** **(Theory)**						
Course Code	**:**	**HS266TEY**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**10 Hrs**
Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution. The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution are the activities of the Self, Self is central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	
Unit – II	**10 Hrs**
Right Understanding (Knowing)- Knower, Known & the Process. The domain of right understanding starts from understanding the human being (the knower, the experiencer and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	
Unit –III	**08 Hrs**
Understanding Existence (including Nature). A comprehensive understanding (knowledge) about the existence, which certainly includes the Nature. The need and the process of inner evolution (through self-exploration, self-awareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
Unit –IV	**08 Hrs**
Understanding Human Being. Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body, the activities and potentialities of the self, Reasons for harmony/contradiction in the self.	
Unit –V	**08 Hrs**
Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living. Understanding Human Conduct, Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	

Course Outcomes: After completion of the course the students will be able to	
CO1	Understand the basic human aspiration with program of its fulfilment and meaning of resolution in the complete expanse of human living.
CO2	Understand human being in depth and see how self is central to human being
CO3	Understand existence in depth and see how coexistence is central to existence
CO4	Understand human conduct and the holistic way of living leading to human tradition

Reference Books	
1	A foundation course in human values and professional ethics, R. R. Gaur, R Asthana, G P Bagaria, 2nd revised Edition, excel books, New Delhi – 2019, ISN 978-93-87034-47-1
2	Avartansheel Arthshastra, A Nagraj, Divya Path Sansthan, Amarkantak, India, ISBN 978-8-174-46781-2
3	Economy of Performance- a quest for social order based on non – violence, J C Kumarappa, 2010, Sarva-Seva-Sangh-Prakashan, Varanasi, India
4	Energy and Equity, Ivan Illich, 1974, The Trinity Press, Worcester & Harper Collins, USA, ISBN, 0060803274, 9780060803278

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	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
	TOTAL	**100**

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**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.**	**20**
2.	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

Semester VI						
INTERDISCIPLINARY PROJECT						
Course Code	**:**	**CS367P**		**CIE**	**:**	**50Marks**
Credits: L:T:P	**:**	**0:0:3**		**SEE**	**:**	**50Marks**
Total Hours	**:**	**15 P**		**SEE Duration**	**:**	**2Hours**

Major Project Guidelines:

1. The project topic, title and synopsis have to be finalized and submitted to the irrespective internal guide(s) before the beginning of the VI semester.
2. The detailed Synopsis(approved by the department ***Project Review Committee***) has to be submitted during the 1st week after the commencement of VI semester.

Batch Formation:

- Students are free to choose their project partners from any other program.
- Each student in the team must contribute towards the successful completion of the project. The project may be carried out In-house only.
- ***The project work is to be carried out by a team of two to four students.***

Project Topic Selection:

The topics of the project work must be in the ***field of Sustainable Development goals areas or in line with CoE's(Centre of Excellence) identified by the college*** or **List of project are as given by Faculty. The projects as far as possible should have societal relevance with focus on sustainability.**

Project Evaluation:

Continuous monitoring of project work will be carried out and cumulative evaluation will be done.

- The students are required to meet their guides once in a week to report their progress in project work.
- **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Guide regularly.
- For CIE assessment the project groups must give a final presentation with the draft copy of the project report.
- The presentation by each group will be for 20-30 minutes and every member of the team needs to justify the contributions to the project.
- The project team is required to submit Hard copies of the detailed Project Report in the prescribed format to the department.
- For CIE 50% weightage should be given to the project guide and 50% weightage to the project evaluation committee.

Course Outcomes:	
1	Identifying critical thinking and problem-solving abilities by analyzing and addressing interdisciplinary challenges, utilizing creative approaches and innovative solutions.
2	Exhibit proficiency in conducting comprehensive research, including literature review, data collection, modelling, simulation, and analysis, to address significant technical challenges and propose innovative solutions.
3	Demonstrate the ability to do effective teamwork, leadership, project management, and communication skills, while adhering to ethical standards and professional responsibility in delivering the project outcomes within time and budget constraints.
4	Utilize appropriate engineering tools, technologies, and software to design, test, and implement project solutions, ensuring adherence to technical specifications, safety standards, and industry best practices.

CIE Assessment:

The following are the weightings given for the various stages of the project.

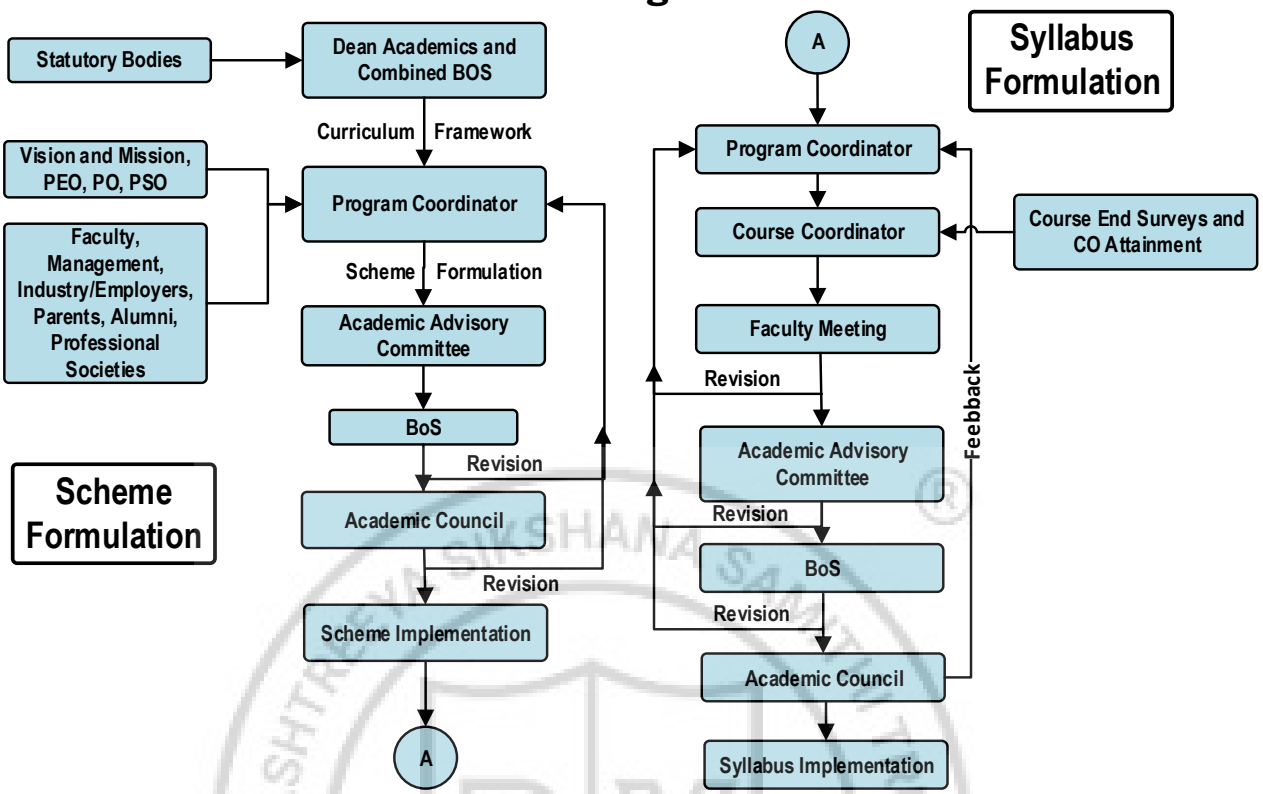
1	Selection of the topic and formulation of objectives	10%
2	Design and Development of Project methodology	25%
3	Execution of Project	25%
4	Presentation, Demonstration and Results Discussion	30%
5	Report Writing & Publication	10%

SEE Assessment:

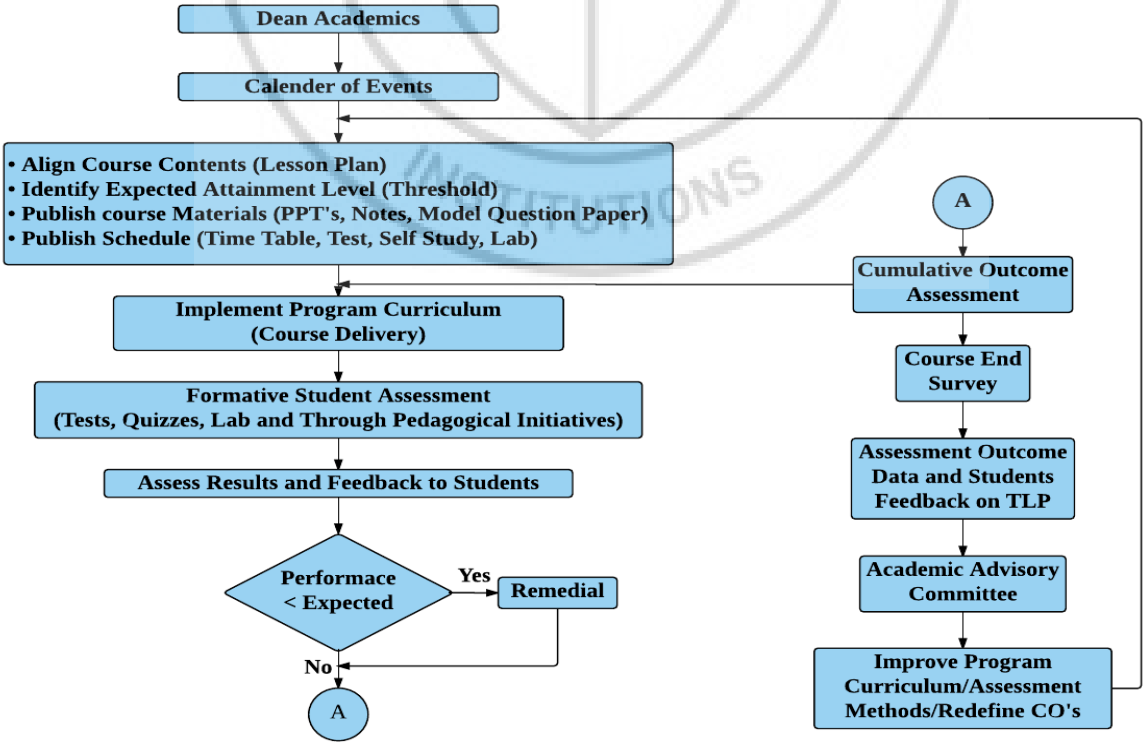
The following are the weightages given during Viva Examination.

1.	Written presentation of synopsis	10%
2.	Presentation/Demonstration of the project	30%
3.	Methodology and Experimental Results & Discussion	30%
4.	Report	10%
5.	Viva Voce	20%

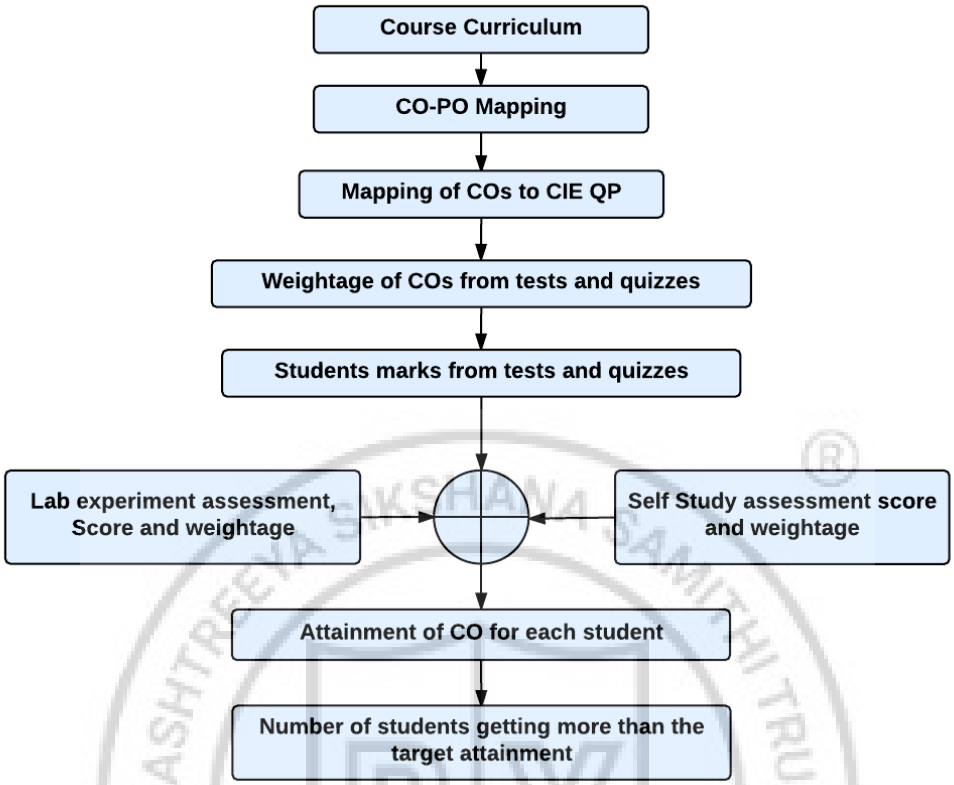
Curriculum Design Process



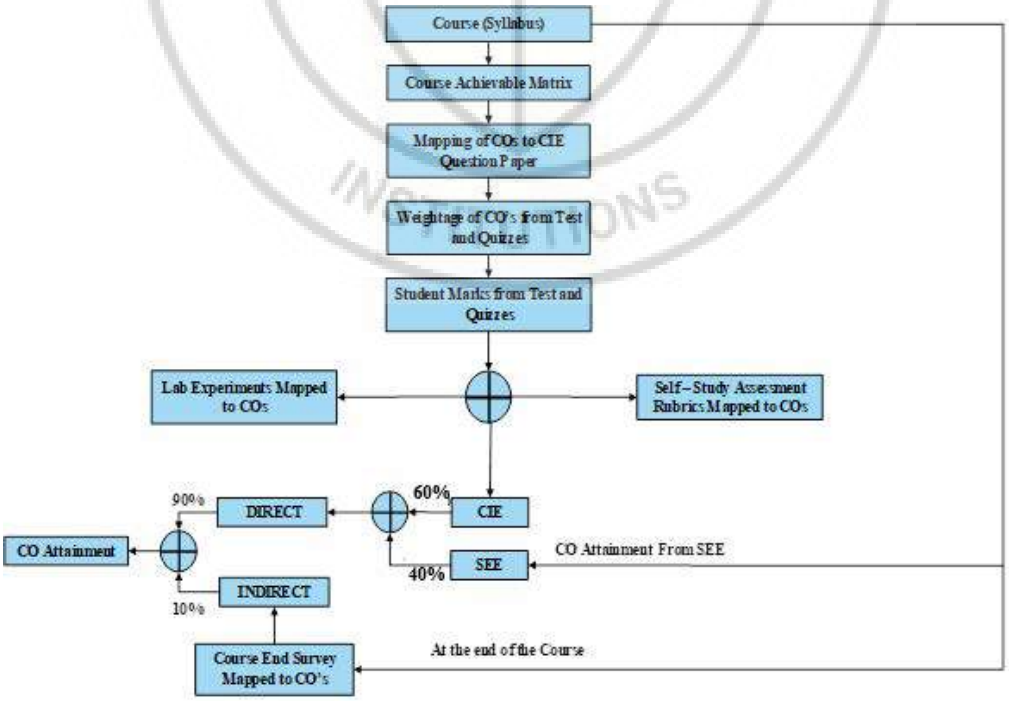
Academic Planning and Implementation



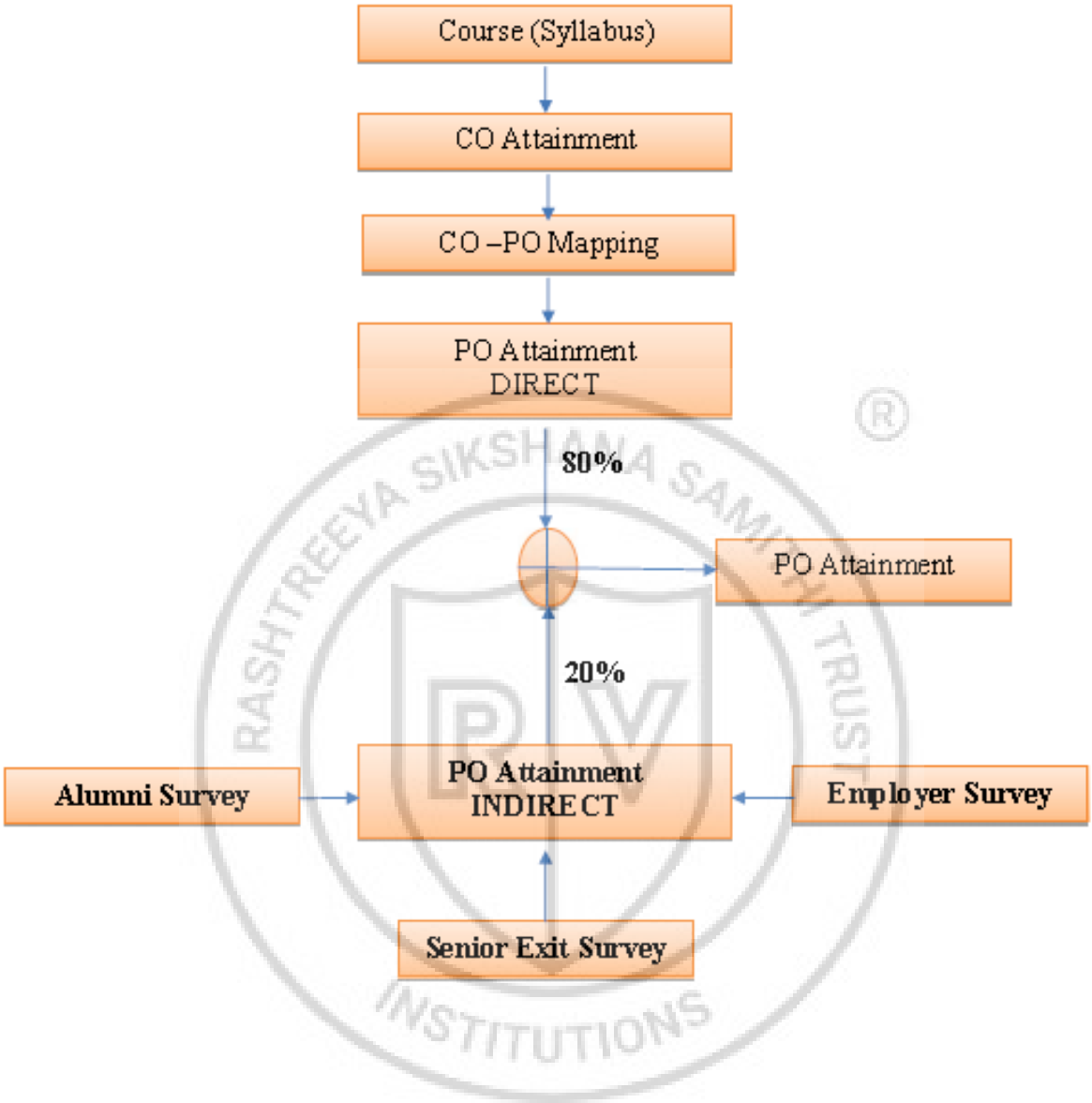
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



KNOWLEDGE & ATTITUDE PROFILE

- **WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- **WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- **WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- **WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- **WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- **WK9:** Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POs)

- **PO1:** Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- **PO2:** Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **PO3:** Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- **PO4:** Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- **PO5:** Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- **PO6**: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- **PO7:** Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- **PO8:** Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **PO9:** Communication: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- **PO10:** Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **PO11:** Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

INNOVATIVE TEAMS OF RVCE

Ashwa Mobility Foundation (AMF): Designs and fabricates Formula-themed race cars and mobility solutions to address urban transportation issues.

Astra Robotics Team: Focuses on designing and building application-specific robots.

Coding Club: Helps students gain coding skills and succeed in competitions like GSoC and ACM-ICPC.

Entrepreneurship Development Cell (E-Cell): Promotes entrepreneurship through workshops, speaker sessions, and mentoring for startups.

Frequency Club Team: Works on software and hardware, emphasizing AI and Machine Learning.

Team Garuda: Develops a supermileage urban concept electric car and E-mobility products.

Team Jatayu: Builds low-cost UAVs with autonomous capabilities for various tasks.

Solar Car Team: Aims to create a solar electric vehicle for sustainable transportation.

Team Antariksh: Focuses on space technology and the development of operational rockets.

Team Chimera: Builds a Formula Electric Car through R&D in E-Mobility.

Helios Racing Team: Designs and tests All-Terrain Vehicles, participating in SAE's BAJA competitions.

Team Hydra: Develops autonomous underwater vehicles for tasks like water purification.

Team Krushi: Creates low-cost farming equipment to assist farmers in cultivation and harvesting.

Team Vyoma: Designs and tests radio-controlled aircraft and UAVs.

Team Dhruva: Engages in astronomy-related activities and collaborates on projects with organizations like ICTS and IIA.

Ham Club: Promotes Amateur Radio and explores technical innovations in communications, especially for disaster response.

Cultural Activity Teams

1. AALAP (Music club)
2. DEBSOC (Debating society)
3. CARV (Dramatics club)
4. FOOTPRINTS (Dance club)
5. QUIZCORP (Quizzing society)
6. ROTARACT (Social welfare club)
7. RAAG (Youth club)
8. EVOKE (Fashion team)
9. f/6.3 (Photography club)
10. CARV ACCESS (Film-making

NSS of RVCE

NCC of RVCE

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

- To deliver outcome based Quality education, emphasizing on experientiallearning with the state of the art infrastructure.
- To create a conducive environment for interdisciplinary research and innovation.
- To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
- To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
- To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation