Computer Science & Engineering [Data Science]

SIXTH SEMESTER									Max Marks CIE		SEE Duration (H)	Max Marks SEE	
Slo. No.	**BoS**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Category**	**Theory**	**Lab**	**Hours**	**Theory**	**Lab**
1	HS	HS361TA	Entrepreneurship and Intellectual Property Rights	3	0	0	3	Theory	**100**	***	**3**	**100**	***
2	CD	CD362IA	Big Data Systems (Theory & Practice)	3	0	1	4	Theory + Practice	**100**	**50**	**3**	**100**	**50**
3	CD	CD363IA	Data Analytics & Visualization Systems (Theory & Practice)	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	CD	XX365TDX	Professional Core Elective-III **(Group- D)**	3	0	0	3	Theory	**100**	***	**3**	**100**	***
6	XX	XX366TEX	Institutional Electives – I **(Group E)**	3	0	0	3	Theory	**100**	***	**3**	**100**	***
7	CD	CD367P	Interdisciplinary Project	0	0	3	3	Project	***	**100**	**3**	***	**100**
			Total				**24**						

Group D: Professional Elective – III Courses				
Sl. No.	**BoS**	**Course Code**	**Course Title**	**Credits**
5	CS	CS365TDA	Computer Vision (Common to CS & CD)	3
	CD	CD365TDB	Semantic Web and Social Network Analysis	3
	CD	CD365TDC	Deep Learning (Common to CD & CY)	3
	AI	AI365TDD	Generative Artificial Intelligence (Common to AI, CS, CD & IS)	3
	CD	CD365TDE	Data Security and Privacy	3

Group E: Institutional Electives-I Courses				
Sl. No.	**BoS**	**Course Code**	**Course Title**	**Credits**
6	AS	AS266TEA	Fundamentals of Aerospace Engineering	3
	BT	BT266TEB	Healthcare Analytics	3
	CH	CH266TEC	Industrial Safety Engineering	3
	CS	CS266TED	Robotics Process Automation	3
	CV	CV266TEE	Intelligent Transport Systems	3
	CV	CV266TEF	Integrated Health Monitoring of Structures	3
	CM	CM266TEG	Advanced Energy Storage for E-Mobility	3
	EC	EC266TEH	Human Machine Interface(HMI)	3
	EE	EE266TEJ	Energy Auditing and Standards	3
	EI	EI266TEK	Biomedical Instrumentation	3
	ET	ET266TEM	Telecommunication Systems	3
	ET	ET266TEN	Mobile Communication Networks and Standards	3
	IS	IS266TEO	Mobile Application Development	3
	IM	IM266TEQ	Elements of Financial Management	3
	IM	IM266TER	Optimization Techniques	3
	ME	ME266TES	Automotive Mechatronics	3
	MA	MA266TEU	Mathematical Modelling	3
	MA	MA266TEV	Mathematics of Quantum Computing	3
	HS	HS266TEW	Applied Psychology for Engineers	3
	HS	HS266TEY	Universal Human Values	3

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 going through this course, the student will be able to	
CO1	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.
CO2	Comprehend the process of opportunity identification of market potential and customers while developing a compelling value proposition solutions.
CO3	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.
CO4	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 attr act stakeholders
CO5	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. **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**)** **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 COURSE** **(Theory and Practice)**						
Course Code	**:**	**CD362IA**		**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**
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

LABORATORY COMPONENT

PART – A

1.
   a. Exercises on Distributed Systems – Hadoop;
   b. Exercises using Map-reduce model: Map only and reduce only jobs, Standard patterns in map reduce models.
2.
   a. Exercises on NoSQL;
   b. Exercises on NoSQL database – Simple CRUD operations and Failure / Consistency tests;
   c. Exercises to implement a Web based application that uses NoSQL databases
3.
   a. Exercises with Pig queries to perform Map-reduce job and understand how to build queries and underlying principles;
   b. Exercises on creating Hive databases and operations on Hive, exploring built in functions, partitioning, data analysis
4.
   a. Exercises on Spark to demonstrate RDD, and operations such as Map, FlatMap, Filter, PairRDD;
   b. Typical Spark Programming idioms such as : Selecting Top N, Sorting, and Joins;
   c. Exercises on Spark SQL and DataFrames
5. Exercises using Spark MLLib: Regression, Classification, Collaborative Filtering, Clustering
6. Exercises on Analytics on the Cloud – using AWS, AWS Map-Reduce, AWS data stores/databases.

PART – B
Open Ended Project

Students are required to implement a mini project using Big Data Tools and Technologies to solve real-world problems. This project aims to provide students with practical experience in applying their knowledge of big data concepts to address challenges encountered in various domains.

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 (20 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50 MARKS	**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						
DATA ANALYTICS & VISUALIZATION **Category: PROFESSIONAL CORE COURSE** **(Theory and Practice)**						
Course Code	**:**	**CD363IA**		**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	**9Hrs**
Introduction to Data Science Data science, Terminology associated with Data Science, Types of Data, Data Science workflow, Popular data science toolkits, Automated methods for Data collection. **Introduction to Data visualisation** Data visualisation, importance of data visualisation, conventional data visualisation methods	
Unit – II	**9Hrs**
Data Collection Collecting the data: Hunting, scrapping, logging Cleaning Data: Error vs Artifacts, Data Compatibility, Dealing with missing values, outlier detection Crowdsourcing: Mechanisms for aggregation, crowdsourcing services, gamification	
Unit –III	**9Hrs**
Data Analysis Introduction to applied statistical techniques, types of the statistical data, types of the bigdata analytics, collecting the data for sampling and distribution, probability, frequency distribution, population and parameters, problems of estimation. Exploratory Data analysis	
Unit –IV	**9Hrs**
Visualising Data Developing a Visualization Aesthetic: Maximising the Data - lnk ratio, Maximising the Lie factor, minimising the chart junk, scaling and labelling Chart Types: Tabular data, dot and line plots, scatter plots, Bar plots and pie charts, Histograms and Data maps Great visualisations, Interactive visualisation	
Unit –V	**09 Hrs**
Data Modelling Philosophies of modelling, A taxonmy of models Baseline models: Baseline models for classification, Baseline models for value prediction Evaluating Models: Evaluating classifiers, receiver -operator characteristic curves, evaluating multi class systems, evaluating value prediction models Evaluation environments, simulation models	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	To demonstrate various techniques for automatic data collection, data cleaning and exploration using visualizations.
CO 2	To implement data collection, data cleaning and exploration techniques in a programming language.
CO 3	To Understand and apply modelling and analysis techniques for various types of datasets including e-commerce transactions, review datasets, time series datasets, text documents etc.
CO 4	To Select methods and create effective visualizations to explain the artifacts in the data, distributions of attributes, relationships between the attributes, efficacy of the models and predictions generated by it.
CO 5	Evaluate different models and their strengths and weakness for a given dataset and task.

Reference Books	
1.	Skiena, Steven S, The Data Science Design Manual, Published by Springer Nature 2017
2.	V.K Jain, Data Science and Analytics (with python, R and SPSS programming), Khanna Book Publishing Company.
3.	Matthew O.Ward , Georges Grinstein, Daniel Keim, "Interactive Data Visualisation : Foundations, Techniques And applications " , 2nd Edition , CRC Press, 2015

LABORATORY COMPONENT

PART A
Implement the following programs using Tableau / R programming

1. Learn how to collect data via web-scraping, APIs and data connectors from suitable sources as specified by the instructor.
2. Perform various types of data cleaning operations on the data collected in previous lab using data exploration, imputation etc.
3. Perform dimensionality reduction on a given dataset and create various visualizations like histograms, scatter-plots, etc.
4. Perform association analysis on a given dataset and evaluate its accuracy.
5. Build a recommendation system on a given dataset and evaluate its accuracy.
6. Build a time-series model on a given dataset and evaluate its accuracy.
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform text mining on a set of documents and visualise the most important words in visualisation such as word cloud.

RUBRIC FOR 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 (20 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50 MARKS	**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 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						
SEMANTIC WEB AND SOCIAL NETWORK ANALYSIS **Category: PROFESSIONAL CORE ELECTIVE-III** **(Group-D)** **(Theory)**						
Course Code	**:**	**CD365TDB**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction Introduction to the Semantic Web and Social Networks: The Semantic Web- Limitations of the current Web, The semantic solution, Development of the Semantic Web, The emergence of the social web. **Social Network Analysis** What is network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis.	
Unit – II	**09 Hrs**
Electronic sources for network analysis Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis. **Knowledge Representation on the Semantic Web** Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web(RDF, OWL).	
Unit –III	**09 Hrs**
Modelling and aggregating social network data State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations. **Developing social-semantic applications:** Building Semantic Web applications with social network features, Flink: the social networks of the Semantic Web community, open academia: distributed, semantic-based publication management	
Unit –IV	**09 Hrs**
Evaluation of web-based social networ extraction and Ontologies are us Differences between survey methods and electronic data extraction, Context of the empirical study, Data collection, Preparing the data, Optimizing goodness of fit, Comparison across methods and networks, Predicting the goodness of fit, Evaluation through analysis. Ontologies are us: A tripartite model of ontologies, Case studies, Evaluation.	
Unit –V	**09 Hrs**
Predicting Human Behavior And Privacy Issues Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences. Security and Privacy in Online Social Networks Introduction, Security Objectives: Privacy, Integrity, and Availability	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Analyze and understand the basics of Semantic Web and Social Networks.
CO 2	Ability to represent knowledge using ontology and Electronic sources for network analysis
CO 3	Modeling and aggregating social network data.
CO 4	Develop social-semantic applications and visualise
CO 5	Evaluate Web- based social network and Ontology

Reference Books	
1.	Social Networks and the Semantic Web, Peter Mika, Springer, 2007
2.	Borko Furht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3.	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group)
4.	Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.

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						
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 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						
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.

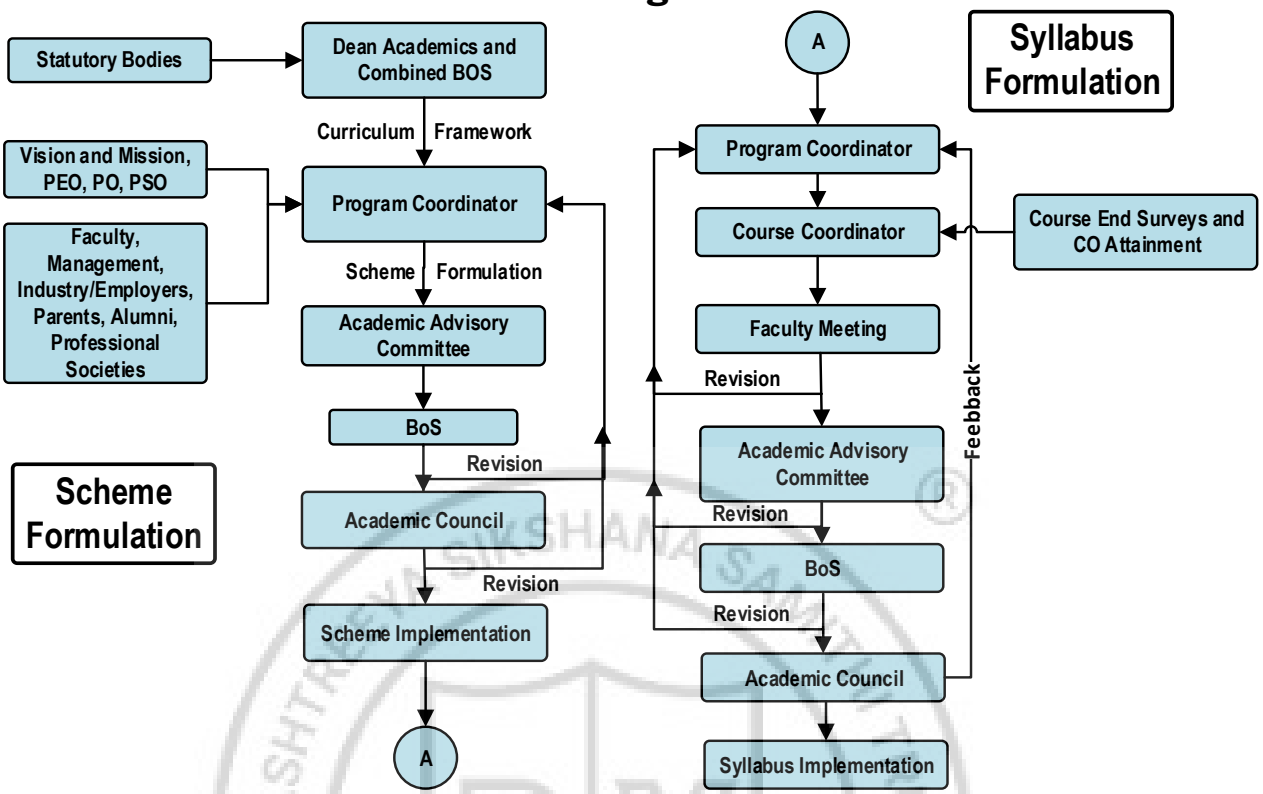
1.	Selection of the topic and formulation of objectives	10%
2.	Design and Development of Project methodology	25%
3.	Execution of Project	25%
4.	Presentation, Demonstration and Results Discussion	30%
5.	Report Writing & Publication	10%

SEE Assessment:

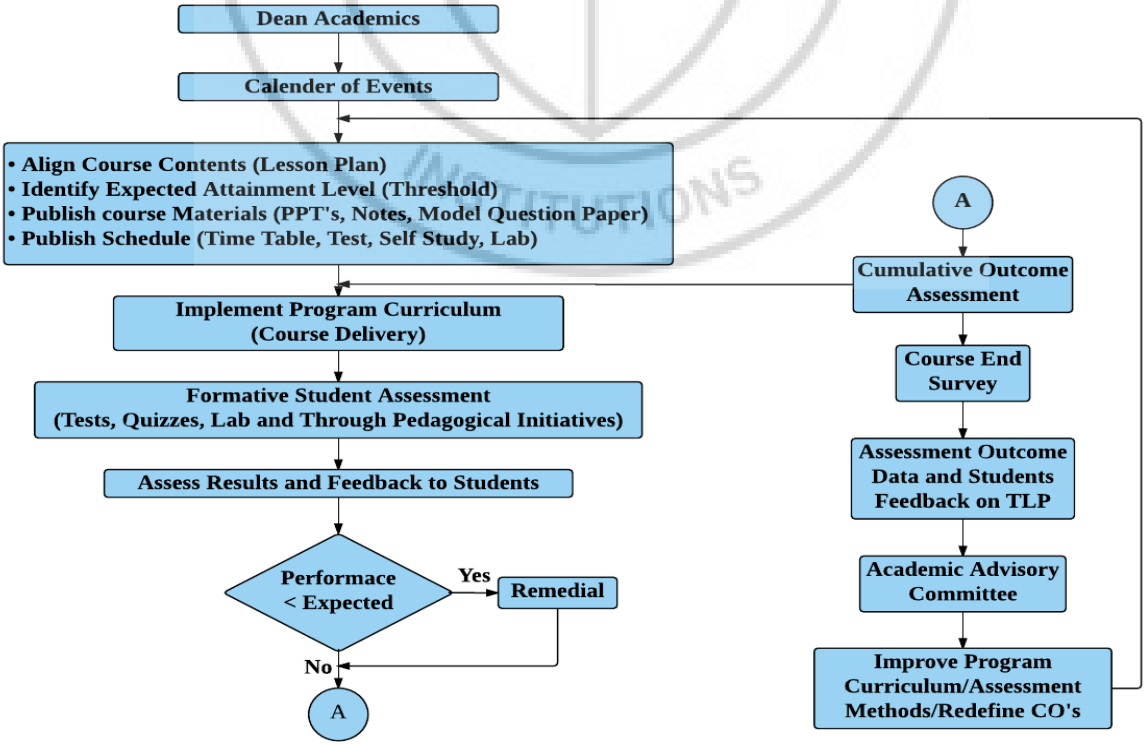
The following are the weightages given during Viva Examination.

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%

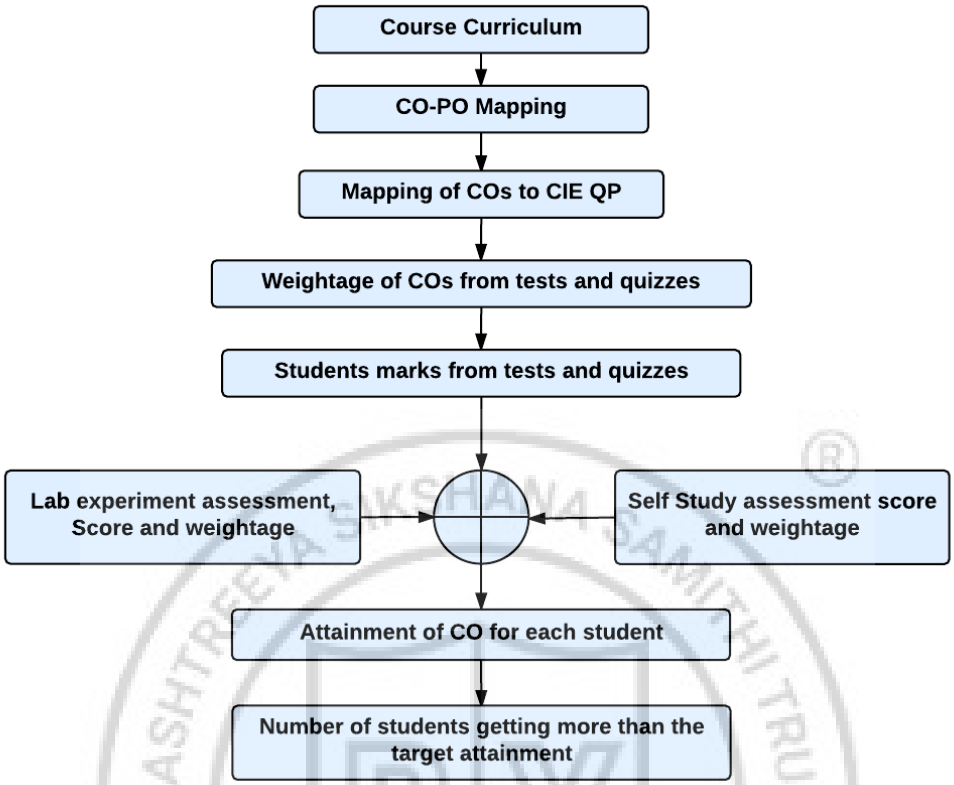
Curriculum Design Process



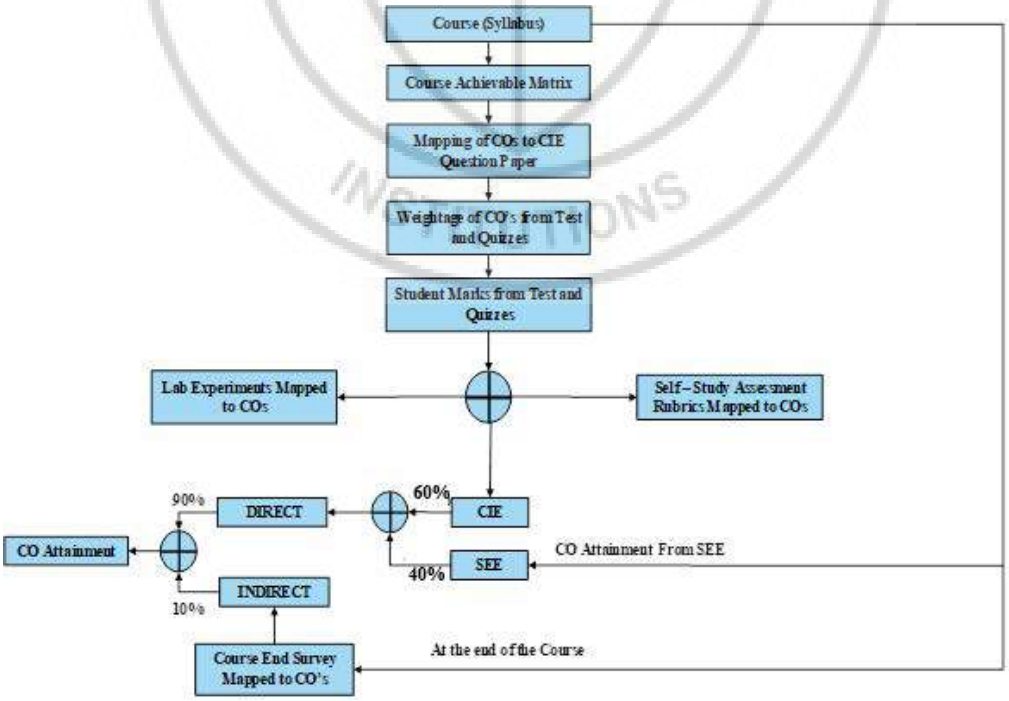
Academic Planning and Implementation



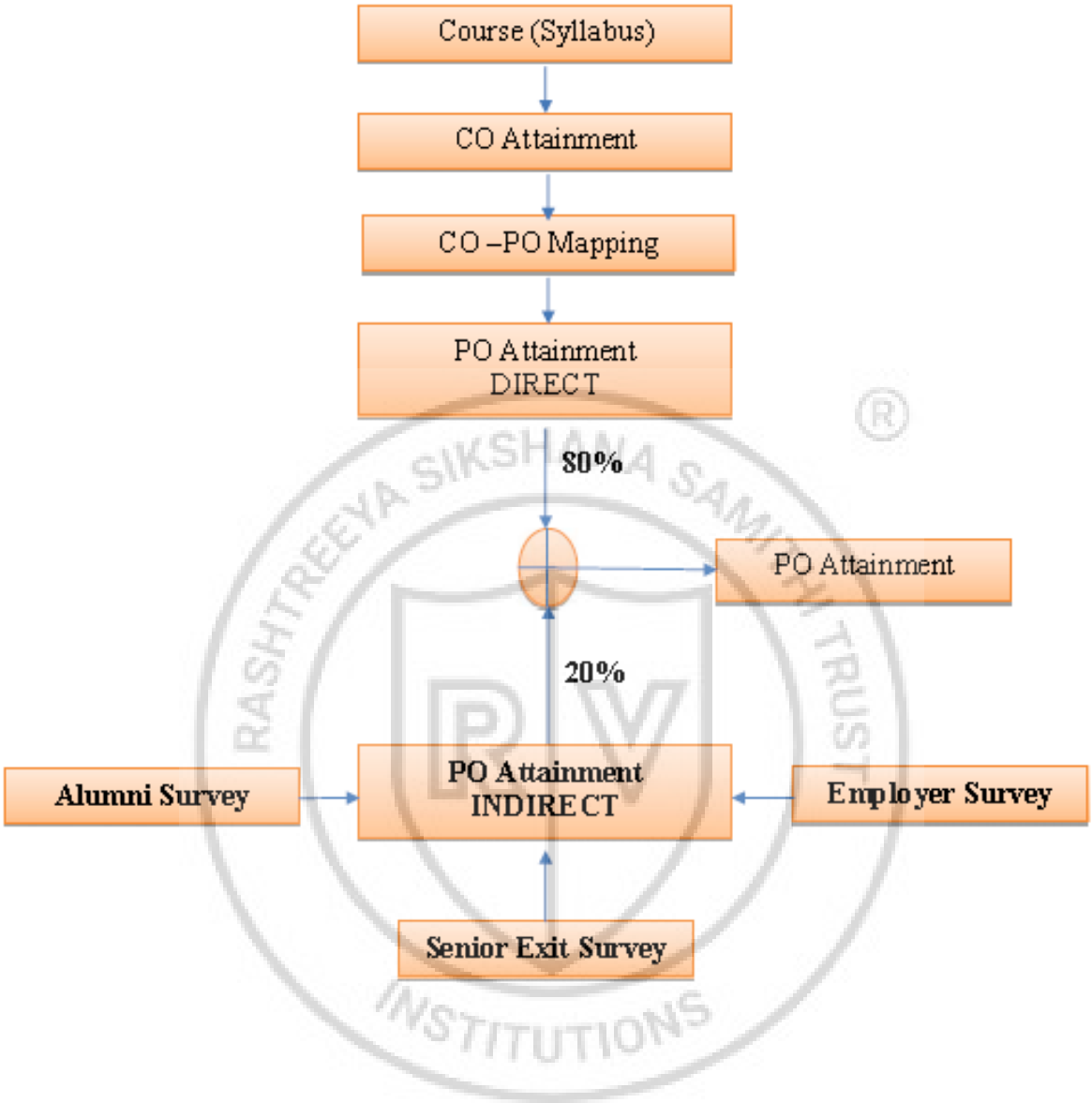
Process For Course Outcome Attainment



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