



RV College of
Engineering®



Computer Science & Engineering

(Cyber Security)

Bachelor of Engineering (B.E)

Scheme And Syllabus Of VII & VIII Semester
(2022 Scheme)

B.E. Programs : AI, AS, BT, CD, CH, CS, CV, CY, EC, EE, EI, 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

2025



RV College of Engineering®

SINCE 1963

SHAPING VISIONARIES, CRAFTING INNOVATORS



NAAC GRADE **A+**
ACCREDITED INSTITUTION

An autonomous institution affiliated with VTU, Belagavi, and approved by AICTE and UGC, New Delhi

- **RV SATELLITE-1 (RVSAT - 1)** India's First Microbiological Payload, launched by RVCE students in December 2024
- **NCC - Best Institution Award** of Karnataka and Goa Directorate (2019, 2022, 2023 & 2025)

₹50 Cr.

MoU with **TATA Technologies** to establish Centre for Invention, Innovation, Incubation & Training

Placements

₹92 LPA
Highest Package

250+
Recruitment Partners

92%
Placement Rate

₹10 LPA
Median Salary

Rankings

99th
NIRF Ranking 2024 in Engineering Category

1501+
Times Higher Education World University Rankings-2025

601+
Times Higher Education Asia University Rankings-2025

NBA
UG and PG programs accredited multiple times

IIRF 2025
Engineering ranking India National - 01
State - 01
Zone - 01

NPTEL
Local Chapter Ranking 2025 National - 09
State - 01

Research and Centres

37 Skill Labs

General Skills, Domain Skills, Interdisciplinary Skills

- Bosch Rexroth
- Mercedes Benz
- Morris Garage
- Boston AI System
- Toyota Kirloskar
- Vision Astra EV Academy

Outcome Based Education (OBE) emphasizing on experiential learning, research-based learning and skill-based learning

20

Centres of Excellence

8

Centres of Competence

16 Research Centres in niche areas

- Autonomous Vehicles
- Nanomaterials and Devices
- Hydrogen and Green Technology
- Extended Reality
- Healthcare
- E-mobility
- IoT and Sensors
- Smart Antenna System
- Computational Genomics
- Quantum Computing

80

Patents filed

65

Patents published

46

Patents granted

32

Innovative & Cultural activity teams

₹30 Cr.

Research and projects consultancy (last 5 years)

Programs and Faculty

- 13 UG Programs; 1420 (2025) annual sanctioned intake
- 13 PG Programs 390 (2025) annual sanctioned intake
- Ph.D. Programs in all departments
- 500+ Faculty Members and Staff

CET / KEA Code: **E005**
COMED-K Code: **E095**

PGCET Code (MTech): **T857**
PGCET Code (MCA): **C463**

State-of-the-Art infrastructure

- Innovation Center
- Gymnasium
- Hostels
- Labs & Workshops

Alumni

36,000 +

Alumni across the globe

100+

RVCE alumni in civil service

RVCE Reconnect - USA edition, our first International Alumni Meet

NUMBER OF ATTENDEES

650
San Jose

120
Seattle

Mr. Suresh Katta, RVCE alumnus & Chairman Emeritus of Saama Group, USA and Mr. Anil Kumble, RVCE alumnus & former Indian cricketer, were the Guests of Honour at the alumni meets held in San Jose & Seattle, USA.

Collaborations with International universities

125 MoUs with Industry, Institutions & Research Establishments



RV College of Engineering®

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2025

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING CSE-CY

DEPARTMENT VISION

To achieve leadership in the field of Computer Science & Engineering by strengthening fundamentals and 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 take up higher education in pursuit of lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	<p>System Analysis and Design</p> <p>The student will be able to:</p> <ol style="list-style-type: none">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	<p>Product Development</p> <p>The student will be able to:</p> <ol style="list-style-type: none">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.

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.	CM	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
24.	CD	Computer Science & Engineering(Data Science)
25.	CY	Computer Science & Engineering(Cyber Security)
26.	CI	Computer Science & Engineering(Artificial Intelligence & Machine Learning)

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VII Semester			
Sl. No.	Course Code	Course Title	Page No.
1.	HS271TA	Indian Knowledge System	1
2.	CY372IA	Cloud Security	3
3.	CY373TA	Cyber Forensics and Incident Response	6
4.	CY374TFX	Professional Core Elective-IV (Group-F)	9
5.	375TGX	Institutional Electives – II (Group G)	19
6.	CY376SI	Summer Internship	75
VIII Semester			
1.	CY481P	Major Project	77



Bachelor of Engineering in COMPUTER SCIENCE AND ENGINEERING [Cyber Security] VII SEMESTER													
Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total			Theory	Lab		Theory	Lab
1	HS271TA	Indian Knowledge System	3	0	0	3	HS	Theory	100	****	3	100	****
2	CY372IA	Cloud Security	3	0	1	4	CY	Theory + Practice	100	50	3	100	50
3	CY373TA	Cyber Forensics and Incident Response	3	1	0	4	CY	Theory	100	****	3	100	****
4	CY374TFX	Professional Core Elective-IV Group-F	3	0	0	3	CY	Theory	100	****	3	100	****
5	XX375TGX	Institutional Electives – II (Group G)	3	0	0	3	XX	Theory	100	****	3	100	****
6	CY376SI	Summer Internship	0	0	3	3	CY	Internship	****	100	3	****	100
Total			15	0	5	20							

Note: * Internship (8 weeks) is to be carried during the vacation after 6th semester and evaluation shall be conducted during 7th semester for 3 credits

VIII SEMESTER													
Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total			Theory	Lab		Theory	Lab
1	CY481P	Major Project	0	0	12	12	CY	Project	****	100	3	****	100
Total						12							



Group F: Professional Core Elective – IV Courses				
Sl. No.	BoS	Course Code	Course Title	Credits
5	CY	CY374TFA	Threat Intelligence	3
	CY	CY374TFB	Adversarial AI	3
	AI	AI374TFC	Ethical Artificial Intelligence	3
	CY	CY374TFD	Scalable and Secure Distributed Ledger Technologies	3

Institutional ELECTIVES- II (GROUP I)

Sl. No.	Course Code	Course Title	Credits
1	AI375TGA	Data and Story Telling	3
2	AS375TGB	Aircraft Systems	3
3	BT375TGC	Health Care Technology for Engineers	3
4	CH375TGD	Green and Hydrogen Technology	3
5	CM375TGE	Chemistry of materials and molecular analysis	3
6	CS375TGF	Prompt Engineering	3
7	CV375TGG	Solid Waste Management and Statutory rules	3
8	CV375TGH	Freight Transportation Systems and Logistics	3
9	EC375TGI	IoT for smart systems	3
10	EE375TGJ	E Mobility	3
11	EI375TGK	Disease and Diagnostics an Engineering Perspective	3
12	ET375TGL	Space Technology and Applications	3
13	IM375TGM	Project Management	3
14	IM375TGN	Global Supply chain management	3
15	MA375TGO	Statistical methods for engineers	3
16	ME375TGP	Industry 5.0	3
17	PY375TGQ	Principles of Astrophysics	3
18	MA375TGR	Mathematics of Music	3
19	HS375TGS	Cognitive Psychology	3
20	HS375TGT	Principles & Practices of Cyber Law	3



Semester: VII			
INDIAN KNOWLEDGE SYSTEM			
Common Course			
Theory			
Course Code	:	HS271TA	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	45 Hrs	SEE Duration : 3 Hours
Unit-I			09 Hrs
Introduction of Indian Knowledge Systems (IKS): Perception and prologue, Historicity of IKS, Indian Traditional Knowledge, Nature and scope, kinds of traditional knowledge, Transition from traditional to western knowledge. The IKS Corpus, Vedic Corpus, Indian Philosophical Systems.			
Unit – II			09 Hrs
Foundational Concepts of Mathematics and Science & Technology: Linguistics; Pānini’s work on Sanskrit Grammar, Phonetics, Ashtadhyayi’s vyakarana. Number System and Units of Measurement: concept of zero, Piṅgala and the Binary system. Knowledge: Framework & Classifications: Prameya, Pramana, Samsaya.			
Unit –III			09 Hrs
Science, Engineering & Technology in IKS: Mathematics; Arithmetic, geometry, trigonometry and algebra, Chanda Sastra of Pingala. Astronomy: Elements of the Indian Calendar, Āryabhaṭīya and the Siddhāntic Tradition, Panchanga, Astronomical Instruments (Yantras) and Jyotish. Engineering & Technology: Metals & Metal Working; Wootz Steel, Iron and Steel in India, Metals and Metal working Technology, Lost-wax casting of idols and artefacts, Dyes and Painting Technology, The art of making perfumes.			
Unit –IV			09 Hrs
Yoga and Ayurveda: Tridoṣas, Trigūṇa System, Body-Mind-Intellect-Consciousness Complex, Sixty-four art forms and occupational skills (64 Kalas). Irrigation Systems and Water management Practices Town Planning & Architecture: Indian Architecture in India, Vāstu Śāstra; Eight limbs of Vāstu, Town Planning; Temple Architecture			
Unit –V			09 Hrs
Governance, Public Administration & Management: Rāmāyaṇa on great attributes, Arthaśāstra – Governance & Administration, Janapada, Durga, Kosa, Danda, Mitra. IKS & United Nations Sustainable development goals. Safeguarding traditional Indian Knowledge.			

Course Outcomes: After completing the course, the students will be able to:-	
CO1	<i>Explain</i> the nature, scope, and historical development of Indian Knowledge Systems and <i>differentiate</i> traditional knowledge from modern scientific paradigms
CO2	<i>Analyze</i> the foundational concepts of Indian contributions to linguistics, mathematics, and science, including works of Pānini, Piṅgala and others
CO3	<i>Evaluate</i> the applications of traditional Indian technologies in areas such as astronomy, metallurgy, architecture, and medicine.
CO4	<i>Assess</i> the relevance of Indian Knowledge Systems in the context of sustainable development goals and <i>propose</i> methods to safeguard and integrate IKS in contemporary society

Reference Books	
1.	Introduction to Indian Knowledge System Concepts & Applications, B Mahadevan, Vinayaka Rajat Bhat, R N Nagendra Pavana, PHI Learning publishers, ISBN-13: 978-9391818203
2.	Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230
3.	Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,
Suggested Web Links:	
1.	https://www.youtube.com/watch?v=LZP1StpYEPM



2.	http://nptel.ac.in/courses/121106003/
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EA1aIQobChMIInp-Jtb_p8gIVTeN3Ch27LAmPEAAAYASAAEgIm1vD_BwE

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: VII						
CLOUD SECURITY						
(Core)						
Course Code	:	CY372IA		CIE	:	100+50 Marks
Credits: L:T:P	:	3:0:1		SEE	:	100+50 Marks
Total Hours	:	45L+30P		SEE Duration	:	03 + 03 Hours

Unit-I	9 Hrs
Cloud Computing Concepts and Introduction to Cloud Security: Fundamentals of Cloud Computing and Cloud Architecture, Service Models (IaaS, PaaS, SaaS) and Deployment Models (Public, Private, Hybrid), Shared Responsibility Model, Cloud Threat Landscape and Challenges, Security Responsibilities of Cloud Providers and Clients.	
Unit – II	9Hrs
Platform, Infrastructure, and Data Security in Cloud: Platform and Infrastructure Security (AWS, Azure, GCP), Cloud Networking and VPC Security, Storage Security (Encryption at Rest and In Transit), Data Security, Secure Key Management (KMS services).	
Unit –III	9Hrs
Cloud Application Security and DevSecOps: Secure Application Development in Cloud (Secure SDLC in Cloud), API Security and Secure CI/CD Pipelines, Identity and Access Management (IAM) across AWS, Azure, and GCP, Cloud-native Security Services (WAF, Shield, Security Centres).	
Unit –IV	9 Hrs
Cloud Operations, Incident Response, and Forensics: Security Operations in Cloud Environments, Cloud Logging, Monitoring, and Threat Detection, Incident Response Planning and Automation (SOAR), Digital Forensics in Cloud (AWS, Azure, GCP)	
Unit –V	9 Hrs
Governance, Risk, Compliance, and Business Continuity: Cloud Risk Management and Governance Frameworks, Cloud Compliance Standards (ISO, GDPR, HIPAA), Business Continuity Planning (BCP) and Disaster Recovery (DR) in Cloud, Penetration Testing Methodology for Cloud	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate understanding of cloud computing principles, architectures, and cloud-specific security challenges.
CO2:	Apply techniques to secure cloud infrastructure, applications, and data across multi-cloud environments (AWS, Azure, GCP).
CO3:	Implement security monitoring, incident response, and forensic investigation techniques in cloud environments.
CO4:	Analyse governance, compliance requirements, and develop business continuity and disaster recovery strategies for cloud environments.



Reference Books	
1	EC-Council. (n.d.). <i>Certified Cloud Security Engineer (C/CSE) - The Most Comprehensive Cloud Security Certification Program</i> . EC-Council. Retrieved May 5, 2025, from https://cert.eccouncil.org/certified-cloud-security-engineer.html .
2	Dotson, C. <i>Practical Cloud Security: A Guide for Secure Design and Deployment</i> . O'Reilly Media, 2023. ISBN 978-1-098-12042-5.
3	Krutz, Ronald L., and Russell Dean Vines. <i>Cloud Security: A Comprehensive Guide to Secure Cloud Computing</i> . Wiley, 2010, ISBN: 978-0-470-93894-2
4	Vora, Zeal. <i>Enterprise Cloud Security and Governance</i> . Packt Publishing, 2017, ISBN: 9781788299558
5	Cloud Security Alliance. <i>Certificate of Cloud Security Knowledge (CCSK) v5 Official Study Guide</i> . Cloud Security Alliance, 2020.
6	Pritchard, A., and A. Croft. <i>Thunder CTF: Learning Cloud Security on a Dime</i> . O'Reilly Media, 2020, https://www.oreilly.com/library/view/thunder-ctf/9781492083089/ .

LABORATORY COMPONENT	
<p>Part A — Lab Programs (Structured Labs): Based on following topics</p> <ol style="list-style-type: none">1. Secure Cloud Deployment with IAM and Networking2. Data Encryption in Cloud Storage3. Cloud Monitoring and Logging4. Secure Application Deployment and API Gateway Protection5. Incident Detection and Response Simulation6. Implementing Backup and Disaster Recovery7. Penetration Testing on Cloud Resources <p>Part B — Open-ended Mini Project</p> <p>Guidelines:</p> <p>Choose two or more cloud platforms (AWS + Azure, or AWS + GCP)</p> <p>Design a basic infrastructure (e.g., website + database + backup)</p> <p>Apply multi-layer security:</p> <ul style="list-style-type: none">• IAM• Network segmentation• Encryption• Monitoring <p>Setup incident detection and simulate a recovery plan</p> <p>Prepare a security architecture diagram and a brief report highlighting:</p> <ul style="list-style-type: none">• Threat modeling• Security tools used• Compliance considerations	



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 SEMESTER END EXAMINATION (LAB)		
Q.NO.	CONTENTS	MARKS
Student is required to perform Computer Simulation/ Develop a prototype or model as the case may be and present the results in the form of a presentation. Further, students have to submit a poster for exhibition and also a report.		
1	Design and development of the project	20
2	Presentation of the working model/simulation results/prototype building	20
3	Viva Voce	10
TOTAL		50



Semester: VII					
Cyber Forensics and Incident Response					
Course Code	:	CY373IA	CIE	:	100 Marks
Credits: L:T:P	:	3:1:0	SEE	:	100 Marks
Total Hours	:	45L	SEE	:	03 Hours
			Duration		

Unit-I	9Hrs
Introduction to Cyber Forensics: Fundamentals of Computer Forensics, Cybercrime and Digital Evidence, Investigation Procedures and Forensic Readiness, Laws, Standards, and Legal Compliance in Forensics, Role of a Forensic Investigator and Challenges.	
Unit – II	9Hrs
Forensic Techniques and Analysis: Computer Forensics Investigation Process, Disk and File System Forensics (Windows, Linux, macOS), Data Acquisition and Imaging Methods, Anti-Forensics Techniques and Evidence Recovery, Password Recovery, Steganography, and Artifact Analysis	
Unit –III	9Hrs
Incident Response and Management: Incident Handling and Response Process, Preparation, Detection, Containment, Eradication, and Recovery, Evidence Gathering and Chain of Custody, Malware, Email, and Network Security Incident Handling, Case Studies: Handling Real-world Cyber Incidents	
Unit –IV	9Hrs
Specialized Forensics Domains: Windows, Linux, and MacOS Forensics, Mobile Device Forensics (Android and iOS), Cloud Forensics (AWS, Azure, GCP), IoT Forensics, Dark Web Forensics and TOR Investigation	
Unit –V	9Hrs
Advanced Threat Investigations and Best Practices: Network Traffic Analysis and Wireless Forensics, Malware Forensics and Ransomware Analysis, Web Application Attack Forensics, Insider Threats and Endpoint Security Incident Handling, Best Practices in Incident Handling, Reporting, and Prevention	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the concepts, processes, and legal aspects of cyber forensics and incident response.
CO2:	Apply forensic techniques to acquire, preserve, and analyze digital evidence from diverse sources.
CO3:	Design and implement systematic incident response procedures for different types of cyberattacks.
CO4:	Investigate advanced threats, mobile/cloud security incidents, and implement best practices in real-world scenarios.

Reference Books	
1	Certified Cloud Security Engineer (CCSE) v2 Academia Series eBook (Volumes 1 - 4)
2	Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, Third Edition, Eoghan Casey, ISBN: 978-0-120374268-1
3	Digital Forensics for Legal Professionals: Understanding Digital Evidence from The Warrant



	To The Courtroom Larry Daniel, Lars Daniel ISBN: 978-1-59749-643-8
4	Cybersecurity Incident Response: How to Contain, Eradicate, and Recover from Incidents" by Eric C. Thompson
5	Computer Incident Response and Forensics Team Management" by Leighton R. Johnson

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 (10) Real time problem solving (10) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE THEORY		100

RUBRIC FOR THE 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



Semester: VII						
Threat Intelligence Professional Core Elective- Group-F						
Course Code	:	CY374TFA		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45		SEE Duration	:	03 Hours

Unit-I		9 Hrs
Threat Analysis and Modeling: Understanding the threat modeling process, Threat modeling methodologies, Understanding Threat Intelligence - Good Intelligence, Bad Intelligence, Comparison of Good and Bad Intelligence, Contrasting Good from Bad intelligence, Good and Bad intelligence shapes threat modelling		
Unit – II		9 Hrs
Adversary Data Collection Sources and Methods: Adversary-based threat modeling, Adversary playbook, MITRE attack usecase Pivot Off and Extracting Adversarial Data- Adversary goals as a data source, Setting up a mitigation plan, taking the necessary precautions.		
Unit –III		9 Hrs
Primary indicators of security compromise: Common indicators of compromise, Challenges of IOCs, Tactics, Techniques, and Procedures (TTP) Identify and build indicators of compromise: Data correlation, Creating system log entry files data , Creating unusual outbound traffic, Key Windows Services		
Unit –IV		9 Hrs
Conduct Threat Assessments In Depth - Malware analysis, SQL injections analysis Heat Maps, Infographics & Dashboards - 2D density plots , when to use heat maps, best Practices for using heat maps , Common heat map options and Visualization tools		
Unit –V		9 Hrs
Planning for Disaster - APTS, Zero-day vulnerabilities , zero-day threats , Planning against APT attacks, case studies - Kaseya attack, Dakota Access Pipeline, Panama Papers, Operation Ababil, Carbanak APT Attack, Ukraine - Nation state attacks		

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply threat modeling processes and methodologies to identify, analyze, and categorize cybersecurity threats using standard threat intelligence frameworks.
CO2:	Analyze adversary data sources and indicators of compromise (IOCs) to evaluate potential threats
CO3:	Evaluate threat assessment data using techniques like log file analysis, TTP correlation, malware analysis, and data visualization through dashboards and heat maps.
CO4:	Design and implement threat intelligence system using statistical and analytical methods.
CO5:	Demonstrate ethical reasoning, project management, teamwork, and effective communication while planning and executing cyber threat modeling projects and responding to advanced persistent threats (APTs) and zero-day attacks.

Reference Books	
1	Erdal Ozkaya, “ Practical Cyber Threat Intelligence”, BPB Online, 2022, ISBN 9355510292.
2	Zane Pokorny and Christopher Ahlberg “ The Threat Intelligence Handbook: Moving Toward a Security Intelligence Program”,CyberEdge Press, 2019.
3	Chris Pace and Christopher Ahlberg, “The Threat Intelligence Handbook: A Practical Guide for Security



Teams to Unlocking the Power of Intelligence”,CyberEdge Press , 2018.

OR 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 (10) Real time problem solving (10) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE THEORY		100

RUBRIC FOR THE 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



Semester: VII						
Course Title: Adversarial AI (Group H: Open Elective)						
Course Code	:	CY374TFB		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45 L		SEE Duration	:	03 Hours
Unit-I					9 Hrs	
<p>Building Our Adversarial Playground: Technical requirements, Setting up your development Environment, Hands-on basic baseline ML, Developing our target AI service with CNNs</p> <p>Security and Adversarial AI: Technical requirements, Security fundamentals, Securing our adversarial playground, Securing code and artifacts, Bypassing security with adversarial AI</p> <p>Model Development Attacks: Basics of poisoning attacks, Staging a simple poisoning attack, Backdoor poisoning attacks, Clean-label attacks, Advanced poisoning attacks, Mitigations and defenses, Hidden-trigger backdoor attacks</p>						
Unit – II					9-Hrs	
<p>Supply Chain Attacks and Adversarial AI: Traditional supply chain risks and AI, AI supply chain risks, Data poisoning</p> <p>Attacks on Deployed AI: Fundamentals of evasion attacks, Perturbations and image evasion attack techniques, NLP evasion attacks with BERT using TextAttack, Universal Adversarial Perturbations (UAPs), Black-box attacks with transferability, Defending against evasion attacks</p>						
Unit –III					9 Hrs	
<p>Privacy Attacks – Stealing Models: Understanding privacy attacks, Stealing models with model extraction attacks, Defenses and mitigations,</p> <p>Privacy Attacks – Stealing Data: Understanding model inversion attacks, Example model inversion attack, Understanding inference attacks, Attribute inference attacks, Example attribute inference attack, Membership inference attacks</p> <p>Privacy-Preserving AI: Privacy-preserving ML and AI, Simple data anonymization, Advanced anonymization, Differential privacy (DP), Federated learning (FL), Split learning, Advanced encryption options for privacy-preserving ML techniques in practice, Advanced ML encryption, Applying privacy-preserving ML techniques</p>						
Unit –IV					9 Hrs	
<p>Generative AI – A New Frontier: A brief introduction to generative AI, Using GANs, Using pre-trained GANs,</p> <p>Weaponizing GANs for Deepfakes and Adversarial Attacks: Use of GANs for deepfakes and deepfake detection, Using GANs in cyberattacks and offensive security, Defenses and mitigations,</p>						
Unit –V					9 Hrs	
<p>LLM Foundations for Adversarial AI: A brief introduction to LLMs, Developing AI applications with LLMs, Hello LLM with Python, Hello LLM with LangChain, Bringing your own data, Adversarial AI</p> <p>Adversarial Attacks with Prompts: Adversarial inputs and prompt injection, Direct prompt injection, Automated gradient-based prompt injection, Risks from bringing your own data, Data exfiltration with prompt injection, Privilege escalation with prompt injection. Defenses and mitigations</p>						



Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the concepts of adversarial examples, threat models, and their implications in real-world AI systems.
CO2:	Implement and compare various adversarial attack algorithms (e.g., FGSM, PGD, C&W) on machine learning models.
CO3:	Apply and assess different defense strategies such as adversarial training and preprocessing to improve model robustness.
CO4:	Demonstrate understanding of certification techniques and evaluate robustness guarantees using formal methods.
CO5:	Analyze the impact of adversarial AI in diverse domains and critically review contemporary research in this field.

Reference Books	
1	“Aversarial AI Attacks, Mitigations, and Defense Strategies: A Cybersecurity Professional's Guide to AI Attacks, Threat Modeling, and Securing AI with MLSecOps”, John Sotiropoulos, Packt Publishing, 2024
2	“Adversarial machine learning: A taxonomy and terminology of attacks and mitigations”, Vassilev, A., Oprea, A., Fordyce, A., & Andersen, H. (2024).
3	Miller, David J., Zhen Xiang, and George Kesidis. <i>Adversarial Learning and Secure AI</i> . Cambridge University Press, 2023.
4	"Verified Artificial Intelligence" by Suman Jana et al. (Chapters on neural net verification)
5	"Artificial Intelligence Safety and Security" by Roman V. Yampolskiy – CRC Press, 2018 (Chapters on adversarial AI, safety, ethical AI)

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 (10) Real time problem solving (10) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE THEORY		100



RUBRIC FOR THE 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



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Semester: VII			
ETHICAL ARTIFICIAL INTELLIGENCE			
(Common to AI,CY,CD,IS)			
Category: Professional Core Elective – IV (Group F)			
(Theory)			
Course Code	:	AI374TFC	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	45L	SEE Duration : 3Hours
Unit-I			9 Hrs
Introduction to AI and ethics - Strong and weak AI, Types of ethics - Descriptive, Normative, Meta, Relationship between ethics and law, Machine ethics examples, Moral Diversity and Testing			
Core Ethical Principles- Bias and Fairness, Transparency and Explainability, Privacy and Security, Robustness and Reliability			
Unit II			9 Hrs
Bias and Fairness – Understanding Bias in data and Models – How Bias can impact Decision Making Process, types of Bias , Examples of Real World Cases, Techniques to detect and Mitigate Bias, Implement Bias Detection and Fairness.			
Unit –III			9 Hrs
Transparency and Explainability - Importance of Transparency and Explainability in AI Models, Methods for Achieving Explainable AI, Tools, Frameworks, and Implementation of Transparency and Explainability, Challenges and Solutions in Achieving Transparency and Explainability			
Unit IV			9 Hrs
Privacy Concerns in AI - Potential Threats to Privacy , Privacy Attacks in AI Models , Mitigating Privacy Risks in AI			
Security Concerns in AI - Potential Threats to Security , Mitigating Security Risks in AI			
Unit V			9 Hrs
Robustness and Reliability - Concepts of Robustness and Reliability- Metrics for Measuring Robustness and Reliability, Challenges in Achieving Robustness , Challenges in Ensuring Reliability – Data Quality, Model Drift, Uncertainty in AI Models			

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand, Identify and address ethical principles arising from developing and deploying AI technologies.
CO2	Critically assess the moral agency and responsibility of AI systems and their creators.
CO4	Demonstrate the use of modern tools in solving ethical issues by exhibiting teamwork through oral presentations and reports
CO5	Evaluate the implications of AI on privacy, surveillance, and data ethics in contemporary society, thereby contributing to life-long learning.

Text Books	
1.	Bartneck, Christoph, Christoph Lütge, Alan Wagner, and Sean Welsh. An introduction to ethics in robotics and AI. Springer Nature, 2021, 1 st edition, ISBN 978-3-030-51109-8.
2.	Avinash Manure Shaleen Bengani,Saravanan S, Introduction to Responsible AI: Implement Ethical AI Using Python, Apress Media LLC, 2023, 1 st edition, ISBN-10 1484299817,ISBN-978-1484299814
3.	Stahl, Bernd Carsten, Doris Schroeder, and Rowena Rodrigues,Ethics of Artificial



	Intelligence: Case Studies and Options for Addressing Ethical Challenges. Springer Nature, 2023, 1 st edition, ISBN 978-3-031-17039-3.
4.	Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield, The ethics of Artificial Intelligence: Issues and initiatives, European Parliamentary Research Service, ISBN: 978-92-846-5799-5, doi: 10.2861/6644

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 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



Scalable and Secure Distributed Ledger Technologies					
Professional Core Elective- Group-F					
Course Code	:	CY374TFD		CIE Marks	: 100
Credits: L:T:P	:	3:0:0		SEE Marks	: 100
Total Hours	:	45L		SEE Duration	: 3 Hrs

Course Learning Objectives: The students will be able to	
1.	Understand the basic principles used in Blockchain.
2.	Explore design principles such as distributed computing, Cryptography and other used in design of Blockchain.
3.	Apply principles of Blockchain in designing application such as Bitcoin, Ethereum. Etc.
4.	Extending design principles of blockchain to other application involving transactions.

Unit – I	09 Hrs
<p>Blockchain: Growth of Blockchain technology, Distributed systems, history of blockchain and Bitcoin - Electronic cash, Blockchain, Generic elements of a blockchain, Benefits and limitations of blockchain, Tiers of blockchain technology, Features of a blockchain, Types of blockchain - Distributed ledgers, Distributed Ledger Technology, , Public and Private blockchains, Shared ledger. Consensus - Consensus mechanism, Types of consensus mechanisms, Consensus in blockchain, CAP theorem and blockchain.</p>	
Unit – II	09 Hrs
<p>Decentralization: Decentralization using blockchain, Methods of decentralization - Disintermediation, Contest-driven decentralization Routes to decentralization- How to decentralize, The decentralization framework example Blockchain and full ecosystem decentralization - Storage, Communication, Computing power and decentralization Smart contracts, Decentralized Organizations- Decentralized Autonomous Organizations, Decentralized Autonomous Corporations, Decentralized Autonomous Societies, Decentralized Applications (DApps), Requirements of a Decentralized Application, Operations of a DApp. Platforms for decentralization - Ethereum, MaidSafe, Lisk.</p>	
Unit – III	09 Hrs
<p>Introducing Bitcoin: Bitcoin definition Digital keys and addresses- Private keys in Bitcoin, Public keys in Bitcoin, Addresses in Bitcoin Transactions - The transaction life cycle, transaction data structure, Types of transactions, Transaction verification Blockchain: The structure of a block, structure of a block header, genesis block. Mining - Tasks of the miners, Mining rewards, Proof of Work (PoW), mining algorithm, hash rate, Mining systems (CPU, GPU), Mining pools.</p>	



Unit – IV	09 Hrs
<p>Ethereum 101, Introduction, Ethereum network – Mainnet, Testnet, Private Net Components of the Ethereum ecosystem -Key and Addresses, Accounts, Transactions and Messages. Ether cryptocurrency / tokens (ETC and ETH), The Ethereum Virtual Machine (EVM)- Execution environment, Machine state, iterator function, Smart contracts- History, definition, Ricardian contracts</p>	
Unit – V	09 Hrs
<p>Alternative Coins-Bitcoin limitations, Privacy and anonymity, Extended protocols on top of Bitcoin. Development of altcoins -Consensus algorithms, Hashing algorithms, Difficulty adjustment algorithms, Inter-block time, Block rewards, Reward halving rate, Block size and transaction size, Interest rate, Coinage, Total supply of coins. Case Studies: Namecoin, Litecoin, Primecoin, Zcash, Smart Contracts.</p>	

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand working principles and design methodologies of Blockchain. WK3, WK4, WK5
CO 2:	Analyze the working principles and design methodologies of Blockchain WK2, WK3, WK4, WK5
CO 3:	Apply the principles and design methodologies used in Blockchain to develop applications such as Bitcoin and Ethereum Network WK4, WK5, WK6
CO 4:	Extend principles of Blockchain to other architectures such as <u>Namecoin</u> , <u>Litecoin</u> , <u>Primecoin</u> , <u>Zcash</u> , <u>Smart Contracts</u> WK4, WK5, WK6, WK8

Reference Books:	
1.	Mastering BlockChain – Second Edition, Imran Bashir, March 2018, Packet Publishing, ISBN: 9781788839044
2.	Mastering Bitcoin: Programming the Open Blockchain –Second Edition, Andreas M. Antonopoulos, June 2017, O’Reilly Publications, ISBN-13: 978-1491954386, ISBN-10: 9781491954386.
3.	Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World – Second Edition, <u>Don Tapscott</u> , <u>Alex Tapscott</u> , March 2016, Penguin Publishing Group, ISBN: 110198015X, 9781101980156
4.	Mastering Bitcoin: Programming the Open Blockchain – <u>Andreas M. Antonopoulos</u> and <u>Gavin Wood</u> , 2014, O’Reilly Publications, ISBN: 1491921986, 9781491921982.



RUBRIC FOR THE 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



Semester: VII			
DATA AND STORYTELLING			
Category : Institutional Elective – II (Group G)			
(Theory)			
Course Code	:	AI375TGA	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	45L	SEE Duration : 3Hours
Unit-I			09 Hrs
Understanding Data: Types, Sources, and Preparation: What is data and why it matters, Types of data – qualitative, quantitative, structured, unstructured, 3Vs of big data – volume, velocity, variety, Common data sources – government portals, sensors, APIs, crowd sourced platforms, Data representations – tabular, relational, JSON, XML formats, Introduction to spreadsheets and data frames, Basics of data preprocessing – missing value handling, normalization, type casting, cleaning workflows using Python (pandas) or spreadsheets			
Unit – II			09 Hrs
Data Collection for Exploratory Research: Methods of primary data collection – surveys, interviews, FGDs, observations, Designing structured questionnaires and interview guides, Ensuring question clarity, neutrality, and goal alignment, Sampling strategies – random, stratified, purposive sampling, Field planning and respondent communication, Ethical considerations – consent, privacy, data sensitivity, Transcription and textual data cleaning.			
Unit –III			09 Hrs
Sensor Data Collection and logging: Introduction to IoT and embedded data logging, Sensor interfacing – temperature, humidity, motion, light sensors, Analog-to-digital conversion and signal conditioning, Sampling rates and real-time clock synchronization, Wireless transmission – BLE, Wi-Fi, LoRa, Local and remote data logging – SD cards, cloud platforms, Handling data quality issues – noise, missing values, power constraints, security and privacy (Man in the middle attacks). Real-time plotting, Visualizing trends, anomalies, and multi-sensor overlays, Debugging and optimizing embedded data pipelines, Mapping Urban Tree Inequality: A Data-Driven Look at Green Access, Building a Local Data Chain to Map Green Equity in Our Cities, Project Pakshi			
Unit –IV			09 Hrs
Storytelling through Data: Communicating patterns and trends with clarity, Building simple, reproducible analysis notebooks, Introduction to data storytelling and presentation, Structuring analysis reports – insights, visuals, limitations, Creating visual narratives – dashboards, summaries, infographics, Ethical data interpretation – avoiding bias and misrepresentation			
Unit –V			09 Hrs
Statistics Done Wrong: Statistical Significance, Statistical Power, and the Problem of Underpowered Studies, Pseudoreplication, Model Abuse, Researcher Freedom, Hiding the data. Final project – design, collect, visualize, and present data using field instruments, embedded systems, or secondary sources			

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand different types, sources, and representations of data, and perform basic preprocessing using modern tools.
CO2	Design and implement primary data collection strategies using surveys, interviews, and sampling techniques with ethical considerations.
CO3	Interface and configure sensors for real-time data logging, transmission, and visualization while addressing data quality and privacy issues.
CO4	Create structured analysis reports and visual narratives to communicate insights clearly and ethically using dashboards and notebooks.



CO5	Identify and critique common statistical errors and misinterpretations in data analysis to promote valid and ethical research practices.
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Reference Books	
1.	The Craft of Research, Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams, University of Chicago Press, Fifth Edition, 2024, ISBN-13: 978-0226826677
2.	Sensor Data Analysis and Management: The Role of Deep Learning, Editors: A. Suresh, R. Udendhran, M. S. Irfan Ahmed, Wiley-IEEE Press, 2021, ISBN-13: 978-1119682424
3.	Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic, Wiley Publications, 2015, ISBN-13: 978-1119002253
4.	Statistics Done Wrong: The Woefully Complete Guide, Alex Reinhart, No Starch Press, 2015, ISBN-13: 978-1593276201

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 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 (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: VII						
AIRCRAFT SYSTEMS						
Category : Institutional Elective – II (Group G)						
(Theory)						
Course Code	:	AS375TGB		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
Flight Control Systems: History of Airplanes, Anatomy of an aircraft, Primary and secondary flight control surfaces, Flight control linkage system, Conventional Systems, Power assisted and fully powered flight controls, Electronic flight control system-fly by wire system.	
Unit – II	09 Hrs
Aircraft Hydraulic & Pneumatic Systems: Components of a typical Hydraulic system, Working or hydraulic system, Power packs, Hydraulic actuators, Pressure regulating devices, Hydraulic pumps, Pneumatic system and components, Use of bleed air, Landing gear and braking,	
Unit –III	09 Hrs
Aircraft Fuel Systems: APU, RAT, Characteristics of aircraft fuel system, Fuel system and its components, different types of fuel tanks, types of fuel lines, Fuel pumps-classification, Fuel control unit, Gravity feed and pressure feed fuel systems,	
Unit –IV	09 Hrs
Environmental Control Systems: Air-conditioning system, vapour cycle system, deicing and anti-icing system, Fire detection- warning and suppression. Crew escape aids. Engine Systems: Engine starting sequence, Starting and Ignition systems, Engine oils and a typical lubricating system.	
Unit –V	09 Hrs
Aircraft Instruments: Instruments displays, Instrumentation grouping, Navigation instruments, Radio instruments, Hydraulic and Engine instruments. Air Data Instruments: Basic air data system and probes, Mach meter, Air speed indicator, Vertical speed indicator, Barometric pressure sensing, Altimeter, Air data alerting system- angle of attack sensing, stall warning, Mach warning, altitude alerting system.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Demonstrate a comprehensive understanding of the fundamental components and operational principles of major aircraft systems
CO2	Analyze and explain the functions of various subsystems of aircraft in emphasizing their roles in safe and efficient flight operations
CO3	Apply knowledge of aircraft systems to identify typical issues and malfunctions related to flight controls and other subsystems
CO4	Evaluate the the regulatory considerations in aircraft system technologies for different flight envelopes



Reference Books	
1	Introduction to Flight, John D. Anderson, 7 th Edition, 2011, McGraw-Hill Education, ISBN 9780071086059.
2	Fundamentals Of Flight Vol 4: Aircraft Systems, Lalit Gupta, Op Sharma, Himalayan Books, ISBN-13: 9788170020974
3	Flight stability and automatic control, Nelson R.C, 2nd Edition, 1998, McGraw-Hill International Editions, ISBN 9780071158381.
4	Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Ian Moir, Allan Seabridge, 3rd Edition, 2008, John Wiley & Sons., ISBN 978111965006.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & PRACTISE)		
#	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 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



Semester: VII			
HEALTHCARE TECHNOLOGY FOR ENGINEERS			
Category : Institutional Elective – II (Group G)			
(Theory)			
Course Code	: BT375TGC	CIE	: 100 Marks
Credits: L:T:P	: 3:0:0	SEE	: 100 Marks
Total Hours	: 45Hrs	SEE Duration	: 3Hours
Unit-I			09Hrs
Introduction to Healthcare Technology: National Digital Health Mission & Healthcare, IT Infrastructure, Telemedicine and remote healthcare applications, Basic Terminology and Role of Engineers in Healthcare Technology; Definition and importance of healthcare technology, Roles and responsibilities of engineers in the healthcare sector, Interdisciplinary collaboration between healthcare professionals and engineers, Key technologies used in modern healthcare systems.			
Unit – II			09 Hrs
Healthcare Data Management and Digital Epidemiology: Introduction to healthcare data types (structured, unstructured, real-time data), EHR in healthcare and its applications, Data security and privacy in healthcare, Role of digital epidemiology in tracking and predicting diseases, Use of AI and machine learning in healthcare data analysis.			
Unit –III			09 Hrs
Technology-Led Healthcare: Clinical Decision Support Systems (CDSS) and AI in Diagnosis Machine Learning and Deep Learning in Healthcare, Patient Monitoring Systems (PMS) and IoT Applications, Wearable Devices for Health Tracking. Technology-Led Healthcare: Quality Management Systems in Healthcare, Infection Prevention and Waste Management Technologies, Medical Device Development and Quality Assurance, Smart Hospitals: Case Study of a Technology-Enabled Hospital.			
Unit –IV			09 Hrs
Regulatory, Policy and Cybersecurity Aspects: Legal, Ethical and Intellectual Property Rights in Healthcare Technology, Cybersecurity in Healthcare; Data Protection and Privacy, Health Technology Assessment and Procurement Strategies.			
Unit –V			09 Hrs
Innovations in Healthcare Technology: Simulation and Organ Modelling for Medical Applications, 3D Printing and Tissue Engineering in Healthcare, Augmented Reality (AR) and Virtual Reality (VR) in Medical Applications, Robotics and Biomechanics in Healthcare, Emerging Digital Health Technologies and Future Trends.			

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Design, and implement healthcare technologies effectively
CO2:	Analyse the perspective of sensing and imaging in technology for the better health
CO3:	Ensuring compliance with regulatory and cybersecurity frameworks of healthcare data.
CO4:	Evaluate various tools, techniques and advances for better formulation and productivity



Reference Books	
1.	“Biomedical Engineering: Bridging Medicine and Technology.” Saltzman, W. Mark., Cambridge University Press, 2015. https://doi.org/10.1017/CBO9781139583831 .
2.	“Medical Instrumentation: Application and Design.”, Webster, John G., 4th ed., John Wiley & Sons, 2010.
3.	“Artificial Intelligence in Healthcare”. Mahajan, Parag., 2nd (General) ed., Updated 2022.
4.	“Healthcare Information Technology Exam Guide for CHTS and CAHIMS Certifications”. McCormick, Karen A., Barbara Gugerty, and James E. Mattison., McGraw Hill Professional, 2017.
5.	“Introduction to Biomedical Engineering”. Enderle, John D., and Joseph D. Bronzino, editors., 3rd ed., Academic Press, 2012. ISBN: 978-0-12-374979-6.
6.	“Healthcare Information Privacy and Security: Regulatory Compliance and Data Security in the Age of Electronic Health Records”. Robichau, Bernard Peter, Apress, 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 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



Semester: VII			
Green and Hydrogen Technology			
Category : Institutional Elective – II (Group G)			
(Theory)			
Course Code	:	CH375TGD	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	45L	SEE Duration : 3 Hours
Unit-I			09 Hrs
Hydrogen: Peculiarity and Types			
Salient features of hydrogen, properties of hydrogen, terminology and types of hydrogen, advantages, disadvantages, comparison with other fuels, and global status of supply and demand.			
Unit – II			09 Hrs
Hydrogen Generation			
Generation of different types of hydrogen, conventional methods (generation from non-renewable sources), nonconventional methods (generation from renewable sources).			
Unit –III			09 Hrs
Hydrogen Storage			
Storage as compressed gas, storage as cryogenic liquid, storage as metal hydrides, storage through liquid organic hydrogen carriers, and other storage methods.			
Unit –IV			09 Hrs
Hydrogen Handling and Safety			
Classification of hydrogen hazards, compressed and liquid hydrogen related hazards, regulation, codes and standards related to hydrogen handling and transport.			
Unit –V			09 Hrs
Hydrogen Applications			
Applications of hydrogen in various sectors such as refineries, petrochemicals, fertilizer industries, transport and automotive sectors, steel industries, and AI in hydrogen technology.			
Course Outcomes			
CO1	Understand the importance of hydrogen and its use as an energy carrier		
CO2	Explain the production, storage and handling of hydrogen		
CO3	Analyze the need for hydrogen as an alternate fuel and the associated challenges		
CO4	Appraise the importance of safety, regulations and codes		

Reference Books	
1.	Hydrogen Safety: Production, Transport, Storage, Use, and the Environment, Fotis Rigas, CRC Press, Taylor & Francis Group, 2 nd Edition, 2023, ISBN: 9781003313007
2.	Hydrogen Fuel: Production, Transport and Storage, Gupta, R. B., CRC Press, Taylor & Francis Group, 1 st Edition, 2009, ISBN: 9780429147364
2.	Hydrogen Production: Electrolysis, Agata Godula-Jopek, Wiley-VCH, 1 st Edition, 2015, ISBN:9783527333424
3.	Handbook of Hydrogen Storage, Michael Hirscher, Wiley-VCH, 1 st Edition, 2010, ISBN:9783527322732
4.	Fuel Cell Systems Explained, James Larminie and Andrew Dicks, John Wiley & Sons, 2 nd Edition, 2003, ISBN 978 0470 848579



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 AND PRACTICE)		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 : VII				
CHEMISTRY OF MATERIALS AND MOLECULAR ANALYSIS				
Category : Institutional Elective – II (Group G)				
(Theory)				
Course Code	CM375TGE		CIE Marks	100
Hrs/Week	L: T: P: EL: 3:0:0:0		SEE Marks	100
Credits	03		SEE duration	03
UNIT – I				
Advanced Materials for Smart Packaging: Biodegradable polymers, Bio-polymers, Nanomaterials, and Active packaging materials-Self-healing films, antimicrobial coatings and moisture-sensitive barriers for food and pharmaceutical industries. Thermal-responsive packaging used in food safety, drug stability and electronics protection.				09 Hrs
UNIT – II				
Innovations in Computational Chemistry: Introduction to ChemDraw and its Interface- basic to advanced functionalities for chemical drawing, reaction representation, and integration with computational tools. Cheminformatics and molecular screening. -molecular modeling and simulation techniques- molecular docking, virtual screening, and quantitative structure-activity relationships (QSAR)- generative AI for novel drug molecules- neural networks for toxicity prediction and AI-assisted biomolecular structure prediction.				09 Hrs
UNIT – III				
IR Spectroscopy: Introduction, principle, molecular vibrations, vibrational frequency, number of fundamental vibrations, factors influencing fundamental vibrations, instrumentation of IR spectrophotometer, application of IR spectroscopy in characterization of functional groups- IR spectroscopy in forensic science, pharmaceuticals, environmental monitoring and material characterization.				09 Hrs
UNIT – IV				
UV- visible Spectroscopy: Introduction-Electronic transitions- factors influencing position and intensity of absorption bands-absorption spectra of dienes, polyene and α , β -unsaturated carbonyl compounds, Bandgap calculations utilizing UV. Working of UV-Vis spectrophotometer. AI-driven spectral analysis, and computational approaches for UV-Vis data interpretation. UV-Vis spectroscopy in nanomaterials and biomedical applications.				09 Hrs
UNIT – V				
NMR spectroscopy: H^1 NMR Spectroscopy: Basic concepts- relaxation process. NMR spectrometer-FT NMR-Solvents used in NMR, internal standards-chemical equivalence - chemical shift-Factors affecting chemical shifts- shielding and deshielding effects – chemical and magnetic equivalent –magnetic anisotropy-spin-spin splitting rules- Application of NMR on in characterization of compounds- magnetic resonance imaging (MRI)-Bio-Engineering-Bio-Imaging. Problems on prediction of structure of compounds. Basics of Solid State NMR.				09 Hrs



Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the principles of chemistry for the synthesis of smart packaging materials, cheminformatics, drug discovery and materials analysis.
CO2:	Utilize the knowledge of chemistry, AI-driven molecular modelling and spectral analysis to identify compounds and predict toxicity.
CO3:	Analyse IR, UV-Vis, and NMR spectroscopic data for material characterization and biomolecular studies.
CO4:	Propose smart packaging solutions and AI-assisted molecular screening methods for biomedical and pharmaceutical applications

Reference Books	
1.	“ <i>Introduction to Spectroscopy</i> ” by Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James A. Vyvyan, Published by Cengage Learning, 5th edition, ISBN- 978-1285460123
2.	“ <i>Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics</i> ” – Errol G. Lewars. Published by Springer 2024, 4th edition, ISBN- 978-3031514425
3.	“ <i>Handbook of Materials Structures, Properties, Processing and Performance</i> ” by Lawrence E. Murr Published by Springer, ISBN- 978-3319018140.
4.	“ <i>Handbook of Biodegradable Polymers-Applications in Biomedical Sciences, Industry, and the Environment</i> ” by Shakeel Ahmed and Riyaz Ali Osmani Published by Jenny Stanford Publishing 2024, ISBN -9789814968843
5.	“ <i>An Introduction to Chemoinformatics</i> ” by Andrew R. Leach and Valerie J. Gillet, published by Springer ISBN 978-1402062902.

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 AND PRACTICE)		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: VII						
CHEMISTRY OF MATERIALS AND MOLECULAR ANALYSIS						
Category : Institutional Elective – II (Group G)						
(Theory)						
Course Code	:	CM375TGE		CIE Marks	:	100
Credits L: T: P	:	3:0:0		SEE Marks	:	100
Total Hrs	:	45L		SEE duration	:	03
UNIT – I					09 Hrs	
Advanced Materials for Smart Packaging: Biodegradable polymers, Bio-polymers, Nanomaterials, and Active packaging materials-Self-healing films, antimicrobial coatings and moisture-sensitive barriers for food and pharmaceutical industries. Thermal-responsive packaging used in food safety, drug stability and electronics protection.						
UNIT – II					09 Hrs	
Innovations in Computational Chemistry: Introduction to ChemDraw and its Interface- basic to advanced functionalities for chemical drawing, reaction representation, and integration with computational tools. Cheminformatics and molecular screening. -molecular modeling and simulation techniques- molecular docking, virtual screening, and quantitative structure-activity relationships (QSAR)- generative AI for novel drug molecules- neural networks for toxicity prediction and AI-assisted biomolecular structure prediction.						
UNIT – III					09 Hrs	
IR Spectroscopy: Introduction, principle, molecular vibrations, vibrational frequency, number of fundamental vibrations, factors influencing fundamental vibrations, instrumentation of IR spectrophotometer, application of IR spectroscopy in characterization of functional groups- IR spectroscopy in forensic science, pharmaceuticals, environmental monitoring and material characterization.						
UNIT – IV					09 Hrs	
UV- visible Spectroscopy: Introduction-Electronic transitions- factors influencing position and intensity of absorption bands-absorption spectra of dienes, polyene and α , β -unsaturated carbonyl compounds, Bandgap calculations utilizing UV. Working of UV-Vis spectrophotometer. AI-driven spectral analysis, and computational approaches for UV-Vis data interpretation. UV-Vis spectroscopy in nanomaterials and biomedical applications.						
UNIT – V					09 Hrs	
NMR spectroscopy: H^1 NMR Spectroscopy: Basic concepts- relaxation process. NMR spectrometer-FT NMR- Solvents used in NMR, internal standards-chemical equivalence - chemical shift-Factors affecting chemical shifts-shielding and deshielding effects – chemical and magnetic equivalent –magnetic anisotropy-spin-spin splitting rules- Application of NMR on in characterization of compounds- magnetic resonance imaging (MRI)-Bio-Engineering- Bio-Imaging. Problems on prediction of structure of compounds. Basics of Solid-State NMR.						

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the principles of chemistry for the synthesis of smart packaging materials, cheminformatics, drug discovery and materials analysis.
CO2:	Utilize the knowledge of chemistry, AI-driven molecular modelling and spectral analysis to identify compounds and predict toxicity.



CO3:	Analyse IR, UV-Vis, and NMR spectroscopic data for material characterization and biomolecular studies.
CO4:	Propose smart packaging solutions and AI-assisted molecular screening methods for biomedical and pharmaceutical applications

Reference Books	
1.	“Introduction to Spectroscopy” by Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James A. Vyvyan, Published by Cengage Learning, 5th edition, ISBN- 978-1285460123
2.	“Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics” – Errol G. Lewars. Published by Springer 2024, 4th edition, ISBN- 978-3031514425
3.	“Handbook of Materials Structures, Properties, Processing and Performance” by Lawrence E. Murr Published by Springer, ISBN- 978-3319018140.
4.	“Handbook of Biodegradable Polymers-Applications in Biomedical Sciences, Industry, and the Environment” by <u>Shakeel Ahmed</u> and <u>Riyaz Ali Osmani</u> Published by Jenny Stanford Publishing 2024, ISBN -9789814968843
5.	“An Introduction to Chemoinformatics” by Andrew R. Leach and Valerie J. Gillet, published by Springer ISBN 978-1402062902.

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 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



Semester: VII						
PROMPT ENGINEERING						
Category : Institutional Elective – II (Group G)						
(Theory)						
Course Code	:	CS375TGF		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	40 L		SEE Duration	:	03 Hours
Unit-I					8 Hrs	
<p>Introduction to Prompt Engineering: Raise of Context Learning, Prompts, Prompt Engineering, LLM Settings, Basic Prompt/ Basics of prompting, Elements of a Prompt, Settings for Prompting Language Model/ General Tips for Designing Prompts, Designing Prompts for Different Tasks: few examples of common tasks using different prompts Text Summarization, Information Extraction, Question Answering, Text Classification, Conversation/Role Playing, Code Generation, Reasoning</p>						
Unit – II					8 Hrs	
<p>Techniques for Effective Prompts: Techniques designed to improve performance on complex tasks - Zero-Shot Prompting, Few-shot prompting, Chain-of-thought (CoT) prompting, Zero-Shot CoT, Self-Consistency, Knowledge Generation Prompting, Program-aided Language Model (PAL), React, Directional Stimulus Prompting Prompt Tuning vs. Fine-Tuning: Introduction and Types for Tuning, Tools & Libraries for Tuning-Hugging Face PEFT library (Parameter-Efficient Fine-Tuning), Trade-off decisions: when to prompt-tune vs. fine-tune</p>						
Unit –III					8 Hrs	
<p>Best Practices in Prompt Engineering Tools & IDEs: Capabilities include: Developing and experimenting with prompts, Evaluating prompts. Versioning and deploying prompts; Advanced prompting techniques: advanced applications with LLMs LLMs and external tools/APIs -- LLMs with External Tools; Data-augmented Generation – Steps, External Data, QA with sources, Summarization using sources Prompt Debugging & Interpretability Tools: Importance of interpretability in LLMs- Visualization tools- LIT (Language Interpretability Tool by Google) - OpenAI Playground, debug tools</p>						
Unit –IV					8 Hrs	
<p>Applications of Prompt Engineering: LLM Applications: Function Calling with LLMs - Getting Started with Function Calling, Function Calling with GPT-4, Function Calling with Open-Source LLMs. Function Calling Use Cases: Conversational Agents, Natural Language Understanding, Math Problem Solving, API Integration, Information Extraction</p>						
Unit –V					8 Hrs	
<p>Ethics in AI-Generated Content: Introduction to AI Ethics in Generation, Key Ethical Concerns in Prompting- Bias and Discrimination, Misinformation and Hallucination. Opportunities: Model safety, Prompt Injection, Prompt Leaking, Jail Breaking; Reinforcement Learning from Human Feedback (RLHF)</p>						
Course Outcomes: After completing the course, the students will be able to						
CO1	Demonstrate an understanding of prompt engineering principles including how prompt structure and phrasing impact the performance of AI models.					



CO2	Design and implement effective prompts- to create and apply prompts for various natural language processing (NLP) tasks, such as text generation, summarization, and translation, using AI models.
CO3	Critically evaluate the effectiveness of prompts - assess the quality and performance of prompts in terms of accuracy, coherence, and relevance, identifying areas for improvement.
CO4	Apply prompt engineering techniques in real-world scenarios - use prompt engineering strategies to address practical problems in domains such as education, healthcare, and business, demonstrating the applicability of AI-driven solutions.

Reference Books	
1	Unlocking the Secrets of Prompt Engineering, Gilbert Mizrahi, Jan 2024, 1st Edition, Packt Publishing, ISBN-13:978-1835083833
2	Prompt Engineering for Generative AI, James Phoenix, Mike Taylor, May 2024, O'Reilly Media, Inc. ISBN: 9781098153434
3	Prompt Engineering for LLMs, John Berryman, Albert Ziegler, O'Reilly Media, Inc. January 2025, ISBN: 9781098156152
4	OpenAI Cookbook - https://github.com/openai/openai-cookbook “Ethics of Artificial Intelligence and Robotics” – Stanford Encyclopedia of Philosophy- https://plato.stanford.edu/entries/ethics-ai/
5	“The Art of Prompt Engineering with OpenAI API” by Nathan Hunter <i>(Beginner-friendly, focused on real-world use and debugging)</i> ISBN: 9798389421630

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 (10) Real time problem solving (10) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE THEORY		100



RUBRIC FOR THE 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



Semester: VII					
SOLID WASTE MANAGEMENT AND STATUTORY RULES					
Category : Institutional Elective – II (Group G)					
(Theory)					
Course Code		CV375TGG		CIE	: 100 Marks
Credits: L:T:P	:	3:0:0		SEE	: 100 Marks
Total Hours	:	42L		SEE Duration	: 3 Hours
Unit-I					10 Hrs
<p>Introduction: Present solid waste disposal methods. Merits and demerits of open dumping, incineration, pyrolysis, composting, sanitary landfill, Biogas Scope and importance of scientific solid waste management. Definition and functional elements of solid waste management.</p> <p>Sources: Sources of Solid waste, types of solid waste, composition of municipal solid waste, generation rate, Numerical Problems.</p> <p>Collection and transportation of municipal solid waste: Collection of solid waste- services and systems, Municipal Solid waste (Management and Handling) 2016 rules with amendments. Draft SWM 2024 rules. Site visit to collection system.</p>					
Unit – II					08 Hrs
<p>Composting Aerobic and anaerobic composting - process description, process microbiology, Vermicomposting, Site visit to compost plant, Numerical problems.</p> <p>Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Site visit to landfill site.</p>					
Unit –III					08 Hrs
<p>Hazardous waste management: Definitions, Identification of hazardous waste, Classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016 with amendments. Hazardous and other wastes (Management and Transboundary Movement) amendment rules, 2024. Site visit to hazardous landfill site</p>					
Unit –IV					08 Hrs
<p>Bio medical waste management: Classification of bio medical waste, collection, transportation, disposal of bio medical waste, Biomedical waste management (Management & Handling Rules) 2016 with amendments. Site visit to hospital to observe biomedical waste collection and transportation system and visit to biomedical waste incineration plant.</p>					
Unit –V					08 Hrs
<p>E-waste management: Definition, Components, Materials used in manufacturing electronic goods, Recycling and recovery integrated approach. E-waste (Management) Rules 2022 and amendments. Site visit to e- waste treatment plant.</p> <p>Plastic waste management: Manufacturing of plastic with norms. Plastic waste management. Plastic waste management rules 2016 with amendments.</p>					

Course Outcomes: After Completing the course, student will be able to,	
CO1	Understand the current solid waste management system and statutory rules.
CO2	Analyze drawbacks in the present system and provide recycling and disposal options for each type of waste in compliance to rules.
CO3	Distinguish Hazardous waste, Biomedical waste, E waste and to provide scientific management system.
CO4	Evaluate and monitor the Biomedical waste, Hazardous waste, E waste, Plastic and Municipal waste management as per the rules laid by Ministry of Environment, Forest and Climate change.



Reference Books	
1.	Integrated Solid Waste Management, George.C.Tchobanoglous, International edition 2022, McGraw hill publication. ISBN 978-0070632370
2.	Electronic waste management, R.E. Hester, Roy M Harrison, , Cambridge, UK, 2009, RSC Publication, ISBN 9780854041121
3.	Solid Waste Management Rules 2016, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 8th April 2016
4.	Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 04th April, 2016.
5.	Biomedical waste management (Management & Handling Rules) 2016, Ministry of Environment & Forest Notification, New Delhi, amendment on 28th March, 2016.
6.	E-waste (Management) Rules 2022 and amendments, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 2 nd November, 2022.
7.	Plastic waste management rules 2016 with amendments., Ministry of Environment, Forest and Climate Change Notification, New Delhi, 6 th July 2022.

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 AND PRACTICE)		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: VII			
Freight Transportation Systems and Logistics Planning			
Category : Institutional Elective – II (Group G)			
(Theory)			
Course Code	:	CV375TGH	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	42L	SEE Duration : 3 Hours
Unit-I			08 Hrs
Characteristics of Freight Transport: Freight Characteristics, Factors influencing Freight Travel, operators, problems in freight transportation, regional and urban goods travel, intermodal freight travel issues, passenger and freight demand models.			
Unit – II			09 Hrs
Freight Demand Estimation: Operations, Planning - purpose, process, Data, Freight Agents, costs, Planning Models and Methods-freight demand estimation and forecasting at the regional and urban level, Freight Generation and Freight Trip Generation, Trend and time series models, freight trip rate models, IO model			
Unit –III			08 Hrs
Freight Transport Planning and Operations: Freight supply – capacity issues; freight productivity and performance; distribution of freight flows; production/consumption to origin/destination, competing modes for specific commodity choice, route planning, scheduling, collection storage, distribution centres, regulation, and enforcement of freight transport.			
Unit –IV			09 Hrs
Logistics and Planning Strategies: Context of Logistics- Activities of Logistics, Aims of Logistics, Importance of Logistics, Current Trends in Logistics; Logistics Strategy- Strategic Decisions, Logistics Strategy, designing a Logistics Strategy; Locating Facilities- Importance of Location, Choosing the Geographic Region, Infinite Set Approaches, Feasible Set Approaches, Network Models, Location Planning; Planning Resources- Types of Planning, Capacity Planning, Adjusting Capacity, Tactical Planning, Schedules			
Unit –V			08 Hrs
Emerging Trends and Case Studies in Transportation Logistics: Sustainable and Green Logistics, Digital Transformation in Logistics-IoT, big data analytics, AI, and blockchain in logistics management. Case Studies and Real-World Applications: Case studies on logistics and transportation from various sectors. Analysis of successful logistics systems and lessons learned.			

Course Outcomes	
CO1	Explain the characteristics, components, and current trends in freight transportation and logistics
CO2	Analyze and apply freight demand estimation methods and logistics planning strategies for urban and regional transport systems
CO3	Evaluate freight transport systems and logistics networks with respect to performance, capacity, sustainability, and regulation
CO4	Design integrated freight and logistics solutions using data-driven models, technology, and strategic planning approaches



Reference Books	
1	M. Ben-Akiva, H. Meersman, and E. V. de Voorde, "Freight Transport Modelling" Bingley, U.K.: Emerald Group Publishing, ISBN-13: 9781781902851,2013.
2	P. K. Sarkar, V. Maitri, and G. J. Joshi, "Transportation Planning: Principles, Practices and Policies", 3rd ed. New Delhi, India: PHI Learning, ISBN : 9788195161188, 2024
3	L. Tavasszy and G. de Jong, "Modelling Freight Transport". 1st ed. Amsterdam, Netherlands: Elsevier, ISBN-13: 9780124104006,2013.
4	M. Al-Azzawi, "Freight and Logistics Transport Modelling and Planning: Mathematical Theories and Practical Applications for the Analysis and Forecasting of Freight Transport Systems". Saarbrücken, Germany: LAP Lambert Academic Publishing, ISBN-13: 9783848428380,2012

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 AND PRACTICE)		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: VII					
IoT FOR SMART SYSTEMS					
Category : Institutional Elective – II (Group G)					
(Theory)					
Course Code	:	EC375TGI		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 IoT and Networking Basics					
IoT Architecture Layers (Perception, Network, Application), Overview of Networking Basics: TCP/IP, OSI Model, Wireless Concepts, Device Addressing: IPv4, IPv6, 6LoWPAN, IoT orchestration primitives, IoT Open-Source platforms.					
Unit – II					09 Hrs
IoT Communication Models and Protocols					
Smart Manufacturing-OPC-UA interfacing, Deterministic Ethernet & Time Sensitive Network, PLC gateways, MQTT-Sparkplug B, Predictive maintenance dashboard design with AI-based Optimization.					
Smart Construction Site: MQTT with QoS for equipment-telemetry and asset tracking, Edge gateway (rugged fog node) with aggregating sensor feeds (On-site construction).					
Unit –III					09 Hrs
IoT Networking Technologies					
Smart Healthcare: IEEE 802.15.6 BLE Body Area Networks, NFC for patient data access and device pairing, HL7 and FHIR standards for health data exchange.					
Smart Mobility: Next-gen V2X, LTE-M for roadside units and environmental sensors, Edge-cloud split for traffic-signal optimization, LPWAN & NB-IoT with link-budget exercise.					
Unit –IV					09 Hrs
IoT Software Stack					
Smart Agriculture Systems:					
Device Layer: Sensor nodes run on MCUs with firmware enabling periodic sensing, sleep scheduling, and uplink messaging over LPWAN. Network Layer: Embedded Operating Systems for IoT (Free RTOS). Middleware Layer: Gateway running rule engine and device management, Device abstraction and Service Enablement, Secure bootloaders for wireless firmware updates in remote farms. Application Layer: Web/mobile dashboard for farmers with real-time alerts and analytics, Things Board for drag-and-drop rule engine.					
Unit –V					09 Hrs
Interoperability and Standardization in Practice: Challenges of integrating multi-vendor IoT devices, Interoperability issues in AI-Enabled IoT Deployments, Data Semantics & Model Portability, AI Bias & Fairness Across Domains, Security of AI pipelines, GDPR compliance & data retention policies in IoT platforms.					

Course Outcomes	
CO1	Develop a conceptual framework of IoT architectural layers and connectivity models.
CO2	Analyze IoT-specific communication models, protocols, and networking technologies.
CO3	Apply AI techniques for IoT communication optimization and network intelligence.
CO4	Evaluate secure, energy-efficient IoT networks with intelligent features.



Reference Books	
1.	Internet of Things: Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufmann Publishers, 2nd Edition, 2024, ISBN: 978-0-323-99167-2
2.	Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Florian Michahelles Springer, 2nd Edition, 2023 ISBN: 978-3-031-10318-4
3.	IoT Applications for Next-Generation Smart Systems, D. Giusto et al., Springer, 2024, ISBN: 978-1-799-87541-3
4.	Artificial Intelligence for the Internet of Everything, William Lawless, Ranjeev Mittu, Donald Sofge Academic Press, 2023 ISBN: 978-0-12-820600-1

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 AND PRACTICE)		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: VII			
E-MOBILITY			
Category : Institutional Elective – II (Group G)			
(Theory)			
Course Code	:	EE375TGJ	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	45L	SEE Duration : 3 Hours
Unit-I			09 Hrs
History, Basics of Electric Vehicles, Components of Electric Vehicle, General Layout of EV, EV classification: Battery Electric Vehicles (BEVs), Hybrid Electric Vehicle (HEV), Fuel-Cell Electric Vehicles (FCEVs) Comparison with Internal Combustion Engine: Technology, Advantages & Disadvantages of EV, National Policy for adoption of EVs.			
Unit – II			09 Hrs
Electric Drive-Trains: Introduction to various electric drive-train topologies in EV and HEV, Power flow control in electric drive-train topologies, classification of electric machines used in automobile drivetrains. E-Motor Drives Configuration (Control Block diagrams): Induction Motor Drive, Permanent Magnet (PM) motor Drive & Switched Reluctance Motor (SRM) Drive.			
Unit –III			09 Hrs
Battery Energy Storage: Types of Battery, Introduction to Electrochemical Battery, Electrochemical Reactions, Battery Parameters: Battery Capacity, Discharge Rate, Charging Rate, SOC, SOD, SOH, DOD, Specific Energy, Specific Power, Energy Efficiency. Battery Management Systems (BMS): Introduction to BMS, Objectives of the BMS: Discharging control, Charging control, Cell Balancing; BMS topologies: Distributed Topology, Modular Topology and Centralized Topology.			
Unit –IV			09 Hrs
Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage, Fuel Cell based energy storage, Super Capacitor based energy storage, Hybridization of different energy storage devices. Introduction to BMS and its topologies. Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, Classification of different energy management strategies, Comparison of different energy management strategies and implementation issues of energy management strategies.			
Unit –V			09 Hrs
Charging Infrastructure: Basic Requirements for Charging System, Charger Architectures, Grid Voltages, Frequencies, and Wiring, Charging Standards and Technologies, SAE J1772. On-board chargers and Off-board chargers, Topologies and Standards, Types of Charging Station Charging Station Placement for Electric Vehicles: A Case Study.			



Course Outcomes		
CO1	Analyze the basics of electric and hybrid electric vehicles, their architecture, technologies and modelling.	
CO2	Analyze various electric drives suitable for electric vehicles.	
CO3	Discuss and implement different energy storage technologies used for electric vehicles and their management system.	
CO4	Analyze various charging methods, requirements, standards and types of charging for EV and HEV.	
Reference Books		
1.	Modern Electric Vehicle Technology C.C. Chan and K.T. Chau, 1st Edition, 2001, Oxford university press, ISBN 0198504160.	
2.	Battery Management system for large Lithium Battery Packs, Davide Andrea, 1st Edition, 2010, ARTECH HOUSE, ISBN-13 978-1-60807-104-3.	
3.	Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, John G. Hayes, G. Abas Goodarzi, 1st Edition, 2018, Wiley, ISBN 9781119063667.	
4.	Hybrid Vehicles from Components to System, F. BADIN, Ed, 1st Edition, 2013, Editions Technip, Paris, ISBN 978-2-7108-0994-4.	
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 AND PRACTICE)		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: VII			
DISEASE AND DIAGNOSTICS AN ENGINEERING PERSPECTIVE			
Category : Institutional Electives -II (Group G)			
(Theory)			
Course Code	:	EI375TGK	CIE : 100 Marks
Credits: L:T:P	:	03:00:00	SEE : 100 Marks
Total Hours	:	45L	SEE Duration : 03 Hrs
Unit-I			09 Hrs
Cardiovascular System (CVS) - Functioning of CVS, Generation of Bio-Potentials of CVS, Common cardiovascular ailments. - Arrhythmias, Hypertension, Coronary vascular Diseases, Diagnostic devices- ECG, ECHO. Coronary Angiogram. Implantable devices: Pacemaker.			
Unit – II			09 Hrs
Respiratory System (RS) - Functioning of RS, Common ailments in RS, Lung volume and capacity, Diagnostic Devices- Spirometer and its recent advances, PPG Signals and its application in RS.			
Unit –III			09 Hrs
Renal System - Functioning of Renal System, Common diseases of Renal System, Diagnostics- Ultrasound and its application in Renal System. Therapeutic- Dialysis and its types. Bio-Markers in Renal System, Emerging dialysis technologies: Wearable artificial kidney.			
Unit –IV			09 Hrs
Central Nervous System (CNS) - Basics of CNS functioning, Common ailments, Diagnostics methods-EEG, Electrode Systems, Role of CT scans and MRI. Brain-Computer Interfaces (BCI): Basic concepts and diagnostic/therapeutic potential.			
Unit –V			09 Hrs
Introduction to Artificial Intelligence (AI) in Healthcare - Overview of AI, Machine Learning, Deep Learning, Need for AI in healthcare, Types of data in healthcare: structured, unstructured., Challenges of AI deployment: Data bias, privacy, and integration in clinical workflow.			

Course Outcomes	
CO1	Understand the basic functioning and common disorders of cardiovascular, respiratory, renal, and nervous systems.
CO2	Understand the working principles and clinical relevance of diagnostic devices such as ECG, EEG, spirometer, ultrasound, and imaging systems.
CO3	Analyze biomedical signals and interpret their significance in the diagnosis and monitoring of diseases.
CO4	Evaluate the potential and limitations of emerging technologies such as wearable devices, Brain-Computer Interfaces, and AI in healthcare applications.
Reference Books	
1.	Handbook of Biomedical Instrumentation, R. S. Khandpur, 3 rd Edition, Reprint 2016, Tata McGraw-Hill, ISBN: 9780070473553.
2.	Biomedical Instrumentation and Measurements, Leslie Cromwell & others, 2 nd Edition, Reprint 2015, ISBN: 9780130771315.
3.	Introduction to Biomedical Equipment Technology, Joseph J. Carr and John M. Brown, 4 th Edition, 2000, Pearson, ISBN:978-0130104922.
4.	Medical Instrumentation Application and Design, John G. Webster, 4 th Edition, 2010, ISBN 13: 978- 0471-67600-3.



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: VII					
Space Technology and Applications					
Category : Institutional Elective (Group-G)					
(Theory)					
Course Code	:	ET375TGL		CIE	: 100 Marks
Credits: L:T:P	:	3:0:0		SEE	: 100 Marks
Total Hours	:	45L		SEE Duration	: 03 Hours

UNIT – I					9 Hours
Orbits and Launching Methods: Kepler’s Laws, Orbital Elements and Perturbations, Inclined Orbits Antenna Look Angles, Earth Eclipse of Satellite, Sun Transit Outage.					
Launch Vehicles: Rocketry, Propellants, Propulsion, Combustion, Solid, Liquid and Cryogenic engines, Control and Guidance system, Ion propulsion and Nuclear Propulsion.					
UNIT – II					9 Hours
Satellite Sub-Systems: Classification of satellites., Payloads, Subsystems-Altitude and orbit control system, TT&C Sub-System, Power Systems.					
Communication sub systems: Transponder, Satellite antennas and Parameters, Satellite Antennas in Practice					
UNIT – III					8 Hours
Satellite Communications: LEO, MEO and GEO orbits, Multiple Access Techniques. -TDMA, FDMA and CDMA					
Space applications: Telephony, V-SAT, DBS system, Satellite Radio and TV, Tele-Education, Tele-medicine, Satellite navigation, GPS					
UNIT – IV					8 Hours
Remote Sensing: Remote Sensing – An Overview, Classification of Satellite Remote Sensing Systems, Remote Sensing Satellite Payloads, Sensor Parameters. Image processing techniques, Remote sensing cameras.					
Applications of Remote Sensing Satellites: - Land Cover Classification, Land Cover Change Detection Water Quality Monitoring and Management, Flood Monitoring, weather modelling, Cyclone predictions, Disaster and flood warning, rainfall predictions using satellites.					
UNIT – V					8 Hours
Space Missions: Technology missions, deep space planetary missions, Lunar missions, zero gravity experiments, space biology and international space Missions.					
Advanced space systems: planetary payloads, space shuttle, space station, Inter-space communication systems.					

Course Outcomes: After going through this course the student will be able to:					
CO1	:	Explore the different types of satellites, their orbital mechanics and associated subsystems.			
CO2	:	Apply the basics of launching vehicles, satellites and sub systems for space applications.			
CO3	:	Identify the applications of satellite in the Various areas such as communication, remote sensing, metrology etc.			
CO4	:	Analyze the technology trends, satellite missions and advanced space systems.			



Reference Books	
1.	Satellite Communications, Dennis Roddy, W. Linwood Jones, Jones Linwood, David G. Long, 5ed, McGraw Hill Education, 2024, ISBN-10: 1265372543
2.	Fundamentals of Satellite Communication, K N Raja Rao, PHI, 2012, ISBN: 9788120324015.
3.	Satellite Communication, Timothy Pratt, John Wiley, 3ed, 2019, ISBN: 978-1-119-48217-8
4.	Remote sensing and applications, B C Panda, VIVA books Pvt. Ltd., 2009, ISBN: 108176496308.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
Sl. No.	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, and Final Quiz 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		100

RUBRICS FOR SEMESTER END EXAMINATION (SEE-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: Question 2	16
3 & 4	Unit 2: Question 3 or 4	16
5 & 6	Unit 3: Question 5 or 6	16
7 & 8	Unit 4: Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
MAXIMUM MARKS FOR THE SEE		100



Semester: VII					
PROJECT MANAGEMENT					
Category : Institutional Elective – II (Group G)					
(Theory)					
Course Code	:	IM375TGM		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: Project, Project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge.					
Generation and Screening of Project Ideas: Generation of ideas, monitoring the environment, corporate appraisal, scouting for project ideas, preliminary screening, project rating index, sources of positive net present value.					
Unit – II					09 Hrs
Project Scope Management: Project scope management, collect requirements define scope, create Work Breakdown Structure, validate scope, control scope.					
Organizational influences & Project life cycle: Organizational influences on project management, project state holders & governance, project team, project life cycle.					
Unit –III					09 Hrs
Project Integration Management: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.					
Project Quality management: Plan quality management, perform quality assurance, control quality.					
Unit –IV					09 Hrs
Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk.					
Project Scheduling: Project implementation scheduling, Effective time management, Different scheduling techniques, Resources allocation method, Project life cycle management concepts. Project life cycle costing.					
Unit –V					09 Hrs
Latest Trends and Open-Source Tools in Project Management: Agile and Hybrid Project Management Approaches, Digital Transformation in Project Management, Sustainability and ESG in Project Management, Overview and Classification of PM Software, Introduction and Demonstration of Key Open-Source Tools.					

Course Outcomes	
CO1	Understand the fundamental concepts of project management and its relationship with organizational strategy, operations management, and business value.
CO2	Apply techniques for generating, screening, and evaluating project ideas, considering factors such as net present value and project rating index.
CO3	Create Work Breakdown Structures (WBS), utilization of PERT/CPM for developing project schedule, alongside requirement collection, scope definition, scope validation, and scope control.
CO4	Develop skills in project integration, quality, risk management, and scheduling, enabling effective project planning, execution, monitoring, and control.



Reference Books	
1.	Project Management Institute, “A Guide to the Project Management Body of Knowledge (PMBOK Guide)”, 5th Edition, 2013, ISBN: 978-1-935589-67-9
2.	Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.
3.	Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.
4.	Rory Burke, “Project Management – Planning and Controlling Techniques”, John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

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 AND PRACTICE)		100

RUBRICS 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: VII						
GLOBAL SUPPLY CHAIN MANAGEMENT						
Category: Institutional Elective – II (Group G)						
(Theory)						
Course Code	:	IM375TGN		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45L		SEE Duration	:	3 Hours
UNIT-I					09 Hrs	
Building a Strategic Frame Work to Analyze Supply Chains: Definition and Objective of Supply Chain, the importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of Supply Chains. Competitive and Supply Chain Strategies, Achieving Strategic fit, Expanding Strategic Scope. Drivers of Supply Chain Performance, Frame work for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing, Infrastructure, International Logistics.						
UNIT – II					09Hrs	
Designing The Supply Chain Network: The Role of Distribution in the Supply Chains, Factors influencing Distribution Network design, Design Options for a Distribution Network, Online sales and the Distribution network, Distribution Networks in practice. Factors influencing network design decisions, Framework for Network design decisions, The impact of Globalization on Supply Chain networks. Designing And Planning Transportation Networks: The role of transportation in a Supply chain, Modes of transportation and their performance characteristics, Transportation infrastructure and policies, Design options for a transportation network, Trade-offs in transportation design, Tailored transportation, The role of IT in transportation, Problems.						
UNIT –III					09Hrs	
Planning and Managing Inventories in a Supply Chain: The Role of Cycle inventory in a Supply Chain, Economies of Scale to Exploit Fixed costs, Managing Multi-echelon Cycle Inventory. The Role of Safety Inventory in a Supply Chain, Determining appropriate level of Safety inventory, Impact of supply Uncertainty on Safety inventory, Impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, Managing Safety Inventory in a Multi-echelon Supply Chain, The Role of IT in inventory management. Problems						
Unit –IV					09Hrs	
Sourcing Decisions in A Supply Chain: The role of sourcing in a supply chain, in-house or outsource, Third-and Fourth-party logistics providers, Total cost of Ownership, Supplier Selection-Auctions and Negotiations, Sharing Risk and Reward in the Supply chain, Ethical Sourcing. Pricing and Revenue management in Supply Chain: The role of pricing and revenue management in supply chain, pricing and revenue management for multiple customer segments, pricing and revenue management for perishable assets, pricing and revenue management for seasonal demand and role of IT in pricing and revenue management.						
UNIT –V					09 Hrs	
Digital Supply Chain: The role of IT in a supply chain, the supply chain IT framework, the supply chain macro processes, Lack of Supply Chain co-ordination and the Bullwhip effect, managerial levers to achieve coordination, continuous replenishment and vendor-managed inventories, collaborative planning, forecasting and replenishment (CPFR).						



Course Outcomes	
CO1	Understand supply chain concepts, systemic and strategic role of SCM in global competitive environment.
CO2	Evaluate alternative supply and distribution network structures using optimization models.
CO3	Develop optimal sourcing and inventory policies in the supply chain context.
CO4	Select appropriate information technology frameworks for managing supply chain processes.

Reference Books	
1	Supply Chain Management – Strategy, Planning & Operation, Sunil Chopra, Peter Meindl & D V Kalra, 6 th Edition, 2016, Pearson Education Asia; ISBN: 978-0-13-274395-2.
2	Supply Chain Management – Creating Linkages for Faster Business Turnaround, Sarika Kulkarni & Ashok Sharma, 1 st Edition, 2004, TATA Mc Graw Hill, ISBN: 0-07-058135-5
3	Designing & Managing the Supply Chain – Concepts Strategies and Case Studies, David Simchi Levi, Philip Kaminsky, Edith Simchi Levi & Ravi Shankar, 3 rd Edition, 2008, Mc Graw Hill, ISBN: 978- 0-07-066698-6
4	Modelling the Supply Chain, Jeremy F Shapiro, 2 nd Edition, 2009, Cengage Learning, ISBN 0-495-12609-8.

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 AND PRACTICE)		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: VII						
STATISTICAL METHODS FOR ENGINEERS						
Category: Institutional Elective – II (Group G)						
(Theory)						
Course Code	:	MA375TGO		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	
Multiple Linear Regression:						
Introduction to multiple linear regression model, Least squares estimation of the parameters, Matrix approach to multiple linear regression, Properties of the least squares estimators, Hypothesis tests -Test for significance of regression, Tests on individual regression coefficients, Confidence intervals - Confidence intervals on individual regression coefficients, Confidence interval on the mean response, Polynomial regression models.						
Unit – II					09 Hrs	
Design and Analysis of Single-Factor Experiments:						
Designing Engineering Experiments, Completely Randomized Single-Factor Experiment, Analysis of Variance (ANOVA), Multiple Comparisons following the ANOVA, Residual analysis and model checking, The random-effects model, Randomized complete block design - design and statistical Analysis						
Design of Experiments with Several Factors:						
Introduction, Factorial experiments, Two-factor factorial experiments, one observation per cell, General factorial experiments - 2^k Factorial designs, 2^2 Design, 2^k Design for $k \geq 3$ factors.						
Unit –III					09 Hrs	
Discriminant Analysis and Factor Analysis:						
Introduction, Linear Discriminant Model, Linear discriminant function, Discriminant analysis, Principal Component, Factor Analysis, Principal Components versus Factor Analysis, Applications.						
Conjoint Analysis:						
Introduction, Additive tables, Multiplicative tables, Computing table margins based on an additive model, Applied conjoint analysis.						
Unit –IV					09 Hrs	
Decision Trees and Clustering:						
Introduction, Basic tree model, Categorical or Quantitative Predictors, Decision Trees, Regression Trees, Bias-Variance Tradeoff, Pruning and Cross-Validation, Loss functions.						
Cluster Analysis-Introduction, Types of Clustering, Correlations and Distances, Hierarchical Clustering, Partitioning via k-means.						
Unit –V					09 Hrs	
Time Series Analysis:						
Time series analysis-Trend, Seasonality, Noise decomposition, Autocorrelation, Stationarity, Lag features, Overview of Autoregressive (AR), Moving Average (MA), Autoregressive Integrated Moving Average (ARIMA) models.						

Course Outcomes:	
CO1	Apply fundamental concepts of multiple regression, design of experiments to analyze and interpret data in discriminant analysis, factor analysis, conjoint analysis, and statistical learning methods.
CO2	Analyze and interpret data using regression, experimental design, and multivariate techniques, and apply suitable statistical learning models to real-world problems.



CO3	Estimate model parameters and interpret results for multiple linear regression, ANOVA, discriminant analysis, factor analysis, and conjoint analysis to support data-driven decision-making using statistical learning techniques.
CO4	Implement multiple linear regression, ANOVA, discriminant analysis, factor analysis, conjoint analysis and time series analysis to support decision-making using statistical methods for solving engineering problems.

Reference Books	
1	An Introduction to Multivariate Analysis, T. W. Anderson, 3 rd Edition, 2003, John Wiley & Sons, New Jersey, ISBN: 0-471-36091-0.
2	Douglas C. Montgomery and George C. Runger, “Applied Statistics and Probability for Engineers”, John Wiley & Sons, 7th Edition, 2019, ISBN: 9781119570615.
3	Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer Series in Statistics, 2nd Edition, 2009.
4	Richard A Jhonson and Dean W. Wichern, Applied Multivariate Statistical Analysis, 6 th Edition, Pearson Education, ISBN-13: 978-0-13-187715-3.
5	Statistics I, SYSTAT 10.2, ISBN 81-88341-04-5.

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. 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 (Two regular tests and one optional improvement test). 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: VII			
INDUSTRY 5.0			
Category: Institutional Elective (Group -G)			
(Theory)			
Course Code	:	ME375TGP	CIE : 100 Marks
Credits: L:T:P	:	3:0:0	SEE : 100 Marks
Total Hours	:	42 Hrs	SEE Duration : 3 Hours
Unit – I			06 Hrs
Evolution to Industry 5.0: Historical overview of industrial revolutions. Transition from automation-centric to human-centric manufacturing. Key drivers: personalization, sustainability, and resilience. Comparison between Industry 4.0 and Industry 5.0 frameworks.			
Unit -II			08 Hrs
Human-Machine Collaboration: Introduction to collaborative robots (cobots) and their applications. Designing ergonomic and safe human-robot workspaces. Augmented Reality (AR) and Virtual Reality (VR) in training and maintenance. Case studies on successful human-robot collaboration.			
Unit –III			08 Hrs
Advanced Digital Technologies: Digital twins and their role in predictive maintenance and system optimization. Integration of AI and machine learning in manufacturing processes. Cyber-Physical Systems (CPS) and their applications. Edge computing and real-time data analytics.			
Unit –IV			10 Hrs
Sustainable and Resilient Manufacturing: Principles of sustainable manufacturing and circular economy. Life Cycle Assessment (LCA) and its importance in product design. Strategies for building resilient supply chains. Regulatory frameworks and standards for sustainable practices.			
Unit - V			10 Hrs
Implementation and Case Studies: Roadmap for transitioning to Industry 5.0. Challenges and solutions in adopting Industry 5.0 principles. Case studies from automotive, aerospace, and electronics industries. Future trends and research directions in Industry 5.0.			

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess the challenges of implementing Industry 5.0 principles in diverse industrial applications.
CO2	Analyze the strategies for transitioning from Industry 4.0 to Industry 5.0 in human-centric manufacturing systems.
CO3	Evaluate the benefits of integrating collaborative technologies and sustainable practices in smart manufacturing.
CO4	Examine the role of human-machine collaboration and ethical data-driven decision-making in achieving resilient and adaptive production systems.



Reference Books	
1.	Industry 5.0: The Future of the Industrial Economy, Uthayan Elangovan, 2022, CRC Press, 1 st Edition, ISBN: 9781032041278 (Unit I)
2.	Industry 5.0: Concepts and Strategies for Digital Transformation, Kaswan, Rathi, Garza-Reyes, 2025, CRC Press, 1 st Edition, ISBN: 9781032878218 (Unit II, V)
3.	Industry 5.0: Design, Standards, Techniques and Applications for Manufacturing, Leong, 2024, The IET, 1 st Edition, ISBN: 9781837240098 (Unit IV)
4.	Towards Industry 5.0, Durakbasa, Gencyilmaz, 2022, Springer, 1 st Edition, ISBN: 9783031244568 (Unit III, V)
5.	Intelligent Manufacturing: Smart Choice, Sunil Kumar Wadhwa, 2023, ISBN: 9781802279153

RUBRICS 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 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 (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE THEORY		100

RUBRICS 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



Semester: VII				
PRINCIPLES OF ASTROPHYSICS				
Category: Institutional Elective – II (Group G)				
(Theory)				
Course Code	:	PY375TGQ	CIE	: 100 Marks
Credits: L:T:P	:	3:0:0	SEE	: 100 Marks
Total Hours	:	42L	SEE Duration	: 3 Hours
Unit-I				08 Hrs
<p>The Celestial Sphere: The Geocentric Universe, Retrograde motion, The Copernican revolution, The celestial sphere, Altitude–Azimuth and Equatorial Coordinate System, Precession.</p> <p>Celestial Mechanics: Kepler’s Laws of Planetary Motion from Newton’s laws of mechanics, Position in the Orbit.</p> <p>Spectrum of Light: Stellar parallax, The magnitude scale, Apparent and Absolute Magnitude, Blackbody radiation and temperature, Spectral lines - Kirchoff’s Laws, Spectrographs.</p>				
Unit – II				09 Hrs
<p>Special Relativity: Einstein’s postulates, The relativity of simultaneity, Time dilation, Length contraction, Galilean transformations, Lorentz transformations, Velocity transformation, Space-time diagrams and causality. Relativistic momentum and energy.</p> <p>General Relativity: The Principle of Equivalence, Gravitation as space-time curvature, (1) perihelion advance of planet Mercury, (2) gravitational red shift and (3) gravitational bending of light (qualitative).</p>				
Unit –III				08 Hrs
<p>Telescopes: Resolution and the Rayleigh Criterion, Aberrations, The Brightness of an Image and focal ratio, Refracting and Reflecting Telescopes, Adaptive Optics, Electronic Detectors - CCD, Radio Telescopes - Spectral Flux Density, Large Apertures and Interferometry, Infrared, Ultraviolet, X-Ray, and Gamma-Ray Astronomy.</p>				
Unit –IV				09 Hrs
<p>Stars: Stellar Spectra, The Harvard Spectral Classification, The Hertzsprung–Russell Diagram, Binary Stars and Stellar Masses - Classification of Binary Stars, Stellar Structure - Internal Equilibrium Conditions, The Sun - The Atmosphere, Solar Activity; Stellar Energy Sources - Nuclear Fusion Reactions, Stellar Evolution - Evolutionary Time Scales, The Contraction of Stars Towards the Main Sequence, The Main Sequence Phase, The Giant Phase, The Final Stages of Evolution - White Dwarfs, Neutron Stars, Black Holes.</p>				
Unit –V				08 Hrs
<p>Galaxies: The Classification of Galaxies, Masses, Galactic Structures, Structural Components of the Milky Way, Dynamics of Galaxies, Systems of Galaxies, The Origin and Evolution of Galaxies. The Interstellar Medium - Interstellar Dust, Interstellar Gas, Cosmic Rays.</p> <p>Cosmology: The Olbers Paradox, Hubble’s Law, Cosmic Microwave Background Radiation, History of the Universe, Astrobiology.</p>				



Course Outcomes	
CO1	Apply the principles of celestial mechanics to describe planetary motion, orbital dynamics, and gravitational interactions in astrophysical systems.
CO2	Interpret the foundational concepts of special relativity and analyse the implications of time dilation, length contraction, and relativistic mass in astronomical contexts.
CO3	Compare and evaluate different types of telescopes and their applications in various regions of the electromagnetic spectrum for observational astronomy.
CO4	Analyse the physical properties, life cycles, and classifications of stars using observational data and theoretical models.

Reference Books	
1.	Bradley W. Carroll, Dale A. Ostlie, An Introduction to Modern Astrophysics: United States Edition, Pearson; 1st edition (7 September 2017), ISBN-10: 1108422160
2.	H. Karttunen, P. Kröger, H. Oja, M. Poutanen, K. J. Donner (Eds.), Fundamental Astronomy, 5th Edition, Springer, 2007, ISBN 978-3-540-34143-7
3	Suresh Chandra Mohit Kumar, A Textbook of Astronomy and Astrophysics, Dreamtech Press, 1 Nov 2019, ISBN-10: 9389520908
4.	Padmanabhan, T., Theoretical Astrophysics, Vols.1-3, 2015, Cambridge University Press, ISBN-9780521016278
5.	Modern Cosmology, Academic Press Inc; 2nd edition, 7 July 2020, ISBN-10: 0128159480,
6.	Harwit, M. Astrophysical Concepts, 4th Edition, 2015, Springer-Verlag, ISBN-10 : 1441921990
7.	Shapiro, Stuart L., and Saul A. Teukolsky. Black Holes, White Dwarfs, and Neutron Stars, 1st Edition, 1983, Wiley, ISBN: 9780471873167

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 AND PRACTICE)		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: VII					
Mathematics of Music					
Category : Institutional Elective – II (Group G)					
(Theory)					
Course Code	:	MA375TGR	CIE	:	100 Marks
Credits: L:T:P	:	3:0:0	SEE	:	100 Marks
Total Hours	:	45L	SEE Duration	:	3 Hours
Unit-I					09 Hrs
Fundamentals of Sound and Musical Structure					
Nature of sound: frequency, amplitude, harmonics, waveforms; Musical pitch and logarithmic perception of frequency, Shruti, Swara, Saptak; Musical notation systems.					
Unit – II					09 Hrs
Tuning Systems and Modular Arithmetic in Music					
Pythagorean tuning, Just Intonation, and Equal Temperament, Circle of Fifths and the irrationality of $\log(3/2)$, Modular arithmetic and pitch class sets, Construction of scales: Melakarta Rāga(Carnatic) and Thaata (Hindustani) systems.					
Unit –III					09 Hrs
Rhythm, Tāla, and Combinatorial Structures					
Tāla systems: concepts of mātra, vibhāga, āvartana; Analysis of Carnatic tālas (Adi, Rupaka, Jhampa, etc.); Combinatorics of tāla patterns and variation (korvais, tihāis); Algorithmic composition of rhythmic phrases					
Unit –IV					09 Hrs
Timbre, Music Analysis and Processing					
Timbre and harmonic spectra, Fourier series and transforms in sound decomposition, Sub-harmonics, Limitation of Fourier Analysis: Noise; Introduction to sound synthesis and spectral envelopes.					
Unit –V					09 Hrs
Algorithmic Music and Perception					
Fractals and recursion in music, Algorithmic and generative composition, Mathematical models of musical perception, Psychoacoustics: pitch, consonance/dissonance, critical bands.					
Course Outcomes					
CO1	Analyze musical phenomena using mathematical tools				
CO2	Model rhythm, harmony, and timbre using algebraic and computational methods.				
CO3	Apply signal processing concepts to sound synthesis and analysis.				
CO4	Explore algorithmic and generative approaches to musical composition.				

Reference Books	
1.	Benson, D. J. (2006). <i>Music: A Mathematical Offering</i> . Cambridge University Press, ISBN: 978-0521619998.
2.	Fauvel, J., Flood, R., & Wilson, R. (Eds.). (2003). <i>Music and Mathematics: From Pythagoras to Fractals</i> . Oxford University Press, ISBN: 978-0199298938.
3.	Loy, G. (2006). <i>Musimathics: The Mathematical Foundations of Music</i> (Vol. 1 & 2). MIT Press, ISBN: 9780262516556.



4.	Sethares, W. A. (2005). <i>Tuning, Timbre, Spectrum, Scale</i> (2nd ed.). Springer, ISBN: 978-1852337971.
5	Radhika Iyer (2018), <i>Elements Of Indian Music: The Melakarta System</i> , ISBN: 1513460854.

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 AND PRACTICE)		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: VII				
Cognitive Psychology				
Category: Institutional Elective Course (Group G)				
Theory				
Course Code	:	HS375TGS	CIE	: 100
Credits: L:T:P	:	3:0:0	SEE	: 100
Total Hours	:	45 L	SEE Duration	: 3 Hours
Unit-I				09 Hrs
Fundamentals & current trends in cognitive psychology: Definition, Emergence of cognitive psychology, Cognitive development theories and perspectives; Current status and trends in cognitive Psychology. Research methods in cognitive psychology- goals of research. Distinctive research method. Current areas of research in cognitive psychology, (Educational application, marketing and advertisement).				
Unit – II				09 Hrs
Basic cognitive processes: Sensation and Perception: Sensory receptors and Brain, The constancies, pattern recognition, Modularity, Imagery: Characteristics of Imagery, Cognitive maps. Attention and Information processing: Nature and Types, Theories and models of attention. Neuropsychological studies of Attention. Consciousness: – meaning, Modern Theories and Contemporary Research of Consciousness.				
Unit –III				09 Hrs
Reasoning, Creativity and Problem- Solving: Reasoning definition, types, influencing factors. Creativity- definition, steps involved in creative process, obstacles involved in creativity, enhancing techniques of creativity. Meta cognition: Problem solving, steps in problem solving, types, methods, obstacles and aids of problem Solving.				
Unit –IV				09 Hrs
Psycholinguistics: Definition, characteristics of language, theories - Chomsky. Structure of Language (Properties), Stages in Language Development, Neurological Language. Comprehension and Production. Bilingualism, Multilingualism and Learning disability.				
Unit –V				09 Hrs
Cognitive Neuroscience: Definition and emergence of cognitive neuroscience, Scope of Neuroscience, structure and functions of Brain, Brain Plasticity, Intelligence and Neuroscience. Meta-cognitive strategies. Artificial intelligence, Robotics, Models on Information Processing.				

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Describe the basic theories, principles, and concepts of cognitive psychology as they relate to behaviour 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 reasoning, problem solving 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.



Reference Books	
1.	Sterberg R.J and Sternberg Karin (2012) Cognitive Psychology 6 th Edition Woods worth Cengage Learning
2.	Psychology-themes and variations, Wayne Weiten, IV edition, Brooks / Cole Publishing Co.
3.	Psychology Robert A. Baron, III edition (1995) Prentice Hall India.
4.	Understanding Psychology Feldman R. S, IV edition, (1996) McGraw Hill India

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		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: VII						
PRINCIPLES & PRACTICES OF CYBER LAW						
Category : Institutional Elective Course (Group G)						
Theory						
Course Code	:	HS375TGT		CIE	:	100
Credits: L:T:P	:	03 :0:0		SEE	:	100
Total Hours	:	45L		SEE Duration	:	3 Hours
Unit-I					09 Hrs	
<p>Introduction - Origin and meaning of Cyberspace; Introduction to Indian Cyber Law, Distinction between Cyber Crime and Conventional Crime, Cyber Criminals and their Objectives, Kinds of Cyber Crime& Cyber Threats, challenges of cybercrimes, Overview of General Laws and Procedures in India.</p> <p>Cyber Jurisdiction-Concept of Jurisdiction, Jurisdiction in Cyberspace, Issues and concerns of Cyberspace Jurisdiction in India, International position of Cyberspace Jurisdiction, Judicial interpretation of Cyberspace Jurisdiction.</p> <p>Activities: Case Studies and Practical Applications</p>						
Unit – II					09 Hrs	
<p>Information Technology Act: A brief overview of Information Technology Act 2000, IT Act 2000 vs. IT Amendment Act 2008, Relevant provisions from Indian Penal Code, Indian Evidence Act, Bankers Book Evidence Act, Reserve Bank of India Act, etc.</p> <p>Electronic Signature and Digital Signature- Meaning & Concept of Relevance of Signature, Handwritten signature vs Digital Signature, Technological Advancement and development of signature, Digital Signature: IT Act, 2000, Cryptography, Public Key and Private Key, Public Key Infrastructure Electronic Signature vs. Digital Signature, E-Commerce under IT Act2000, Issues and challenges of E-Commerce.</p> <p>Activities: Case Studies and Practical Applications</p>						
Unit –III					09 Hrs	
<p>Data Protection and Privacy Concerns in Cyberspace - Need to protect data in cyberspace, Types of data, Legal framework of data protection, Data protection bill -an overview, GDPR, Concept of privacy, Privacy concerns of cyberspace, Constitutional framework of privacy, Judicial interpretation of privacy in India.</p> <p>Data Privacy and Data Security- Defining data, meta-data, big data, non- personal data. Data protection, Data privacy and data security, Data protection regulations of other countries- General Data Protection Regulations (GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., social media- data privacy and security issues.</p> <p>Activities: Case Studies and Practical Applications</p>						
Unit –IV					09 Hrs	
<p>IP Protection Issues in Cyberspace</p> <p>Copyright Issues in Cyberspace- Copyright infringement in digital environment. Indian legal protection of copyright in cyberspace.</p> <p>Trademark Issues in Cyberspace -Domain Name Vs Trademark, Domain Name dispute and Related Laws, Different Form of Domain in Cyberspace.</p> <p>Patent Issues in Cyberspace-Legal position on Computer related Patents - Indian Position on Patents.</p> <p>Activities: Case Studies and Practical Applications</p>						
Unit –V					09 Hrs	



Digital Forensics- Computer Forensics, Mobile Forensics, Forensic Tools, Anti-Forensics
Cyber Crime & Criminal Justice Agencies -Cyber Crime Cells, Cyber Crime Appellate- Cyber Crime Investigation, Investigation Procedure- FIR -Charge Sheet

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

CO1	Understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
CO2	Build in Depth Knowledge of Information Technology Act and Legal Frame Work of Right to Privacy, Data Security and Data Protection.
CO3	Identify the bone of contentions of cybercrime investigation techniques, evaluate problem-solving strategies, and develop science-based solutions.
CO4	Develop an Understanding of the Relationship Between E-Commerce and Cyberspace.

Reference Books

1.	Cyber Law by Dr. Pavan Duggal Publisher: LexisNexis, ISBN-10: 8196241070, ISBN-13: 978-8196241070
2.	Introduction to Information Security and Cyber Laws by Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla ASIN: 9351194736, Publisher: Dream tech Press, ISBN-10: 9789351194736, ISBN-13: 978-9351194736.
3.	Cyber Forensics in India: A Legal Perspective by Nishesh Sharma, 1 st Edition, ISBN: 9788131250709.
4.	Cyber Laws, Justice Yatindra Singh, 6 th Edition, Vol. 1, ISBN: 9789351437338

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 AND PRACTICE)		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: VII						
SUMMER INTERNSHIP						
Course Code	:	CY376SI		CIE	:	100 Marks
Credits: L:T:P	:	0:0:3		SEE	:	100 Marks
No. of Weeks	:	08		SEE Duration	:	3 Hours
GUIDELINES						
<p>1. The duration of the internship shall be for a period of 8 weeks on full time basis after VI semester final exams and before the commencement of VII semester.</p> <p>2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.</p> <p>3. Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.</p> <p>4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.</p> <p>5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry / organizations.</p> <p>6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Ivory color for UG circuit Programs and Light Blue for Non-Circuit Programs.</p> <p>7. The broad format of the internship final report shall be as follows</p> <ul style="list-style-type: none"> • Cover Page • Certificate from College • Certificate from Industry / Organization • Acknowledgement • Synopsis • Table of Contents • Chapter 1 - Profile of the Organization: Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices, • Chapter 2 - Activities of the Department • Chapter 3 - Tasks Performed: summary of the tasks performed during 8-week period • Chapter 4 – Reflections: Highlight specific technical and soft skills acquired during internship • References & Annexure 						
<p>Course Outcomes: After going through the internship the student will be able to: CO1: Apply Engineering and Management principles CO2: Analyze real-time problems and suggest alternate solutions CO3: Communicate effectively and work in teams CO4: Imbibe the practice of professional ethics and need for lifelong learning.</p>						
<p>Scheme of Continuous Internal Evaluation (CIE):</p> <p>The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews. The evaluation criteria shall be as per the rubrics given below:</p>						
Reviews	Activity				Weightage	

Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments.	50 Marks
Review - II	Importance of resource management, environment and sustainability, presentation skills and report writing	50 Marks

Scheme for Semester End Evaluation (SEE):

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

Scheme of Evaluation for SEE	
Particulars	%Marks
Project Synopsis (Initial Writeup)	10%
Project Demo/Presentation	30%
Methodology and Results Discussion	30%
Project Work Report	10%
Viva-voce	20%
Total	100

Semester: VIII					
MAJOR PROJECT					
Course Code	:	CY481P		CIE	: 100 Marks
Credits: L:T:P	:	0:0:12		SEE	: 100 Marks
Hours/Week	:	24		SEE Duration	: 03 Hours

GUIDELINES

1. The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester.
2. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Batch Formation:

- Students are free to choose their project partners from within the program or 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 / Industry / R & D Institution. The project work is to be carried out by a team of two to four students, in exceptional cases where a student is placed in a company and offered an internship through the competitive process or student is selected for internship at national or international level through competitive process, the student can work independently.
- The students are allowed to do either a project for full 5 days in the industry or full 5 days in the college.
- In case the project work is carried out outside Bengaluru, such students must be available during Project Evaluation process scheduled by the respective departments and they must also interact with their guide regularly through Email / Webinar / Skype etc.

Project Topic Selection:

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

Students can select courses in NPTEL from the discipline of Humanities and Social Sciences, Management, Multidisciplinary and Design Engineering. The course chosen could be either of 4w/8w/12w duration. The students need to enrol for a course, register for the exam and submit the e-certificate to the department, as and when it is released by NPTEL. The same will be considered as one of the components during project evaluation of phase 2 and phase 5.

Project Evaluation:

- Continuous monitoring of project work will be carried out and cumulative evaluation will be done.
- The students are required to meet their internal 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 Internal Guide regularly.
- In case of Industry project, during the course of project work, the internal guides will have continuous interaction with external guides and will visit the industry at least twice during the project period.

- For CIE assessment the project groups must give a final seminar 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.
- Before the final evaluations the project group is required to produce a No dues certificate from Industry, Central Library and Department.

Course Outcomes:

After going through the major project the student will be able to:

CO1: Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.

CO2: Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.

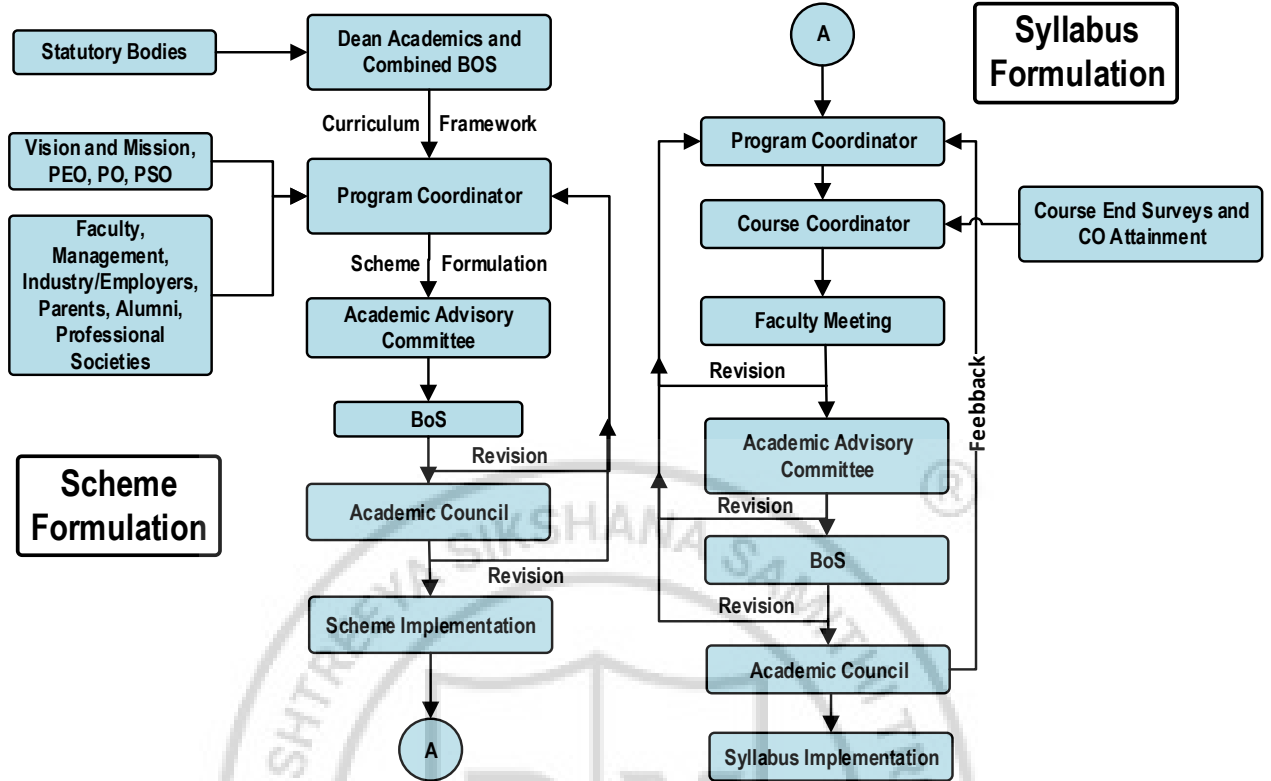
CO3: Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.

CO4: Function effectively as an individual, or leader in diverse teams, with the understanding of professional ethics and responsibilities.

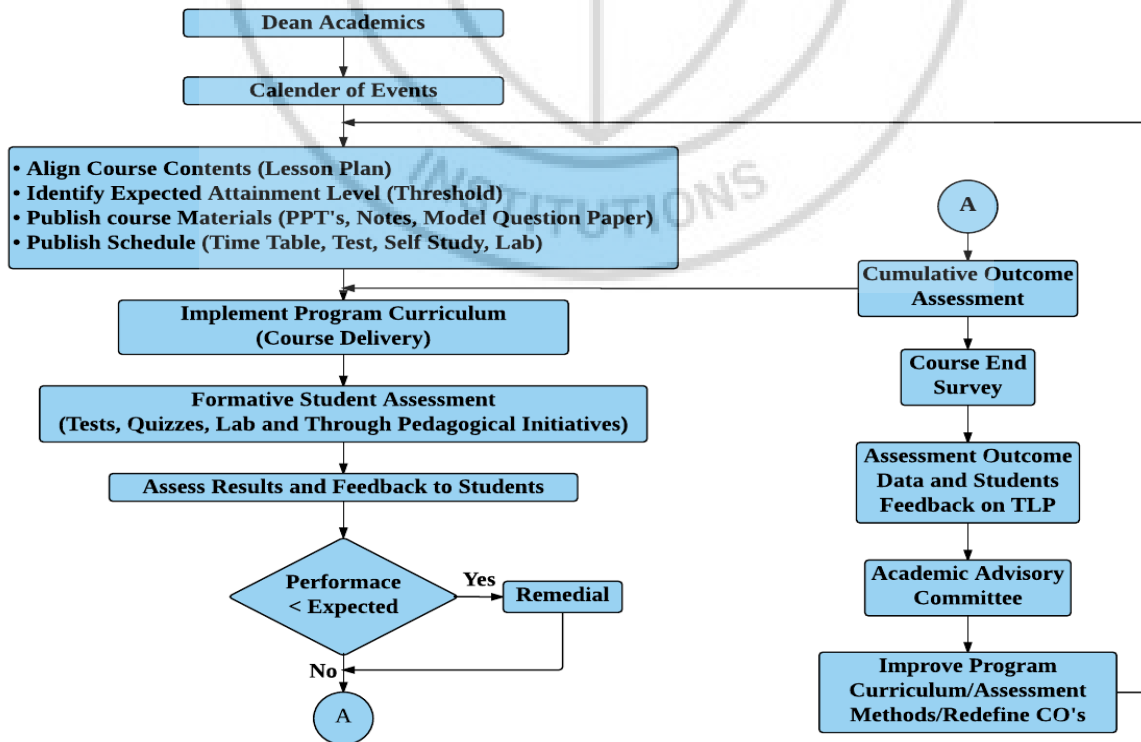
Scheme of Continuous Internal Evaluation (CIE):

Scheme of Evaluation for CIE		Scheme of Evaluation for SEE	
Particulars	%Marks	Particulars	%Marks
Project Evaluation I	10%	Project Synopsis (Initial Writeup)	10%
Project Evaluation II	20%	Project Demo/Presentation	25%
Project Evaluation III	25%	Methodology, Results and Discussion	25%
Project Evaluation Phase-IV (Submission of Draft Project Report for Verification) (Project Final Internal Evaluation)	25%	Project Work Report	15%
Publication	20%	Viva-voce	25%
Total	100	Total	100

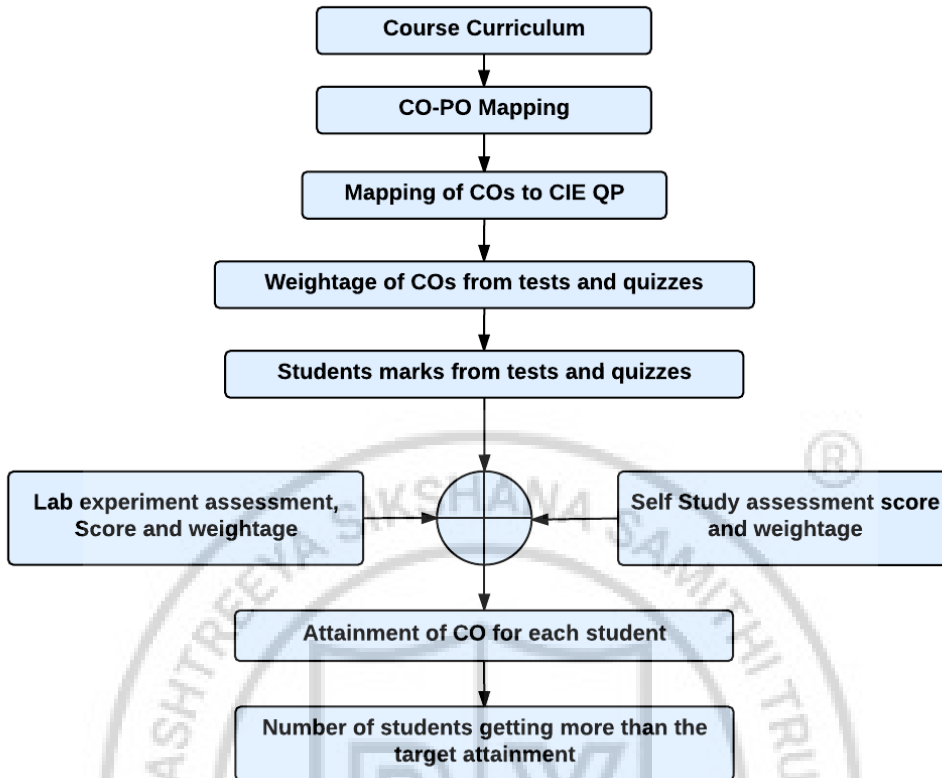
Curriculum Design Process



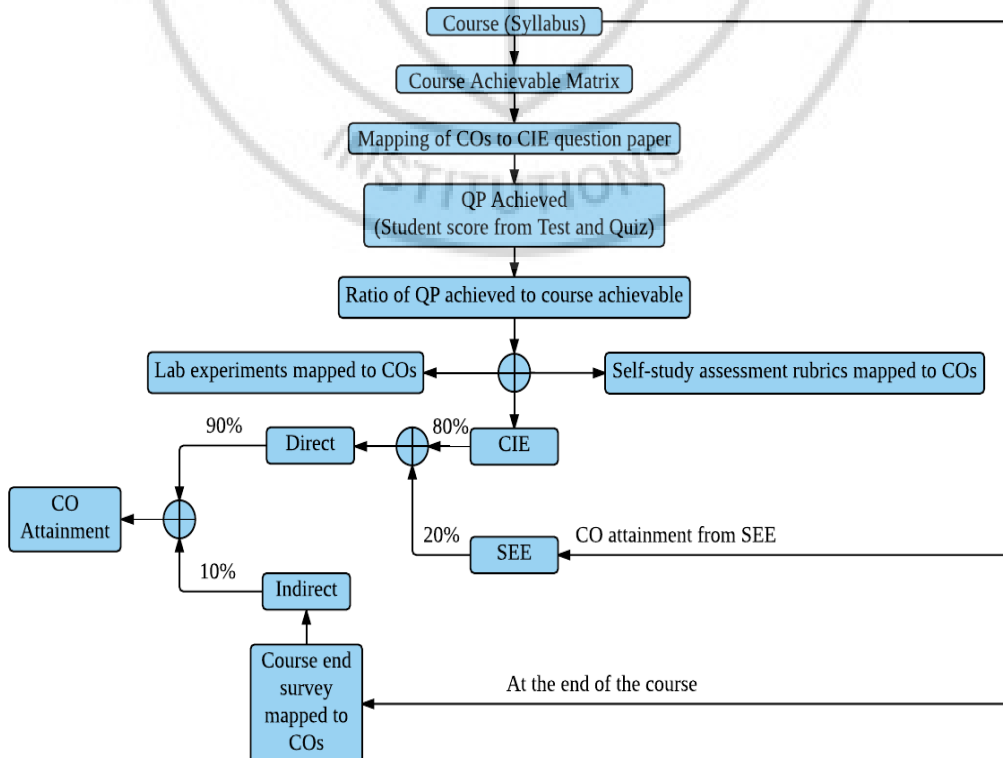
Academic Planning and Implementation



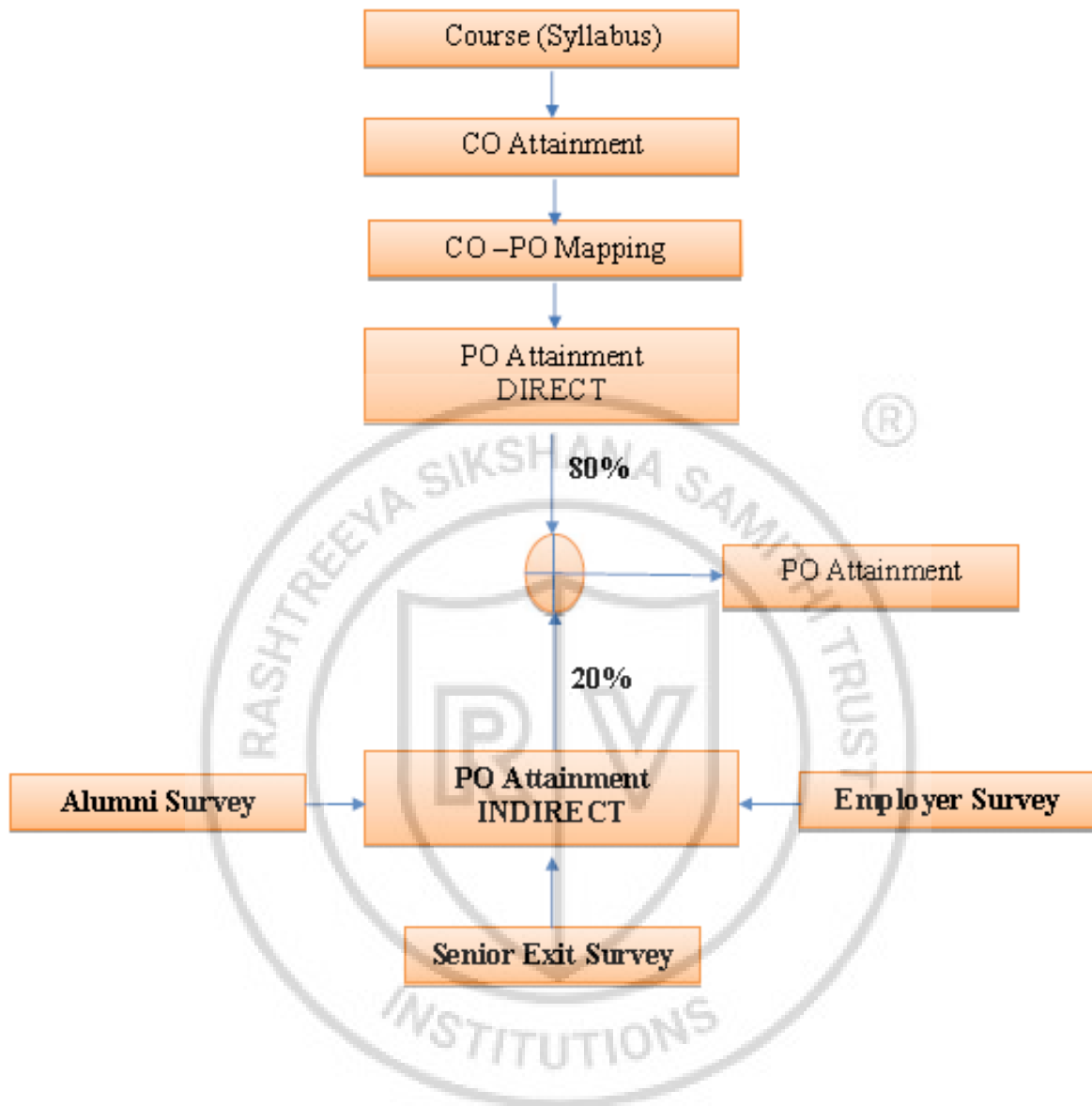
Process For Course Outcome Attainment



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.

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.

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 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.

Chitrak : It is the official electric bike team of RV College of Engineering (RVCE) in Bangalore

Anoraniya: A Quantum based technical club initiated by students. The club is dedicated to addressing various technical challenges in quantum technologies and is on the verge of delivering some fascinating results.

Accelerate Club: organizes and participates in hackathons, bootcamps, workshops, and student-led innovation drives.

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 experiential learning 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



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