RV College of Engineering®

Electronics & Telecommunication Engineering

Bachelor of Engineering (B.E)

Scheme And Syllabus Of VII & VIII Semester
(2021 Scheme)

B.E. Programs : AI, AS, BT, CH, CS, CV, 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

2024

99TH
NIRF RANKING IN ENGINEERING (2024)

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

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

1001+
SUBJECT RANKING (ENGINEERING)

801+
SUBJECT RANKING (COMPUTER SCIENCE)

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

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

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

17
Centers of Excellence

11
Centers of Competence

212
Publications On Web Of Science

669
Publications Scopus (2023 - 24)

1093
Citations

70
Patents Filed

39
Patents Granted

61
Published Patents

11
Skill Based Laboratories Across Four Semesters

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

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

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2024

Department Vision

Imparting quality education in Electronics and Telecommunication Engineering through focus on fundamentals, research and innovation for sustainable development

Department Mission

- Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.
- Create state-of-the–art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering Education
- Encourage students to be innovators to meet local and global needs with ethical practice
- Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Centre of Excellence with focus on affordable innovation.
- Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO	Description
PEO1	Acquire appropriate knowledge of the fundamentals of basic sciences, mathematics, engineering sciences, Electronics & Telecommunication engineering so as to adapt to rapidly changing technology
PEO2	Think critically to analyze, evaluate, design and solve complex technical and managerial problems through research and innovation.
PEO3	Function and communicate effectively demonstrating team spirit, ethics, respectful and professional behavior.
PEO4	To face challenges through lifelong learning for global acceptance.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	Analyze, design and implement emerging Telecommunications systems using devices, sub-systems,
PSO2	Exhibit Technical skills necessary to choose careers in the design, installation, testing, management and operation of Telecommunication systems.

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

ABBREVIATIONS

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

INDEX

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

Go, change the world

Bachelor of Engineering in

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VII SEMESTER									Max Marks CIE		SEE Duration (H)	Max Marks SEE	
Slo. No.	Bo S	Course Code	Course Title	L	T	P	Credits	Category	Theory	Lab		Theory	Lab
1	HS	21HS71	Constitution of India and Professional Ethics	3	0	0	3	Theory	100	----	3	100	----
2	ET	21ET72	Communication Engineering III	3	0	1	4	Theory + Practice	100	50	3	100	50
3	ET	21ET73GX	Professional Core Elective-III **(Group – G)**	3	0	0	4	Theory	100	----	3	100	----
4	ET	21ET74HX	Professional Core Elective-IV **(Group- H)**	3	0	0	3	Theory	100	----	3	100	----
5	XX	21XX75IX	Institutional Electives – II **(Group I)**	3	0	0	3	Theory	100	----	3	100	----
6	ET	21ET76I	Summer Internship-III	0	0	2	2	Internship	----	50	2	----	50
7	ET	21ET77	Minor Project	0	0	2	2	Project	----	50	2	----	50
				Total			21						

Professional Core Elective-III (Group – G)				
Sl. No.	**BoS**	**Course Code**	**Course Title**	**Credits**
3	ET	21ET73G1	Advanced Embedded Systems	3
	ET	21ET73G2	Optical Fiber Communication	3
	ET	21ET73G3	RF Integrated Circuits	3
	ET	21ET73G4	Mobile Adhoc Networks	3
	ET	21ET73G5	Deep learning for Telecommunication Systems	3

Professional Core Elective-IV (Group – H)				
Sl. No.	**BoS**	**Course Code**	**Course Title**	**Credits**
4	ET	21ET74H1	Signal Processing Applications with Machine Learning	3
	ET	21ET74H2	Mixed Signal VLSI	3
	ET	21ET74H3	Next Generation Networks	3
	ET	21ET74H4	Wireless Broadband Networks	3
	ET	21ET74H5	RADAR and Navigation Systems	3

Institutional Electives – II (Group I)				
Sl. No.	**BoS**	**Course Code**	**Course Title**	
5	AS	21AS75IA	Unmanned Aerial Vehicles	3
	BT	21BT75IB	Healthcare Analytics	3
	CH	21CH75IC	Sustainability and Life Cycle Analysis	3
	CM	21CM75ID	Advances in Corrosion Science and Management	3
	CS	21CS75IE	Prompt Engineering	3
	CV	21CV75IF	Integrated Health Monitoring of Structures	3
	EC	21EC75IG	Wearable Electronics	3
	EE	21EE75IH	E-Mobility	3
	EI	21EI75IJ	Programmable Logic Controllers and applications.	3
	ET	21ET75IK	Space Technology and Applications	3
	IS	21IS75IL	Mobile Applications Development	3
	IM	21IM75IM	Project Management	3
	IM	21IM75IN	Supply Chain Analytics	3
	ME	21ME75IO	Nuclear Engineering	3
	HS	21HS75IQ	Cognitive Psychology	3
	HS	21HS75IR	Principle and Practices of Cyber Law	3

VIII SEMESTER									Max Marks CIE		SEE Duration (H)	Max Marks SEE	
Sl. No.	**BoS**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Category**	**Theory**	**Lab**		**Theory**	**Lab**
1	ET	21ET81P	Major Project	0	0	12	12	Project	**----**	**100**	**3**	**----**	**100**
						Total	**12**						

Semester: VII						
CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS **Category: Professional Core Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	21HS71		**CIE**	**:**	100
Credits: L:T:P	**:**	03		**SEE**	**:**	100
Total Hours	**:**	03		**SEE Duration**	**:**	3 Hours

Unit-I	**10 Hrs**
Salient features of Indian Constitution; Preamble to the Constitution of India; Provisions Relating to Citizenship in India-Modes of Acquisition and Termination of Citizenship of India. Scope & Extent of Fundamental Rights-Articles 14-32 with case studies; Right to Information Act, 2005 with Case studies.	
Unit – II	**10 Hrs**
Significance of Directive Principles of State Policy; Fundamental Duties in the Constitution of India; Union Executive- President and State Executive- Governor; Parliament & State Legislature; Council of Ministers; Union and State Judiciary; Emergency provisions; Elections commission . Human Rights & Human Rights Commission.	
Unit –III	**05 Hrs**
Consumer Protection Law - Definition and Need of Consumer Protection; Consumer Rights under the Consumer Protection Act, 2019; Unfair Trade Practice, Defect in goods, Deficiency in services; Product liability and **Penal Consequences, False and Misleading Advertisement, E-Commerce, Alternate dispute Redress mechanism;** Redresses Mechanisms under the Consumer Protection Act, 2019.	
Unit –IV	**07 Hrs**
Introduction to Labour and Industrial Law, Theory and Concept of Industrial Relations, Industrial Relations Code 2020, Code on Social Security 2020, Code on Occupational Safety, Health and Working Conditions 2020, Code on Wages 2020, Industrial Disputes Act , **The Factories Act, 1948** ,Analysis of Recent Amendments made in Labour Laws.	
Unit –V	**07 Hrs**
Scope and aims of engineering ethics (NSPE Code of Ethics), Responsibility of Engineers, Impediments to responsibility. Honesty, Integrity and reliability, Risks, Safety and Liability in Engineering.Corporate Social Responsibility,Statutory Provision regarding prohibition and prevention of Ragging, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Equips with a comprehensive understanding of the legal and political framework of India, preparing them to engage with complex legal, social, and political issues both as professionals and responsible citizens.
CO2	Effectively advocate for consumer rights, navigate regulatory frameworks, and address emerging challenges in the marketplace & empowers them with the legal knowledge and practical skills necessary to protect consumers and promote fair business practices.
CO3	Equipping with the knowledge and skills to navigate legal, ethical, and social issues in their professional and personal lives & Cultivate a sense of professional integrity and responsibility, emphasizing the importance of ethical behavior in engineering.
CO4	Apply the knowledge to solve practical problems with regard to personal issues & business enterprises

Reference Books	
1.	Dr. J. N Pandey, Constitutional Law of India, Central Law Agency, 2023 Edition
2.	Avtar Singh: Law of Consumer Protection: Principles and Practice, Eastern Book Company, 5th Edition, 2015, ISBN: 9789351452461.
3.	S.C. Srivastava: Industrial Relation and Labour Laws, Vikas Publishing House, 8th Kindle Edition 2023, ASIN : B0C5CCJX63

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.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only) * (Small case lets and case example in one subdivision)case example in one subdivision)case example in one subdivision)	
2	Unit 1: (Compulsory)	16
3&	Unit 2: Question 3 or 4	16
5&	Unit 3: Question 5 or 6	16
7&	Unit 4: Question 7 or 8	16
9&	Unit 5: Question 9 or 10	16
	TOTAL	**100**

Semester: VII						
Communication Engineering III **Category: Professional Core Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	21ET72		**CIE**	**:**	100+50
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100+50
Total Hours	**:**	45L+30P		**SEE Duration**	**:**	3 Hours

Unit-I	**9 Hrs**
Cellular concept: Introduction Frequency reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Improving coverage and capacity in cellular systems-Cell splitting & Cell Sectoring, Problems.	
Unit – II	**9 Hrs**
Propagation models for Large scale: Introduction to radio wave Propagation, Free Space Propagation Model, Relating Power to Electric field, The Three basic propagation Mechanisms, Reflection, Diffraction, Scattering, Practical link budget design using path loss models, Outdoor Propagation models: Okumura, Hata, Indoor Propagation models, problems. **Small scale fading:** Small scale fading Multipath Propagation, Impulse response model of a multipath channel, Small scale multipath measurements, problems.	
Unit –III	**9 Hrs**
Mobile Multipath Channels: Parameters of Mobile Multipath Channels, Types of Small scale fading, Rayleign & Ricean distributions, Examples of fading behaviour, Problems. **Equalisation techniques:** Introduction, Fundamentals of equalisation, Training a generic adaptive equaliser, Equaliser in communication receiver, Linear equaliser, problems.	
Unit –IV	**8 Hrs**
Nonlinear Equalisation: Algorithms for adaptive equalisation. **Diversity techniques:** Introduction, Derivation of Selection Diversity Improvement, Derivation of Maximal ratio combining, Practical space diversity considerations, Polarisation diversity, frequency diversity, Time diversity, Rake receiver, Interleaving, problems.	
Unit –V	**10 Hrs**
4G LTE: Introduction, History of mobile telecommunication systems, Need for LTE, From UMTS to LTE and From LTE to LTE - advanced, The 3GPP specifications for LTE, Architecture of LTE. **Communication protocols:** Protocol model, Air interface transport protocols, Fixed network transport protocols, User plane protocols, Signaling protocols, Data transport, Bearer Management, State diagram, Spectrum allocation. **The 5G Architecture:** Introduction, High-level requirements for the 5G architecture, Functional architecture and 5G flexibility.	

Laboratory Experiments
1. Simulation of Okumura path loss model using MATLAB simulation. 2. Realization of the HATA model using MATLAB. 3. Realization of Indoor propagation model using MATLAB. 4. Demonstrate operation of BPSK, QPSK & QAM modulation using **VSA/system vue.** 5. Configure a WiMax N/W, UMTS N/W, wireless sensor networks, 2G network, VoIP using network simulator tool. 6. Experiments on USRP.

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain cellular concepts, fading, equalisation & diversity techniques.
CO 2	Analyze path loss models, fading types and equalisation & diversity techniques.
CO 3	To implement various improvement techniques with respect to performance & user
CO 4	Discuss the requirements of 4G, architecture & communication protocols & 5G

Reference Books	
1.	Wireless Communications Principles and practice, Theodore S Rappaport, 2nd Edition, Pearson,2018, ISBN 97881-317-3186-4.
2.	An Introduction to LTE: LTE, LTE- advanced, SAE and 4G mobile Communications, Christopher Cox, 1st Edition, 2012, John Wiley & Sons Ltd., ISBN: 978-1-119-97038-5.
3.	Wireless Communication, T L Singal, 3rd Edition, 2011, McGraw Hill, ISBN: 9780070681781.
4.	5G Mobile and Wireless Communication Technology, Afif Osseran, Jose F Monserrat, Patrick Marsch, Cambridge University Press, 2016, ISBN: 9781107130098

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks),lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. **THE FINAL MARKS WILL BE 50 MARKS**	**50**
	MAXIMUM MARKS FOR THE CIE THEORY	**150**

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

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

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Semester: VII						
ADVANCED EMBEDDED SYSTEMS **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	21ET73GA		**CIE**	**:**	100
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100
Total Hours	**:**	45L		**SEE Duration**	**:**	3 Hours

Unit-I	**9 Hrs**
Real-Time Operating Systems (RTOS) Fundamentals: Introduction to RTOS, Defining an RTOS, The Scheduler, objects, services, Key characteristics, Task States and Scheduling, Task scheduling algorithms, Inter-task communication and synchronization, Memory management-Fixed-Size Memory Management, Blocking vs. Non-Blocking Memory Functions, Hardware Memory Management Units	
Unit – II	**9 Hrs**
Embedded Systems Optimization: Code optimization-Loop optimization, algorithmic improvements and code specialization, Memory Optimization-Data compression, Memory tooling, Memory alignment, Memory segmentation, Memory mapped I/O and Dynamic Memory Allocation. Power optimization-Low power modes, resource Management, test and measurements	
Unit –III	**9 Hrs**
Embedded Systems Security: Core embedded operating system security requirements-Memory protection, virtual memory, Fault recovery, Guarantee resource, virtual device driver, secure scheduling, **Key management for embedded systems:** Generalized models and case study **Cryptographic certifications**: - 140-2 certification, NSA certification	
Unit –IV	**9 Hrs**
Advanced Embedded Programming: Multithreading - Design consideration, coarse grained multithreading, Fine grained multithreading, simultaneous multi-threading, concurrency-cooperative and pre-emptive models, performance metrics, Low-power programming	
Unit –V	**9 Hrs**
Advanced Topics in Embedded Systems: FPGA-based embedded systems- reconfigurable embedded systems, Real-time signal processing-Applications and architecture trends, Machine learning on embedded systems, Threat modelling and risk assessment, Secure booting and firmware updates	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Demonstrate a deep understanding of advanced microcontroller architecture and programming techniques, including memory management and optimization strategies.
CO 2	Implement secure booting mechanisms, employ cryptographic techniques, optimize code for memory and performance, and apply power optimization strategies to enhance the reliability and efficiency of embedded systems.
CO 3	Proficiency in utilizing real-time operating systems (RTOS) for developing multitasking embedded applications
CO 4	Analyse system requirements, select appropriate FPGA hardware and integrate peripherals and interfaces to create complex embedded systems.

Reference Books	
1.	"Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers" by Jonathan W. Valvano, 5th Edition, 2011, Create Space Independent Publishing Platform, ISBN13: 978-1463590154
2.	"Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development" , David Kleidermacher , Mike Kleidermacher, 1st Edition, Elsevier Inc,.,2012, ISBN13: 978-0123868862
3.	"Real-Time Operating Systems for Embedded Systems", Qing Li and Caroline Yao, 1st Edition, CRC Press,2003, ISBN: 9781138625822

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
OPTICAL FIBER COMMUNICATION **Category: Professional Elective Course** **Stream: Electronics & Telecommunication Engineering** **(Theory)**						
Course Code	**:**	21ET73GB		**CIE**	**:**	100
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100
Total Hours	**:**	45L		**SEE Duration**	**:**	3 Hours

Unit-I	**09 Hrs**
Overview of Optical Fiber Communications: Motivations for Light wave Communications, Optical Spectral Bands, Fundamental Data Communication Concepts, Key elements of Optical Fiber Systems. **Optical Fiber Structures & Wave guiding:** Nature of Light: Polarization, Basic Optical Laws and Definitions, Optical Fiber Modes and Configurations, Single-mode Fibers, Graded-index Fiber Structure.	
Unit – II	**09 Hrs**
Signal Degradation in Optical Fibers: Attenuation, Signal Distortion in Fibers: Intermodal dispersion, Group delay, Material dispersion, Waveguide dispersion, Polarization Mode Dispersion, Signal distortion Single Mode Fibers, Characteristics of Single-Mode Fibers. **Optical Sources:** Light-Emitting Diodes (LEDs), LASER Diodes, Line Coding.	
Unit –III	**09 Hrs**
Power Launching and Coupling: Source-to-Fiber Power Launching, Lensing Schemes for coupling Improvement, LED Coupling to Single-Mode Fibers, Fiber Splicing, Optical Fiber Connectors: Types, Single mode fiber connectors. **Photo detectors**: Physical Principles of Photodiodes, Photo detector Noise, Detector Response Time, Structures for InGaAs APDs.	
Unit –IV	**09 Hrs**
Optical Receiver Operation: Fundamental Receiver Operation: Error Sources, Front End Amplifiers, Digital Receiver Performance: Receiver Sensitivity, Quantum Limit, Eye Diagrams, Burst-Mode Receivers. **Optical Amplifiers:** Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers.	
Unit –V	**09 Hrs**
Digital Links: Point-to-Point Links: Link power budget analysis, Rise time budget analysis. **WDM Concepts:** Overview of WDM: Operational principles of WDM, WDM Standards, SONET/SDH : Transmission Formats & Speeds, SONET/SDH Rings, SONET/SDH Networks.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the characterization of fibers, optical sources, detectors & their selection.
CO 2	Apply the design methodology for analog& digital optical links.
CO 3	Analyze the concepts of WDM in optical networks with standards.
CO 4	Evaluate the selection of network topology and network standards.

Reference Books	
1.	Optical Fiber Communication, Gerd Keiser, 5th Edition, 2009, Tata MGH, ISBN: 0-07-064810-7.
2.	Optical Fiber Communication, John M Senior PHI, 2nd Edition, 2009, ISBN-0324359810.
3.	Fiber Optics Communication Systems, G.P. Agarwal, 3rd Edition, 2004, John Wiley New York, ISBN: 9-8141-2660-8.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
RF INTEGRATED CIRCUITS **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	21ET73GC		**CIE**	**:**	100
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100
Total Hours	**:**	45L		**SEE Duration**	**:**	3 Hours

Unit-I	**9 Hrs**
Introduction: Lower Frequency Analog Design and Microwave Design Versus Radio Frequency Integrated Circuit Design, Units for Microwave and Low-Frequency Analog Design ,Radio Frequency Integrated Circuits Used in a Communications, Monolithic IC technology, MMIC design and examples, CMOS fabrication. **Brief Review of Technology:** Bipolar Transistor Description, Small-Signal Model, Small-Signal parameters, High-Frequency Effects, Noise Sources in the Transistor Model, Bipolar Transistor Design Considerations, CMOS Transistors, CMOS Small-Signal Model Including Noise, Hetero Bipolar Junction Transistors(HBT), FET- HEMT Technologies	
Unit – II	**9 Hrs**
Issues in RFIC design, noise, linearity and filtering: Introduction, Noise, thermal Noise, Noise figure, The noise figure of an Amplifier circuits and components in series, Linearity and Distortion in RF circuits, Third-order and second order Intercepts point, the 1-dB compression point, Broad band measures of linearity. Filtering issues, image signals and image reject filtering. Blockers and Blocker filtering. **CAD Techniques**: Integrated CAD Design Environment, CAD package features, Circuit simulation Engines, Commercial CAD packages, Commercial Modelling Software. EM simulation Tools..	
Unit –III	**9 Hrs**
Impedance Matching: Introduction, review of smith chart, impedance matching using LC networks, bandwidth and Q factor of matching networks **Design of passive circuit elements in IC technologies:** Introduction, sheet resistance and the skin effect, parasitic capacitance & inductance, Poly Resistors and Diffusion Resistors, Metal-Insulator-Metal Capacitors and Poly capacitors, Applications of On-Chip Spiral Inductors and Transformers, On-chip Transmission lines,	
Unit –IV	**9 Hrs**
RF and Microwave Modules: RF System as a Cascade of Modules, A 15GHz Receiver Subsystem, Amplifiers, Filters, Noise, Diodes, Switches, Ferrite components, Local Oscillators, Mixers, Frequency Multipliers	
Unit –V	**9 Hrs**
Transceivers: Conventional UP/Down conversion architectures, Direct Conversion architectures, Modulators, demodulators, and Frequency Translators **Integrated Antennas:** Basic Integrated Antenna Requirements, Integrated Antenna selection and examples, Photonic Band gap antennas	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the design concepts and performance parameters in RFICs
CO 2	Identify different Passive Circuit Elements on RF ICs and design the matching circuits for RF systems
CO 3	Analyze and Identify the CAD tools used for RFIC Design
CO 4	Evaluate the performance characteristics of RF subsystems.

Reference Books	
1.	John Rogers, Calvin Plett -"Radio Frequency Integrated Circuit Design", Artech house, 2003
2.	I. D. Robertson, S. Lucyszyn, "RFIC and MMIC design Technology", IEE Publications, 2001, ISBN: 0- 85296- 786 -1
3.	Micheal Steer ,"Fundamentals of Microwave and RF Design"Published by NC State University, 2019, Third edition
4.	Inder J Bahl, "Fundamentals of RF and Microwave Transistor Amplifiers", John Wiley & sons Inc, 2009. ISBN: 978-0-470-39166-2

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
MOBILE ADHOC NETWORKS **Category: Professional Core Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET73GD**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Introduction: Introduction to Cellular and Ad hoc wireless networks, Applications of ad hoc networks, Issues in ad hoc wireless networks, Medium access scheme, Routing, Multicasting, Transport layer protocols, Pricing scheme, Quality of Service provisioning, Self-organization, Security, Address and security discovery, Energy management, Scalability, Deployment considerations, Ad hoc wireless internet.	
Unit – II	**9 Hrs**
MAC Protocols: Issues in designing a MAC Protocol for ad hoc wireless networks, design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based Protocols, Contention based Protocols with Reservation mechanism, Contention based Protocols with scheduling mechanism.	
Unit –III	**9 Hrs**
Routing Protocols: Issues in designing a routing protocol for Ad Hoc Wireless Networks, classification of routing protocols, Table-driven routing protocols, On-demand and Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical and Power-aware routing protocols.	
Unit –IV	**9 Hrs**
Multicast Routing Protocols : Design issues and operation, Architecture reference model, Classification, Tree-based protocols.	
Unit –V	**9 Hrs**
Quality of Service and Security Issues : Issues and challenges in providing QoS, Classification of QoS solutions, MAC layer solutions, Network layer solutions.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the fundamentals of ad hoc wireless networks and cellular networks.
CO 2	Design various MAC layer and Network layer protocols associated with Mobile Ad Hoc Networks.
CO 3	Analyse the Issues and challenges in designing MAC layer & Network layer protocols.
CO 4	Evaluate the performance of ad hoc networks using quality of service.

Reference Books	
1.	C. Siva Ram Murthy, B. S. Manoj, Ad-Hoc Wireless Networks: Architectures and Protocols, 2012, 1st Edition, Prentice Hall, New Jersey. ISBN- 978-81-26547-86-9.
2.	C-K. Toh, AdHoc Mobile Wireless Networks: Protocols and Systems, 2011, 1st Edition, Prentice Hall, New Jersey. ISBN- 978-01-30078-17-9.
3.	Mohammad Ilyas, The Handbook of AdHoc Wireless Networks, 2012, 1st Edition, CRC press, Florida. ISBN-978-03-67248-26-0.
4.	Minoru Etoh, Next Generation Mobile Systems 3G and Beyond, 2011, 1st Edition, Wiley Publications, New Jersey. ISBN: 978-04-70091-51-7.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
DEEP LEARNING FOR TELECOMMUNICATION SYSTEMS **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET73GE**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Fundamentals of Deep Learning and Neural Networks: The neural networks, Building Intelligent Machines, Limits of Traditional Computer Programs, Mechanics of Machine Learning, Neuron, single layer perceptron, multilayer perceptron, Expressing Linear perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers, Open source framework for deep Learning, Hardware support for deep learning,Implementing Neural Networks in TensorFlow	
Unit – II	**9 Hrs**
Training Feed-Forward Neural Networks: The Fast-Food Problem, Gradient Descent, Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, Backpropagation Algorithm, Stochastic and Minibatch Gradient Descent, Test Sets, Validation Sets, Overfitting, Preventing Overfitting in deep Neural Networks.**Beyond Gradient Descent:** Challenges with gradient descent, Local minima in the error surfaces of deep networks, Model Identifiability, spurious local minima in deep networks, Flat regions in error surface, gradient points in the wrong direction, Momentum based optimization, second order methods, Learning rate Adaptation (AdaGrad, RMSProp, Adam)	
Unit –III	**9 Hrs**
Convolutional Neural Networks (CNN): Introduction to CNN, Components of CNN, Properties of CNN, Architectures of CNN, Applications of CNN. **Recurrent Neural Networks (RNN):** Introduction to RNN, Training of RNN, Back propagation through time (BPTT) illustration, RNN Topology, Challenges with Vanishing gradients, Bidirectional RNNs, Long Short Term Memory (LSTM), Gated Recurrent unit (GRU), Deep Recurrent Neural Networks, Applications of RNN.**Auto Encoders:** Introduction to auto encoders Features of auto encoders, Types of Auto encoders, Regularization in auto encoder (regularized autoencoder). Applications of Auto encoders.	
Unit –IV	**9 Hrs**
Memory Augmented Neural Networks: Neural Turing Machines (NTM), Attention based memory access, NTM memory addressing mechanisms, Differentiable Neural Computers(DNC), Interference-Free writing in DNCs, DNC memory Reuse, Temporal Linking of DNC Writes, DNC Read Head, DNC controller network, Visualizing DNC in action. **Deep Reinforcement Learning:** Introduction, Deep Reinforcement Learning Masters Atari Games, Markov Decision Processes (MDP), Explore Versus Exploit, Policy Versus Value Learning.	

Unit –V	9 Hrs
Applications of Deep learning in telecom sector: Role of AI in Telecommunication and ITU standards, Deep Learning in Mobile and Wireless Networking, Deep Learning-Based end-to-end wireless Communication systems, Visual recognition, Self-Driving cars, Language Translations, Machine Translation, Game Playing, Entertainment, Health care	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Describe the concepts of deep learning its software implementation
CO 2	Analyze different learning techniques to train neural networks for real-time applications.
CO 3	Apply the knowledge of neural networks in various deep learning architectures
CO 4	Evaluate the role of AI in various applications of telecommunication domain

Reference Books	
1.	Nikhil Buduma "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms" 1st Edition, O'Reilly Media Inc, USA, 2017, ISBN: 978-1-491-92561-4.
2.	Goodfellow, Y, Bengio, A. Courville, "Deep Learning", MIT Press, 2016
3.	Lovelyn Rose, L Ashok Kuma "Deep Learning using Python" Wiley, 2020, ISBN: 9788126579914.
4.	Charles Bostian, Thomas Rondeau "Artificial Intelligence in Wireless Communications" Artech House Publishers, Unabridged edition, 2009, ISBN: 0415012287

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
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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						
SIGNAL PROCESSING APPLICATIONS WITH MACHINE LEARNING **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET74HA**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Introduction to ML: Distance based classification, Nearest neighbour classification, Hilbert space, Fusion of machine learning in signal processing, Benefits of adopting machine learning in signal processing, Machine learning algorithms-Supervised learning, Unsupervised, Semi-supervised, Reinforcement learning.	
Unit – II	**9 Hrs**
Multi-rate DSP: Introduction, Concepts of sampling rate conversion; Noble Identities, Poly phase structures for sampling rate conversion. Applications: Design of Phase shifters, Interfacing of Digital Systems with different sampling rates, Narrow band filters, Sub band Coding of Speech signals	
Unit –III	**9 Hrs**
Digital Filter Banks: Concepts, Polyphase structures of uniform filter banks, Transmultiplexers – TDM to FDM conversion, FDM to TDM conversion. **Two-channel QMF Bank**: Elimination of Aliasing, Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank, Perfect Reconstruction Two-channel FIR QMF Bank, QMF banks in sub band Coding.	
Unit –IV	**9 Hrs**
Adaptive Filters: Applications of Adaptive filters, Adaptive Direct-Form FIR Filters- The LMS algorithm, and Adaptive Direct Form Filters- RLS algorithm.	
Unit –V	**9 Hrs**
Applications of Signal Processing in ML: Audio signal processing, Audio compression, Digital Image processing, Video compression, Digital communication, Healthcare, Seismology, speech recognition, computer vision, Economic Forecasting.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the functions of Decimator, Interpolator, Adaptive filters and its applications
CO 2	Apply different DSP operations for various data.
CO 3	Design and Analyze filter banks and Adaptive filter
CO 4	Apply machine learning algorithms to signal processing test cases

Reference Books	
4.	John G. Proakis and Manolakis, "Digital Signal Processing", Prentice Hall, 4th Edition, 2007.
5.	E.C.Ifeachor and B.W.Jervis, "Digital Signal Processing – A Practical approach", 2nd Edition, Pearson Education, 2002.
6.	Li Tan, "Digital Signal Processing Fundamentals and Applications", Academic Press, India, 2008.
7.	Sudeep Tanwar, Anand Nayyar, Rudra Rameshwar, "Machine Learning in Signal Processing –Applications, Challenges, And the Road Ahead", CRC Press Taylor & Francis Group , 2022 .
8.	Himanshu singh, "Practical Machine learning and Image Processing", Apress, ISBN-13 (pbk): 978-1-4842-4148-6.

RUBRICFOR 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 (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
Mixed-Signal VLSI **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET74HB**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

Unit - I	**09 Hrs**
Data Converters Fundamentals: MOSFET switch, Charge injection, Capacitive feedthrough, Basic sample-and-hold circuit, Sample and Hold characteristics: Sample mode, Hold mode, and Aperture error. Stick diagrams and VLSI layouts, Mixed-signal layout issues: Mixed-signal layout strategy.	
Unit – II	**09 Hrs**
DAC specifications: DNL, INL, offset, gain error, latency, SNR, dynamic range. **ADC specifications:** Quantization error, DNL, INL, missing codes, offset, gain error, SNR, aperture error.	
Unit – III	**09 Hrs**
DAC Architectures: Digital input code, Resistor string, R-2R ladder networks, Current steering: Generic and Binary-weighted, Charge scaling, Charge scaling using a split array, Cyclic, and Pipeline DAC.	
Unit – IV	**09 Hrs**
ADC Architectures: Two-step flash, Pipeline, Integrating: single and dual slope, Successive approximation, Nyquist rate vs Oversampling ADCs, Oversampling ADC: first-order sigma-delta modulator (block diagram discussion).	
Unit – V	**09 Hrs**
Basic CMOS comparator design, Analog multipliers, and Multiplying quad. SPICE modelling of the MOSFET, BSIM1 SPICE Model parameters, SPICE Models for DACs and ADCs.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Define data converter fundamentals and draw stick diagrams and layouts.
CO 2	Analyze the working principle of data converters and to derive SPICE models for DACs and ADCs.
CO 3	Design basic comparator, multiplier and ADC and DAC converters.
CO 4	Evaluate data converters for different applications and choose specific data converter for system design.

Reference Books	
1.	R. Jacob Baker, Harry W Li, David E Boyce, "CMOS circuit design, Layout and Simulation", PHI, 2004, ISBN: 81-203-1682-7.
2.	R. Jacob Baker, "CMOS Mixed-Signal Circuit Design", Wiley-IEEE press, 2009, ISBN: 978-81-265-1657-5.
3.	Digital Integrated Circuits: A Design Perspective, Jan M. Rabaey. Anantha Chandrakasan, and Borivoje Nikolic, 2nd Edition, Pearson Education India, ISBN: 9385152343.

RUBRICFOR 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 (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering the 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						
Next Generation Networks **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET74HC**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

Unit-I	**9 Hrs**
Software Defined Networking: Introduction, Modern Data Center, Traditional Switch Architecture, Layer 2 & 3 Control, Evolution of switches and control planes, Data Center Innovation & Needs, The Evolution of Networking Technology, Forerunners of SDN, Open Source Contributions and Network Virtualization.	
Unit – II	**9 Hrs**
SDN Operation: Fundamental Characteristics of SDN, SDN Operation SDN Devices, SDN Controller, SDN Applications. The Open Flow Specification: Open Flow Overview, Open Flow 1.0 and Open Flow Basics, Open Flow 1.1, 1.2, and 1.3 Additions and Open Flow Limitations.	
Unit –III	**9 Hrs**
Alternative Methods of SDN: Potential Drawbacks of Open SDN, Alternate SDN Methods, Network Functions Virtualization, Alternatives Overlap and Ranking, SDN in the Data Center: Definition, Data Center Demands, Tunneling Technologies, Path Technologies, Ethernet Fabrics, SDN Use Cases in the Data Center and Real-World Data Center Implementations.	
Unit –IV	**9 Hrs**
SDN in Other Environments: Consistent Policy Configuration, Global Network View, WANs, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, and Optical Networks.	
Unit –V	**9 Hrs**
SDN Applications: Reactive versus Proactive Applications, Background on various Controllers like Floodlight Controller, Open Daylight Controller, Cisco XNC Controller, and Hewlett-Packard Controller. Switch Considerations, Creating NV Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the basic concepts, evolution of software defined networks architectural differences of conventional networking approaches and SDN.
CO 2	Analyze Software Defined Networks through Open Flow Switches.
CO 3	Apply the principles of SDN for the design of data centre using SDN elements of reputed vendors.
CO 4	Design and implement software defined network application on SDN-based networking devices

Reference Books	
1.	Software Defined Networks: A Comprehensive approach, Paul Goransson, Chuck Black, Timothy Culver, 2nd Edition, Elsevier, 2014,ISBN-13: 978-0128045558, ISBN-10: 0128045558
2.	Software Defined Networking design and deployment, Patricia A. Morreale, James M. Anderson, 1st Edition, CRC Press, 2015, ISBN-10: 1482238632, ISBN-13: 978-1482238631
3.	SDN: Software Defined Networks: An Authoritative Review of Network, Programmability Technologies, Thomas D. Nadeau, Ken Gray, 1st Edition, , 2013,ISBN-13: 978-1449342302, ISBN-10: 9781449342302.
4.	OpenFlow Cookbook, S., Kingston Smiler, 1st Edition, Packt Publishing, ISBN - 1783987944, 9781783987948, 2015.

RUBRICFOR 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 (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering the 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: Wireless Broadband Networks **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET74HD**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Background of LTE: Introduction, ITU Activities, Drivers For LTE, Standardization of LTE **Overview of LTE Radio Access:** Basic principles, LTE release 9, LTE release 10 and IMT-Advanced, Terminal capabilities.	
Unit – II	**9 Hrs**
Radio-Interface Architecture: Overall System Architecture, Radio Protocol Architecture, Control-Plane Protocols**.**	
Unit –III	**9 Hrs**
Physical Transmission Resources: Overall Time–Frequency Structure, Normal Sub frames and MBSFN Sub frames, Carrier Aggregation, Frequency-Domain Location of LTE Carriers, Duplex Schemes.	
Unit –IV	**9 Hrs**
Access Procedures: Acquisition and cell search, PSS structure, SSS structure, System-Information blocks, Random access, Paging, **Scheduling:** Traffic behaviour and scheduling	
Unit –V	**9 Hrs**
Spectrum: Spectrum for LTE, Flexible Spectrum Use, Flexible Channel Bandwidth Operation, Carrier Aggregation for LTE, Multi-Standard Radio Base Stations **Transceiver Characteristics:** Overview of RF Requirements for LTE, Output Power Level Requirements, Transmitted Signal Quality, Unwanted Emissions Requirements, Sensitivity and Dynamic Range, Receiver Susceptibility to Interfering Signals.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the basic concepts, evolution of software defined networks architectural differences of conventional networking approaches and SDN.
CO 2	Analyze Software Defined Networks through Open Flow Switches.
CO 3	Apply the principles of SDN for the design of data centre using SDN elements of reputed vendors.
CO 4	Design and implement software defined network application on SDN-based networking devices

Reference Books	
1.	4G LTE/LTE-Advanced for Mobile Broadband, Erik Dahlman, Stefan Parkvall, and Johan Sköld", Elsevier Ltd,2011
2.	Advanced WirelessCommunications-4G Technologies, Savo Glisic , John Wiley & Sons Ltd,2004
3.	LTE for UMTS Evolution to LTE-Advanced, HarriHolma and Antti Toskala, 2nd Edition, 2011, John Wiley & Sons, Ltd, ISBN: 978-0-47-066000-3.
4.	Fundamentals of LTE, Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 2010, Prentice Hall, Communications Engg and Emerging Technologies, ISBN: 978-9-35-306239-

RUBRICFOR 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 (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering the 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: RADAR and Navigation Systems **Category: Professional Elective Course** **Stream: Electronics and Telecommunication Engineering** **(Theory)**						
Course Code	**:**	**21ET74HE**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

UNIT-I	**09 Hrs**
An Introduction to Radar: Basic Radar, The simple form of the Radar Equation, Radar Block Diagram, Radar Frequencies, Application of radar, Types of Radars. **The Radar Equation:** Introduction, Detection of signals in Noise, Receiver Noise and the Signal-to Noise Ratio, Probability of Detection and False alarm, Radar Cross Section of the targets, Transmitter power, Pulse repetition Frequency.	
UNIT-II	**09 Hrs**
MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, Delay-Line Cancellers, Staggered Pulse Repetition frequencies, Doppler Filter Banks, Digital MTI processing, Moving Target detector.	
UNIT-III	**09 Hrs**
Terrestrial Network based positioning and navigation: Fundamentals, positioning in cellular networks, positioning in WLANs, Positioning in Wireless sensor networks.	
UNIT-IV	**09 Hrs**
GPS: Introduction- Project phases, reference systems, GPS services- Standard positioning service, Precise positioning service, GPS segments, GPS signal Structure.	
UNIT-V	**09 Hrs**
Satellite-based navigation systems: Global Navigation satellite systems (GNSS), GNSS receivers, Augmented systems and assisted GNSS.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concept of radars and its signal processing techniques, navigation using satellite and terrestrial networks.
CO2	Apply the concepts of radars, cellular networks, WLAN, sensor networks and satellites in determining the user position and navigation.
CO3	Analyze the different parameters of satellite and terrestrial networks for navigation systems.
CO4	Evaluate the radar systems and satellite and terrestrial network based navigation systems.

Reference Books	
1	Introduction to RADAR Systems, M. L Skolnik,2001,TATA Mcgraw-Hill, ISBN: 0-07-044533-8.
2	Principles of Modern Radar Basic Principles, Mark A Richards, James A Scheer, William A Holam, 2012, Yes Dee Publishing Pvt Ltd, ISBN:978-1891121524 .
3	GPS - Theory and Practice, B. Hoffman, Wellenhof, H. Lichtenegger and J. Collins, 5th revised edition,2001, Springer, NewYork, ISBN 978-3-211-83534-0.
4	Satellite and Terrestrial Radio Positioning techniques- A signal processing perspective, Davidedardari, EmanuelaFalletti, Marco Luise, 1st Edition, 2012, Elsevier Academic Press, ISBN: 978-0-12-382084-6.

RUBRICFOR 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 (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering the 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						
UNMANNED AERIAL VEHICLES **Category: Institutional Electives-II** **(Theory)**						
Course Code	**:**	**21AS75IA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08Hrs**
Introduction to Unmanned Aerial Vehicles (UAVs): History of UAVs, Need of unmanned aerial systems, Overview of UAV Systems-System Composition, Classes and Missions of UAVs-Classification of UAVs based on size, range and endurance, Applications, Examples of UAVs	
Unit – II	**11Hrs**
Aerodynamics & Propulsion aspects of UAVs: Basic Aerodynamic Equations, Air foils, lift, drag, moments, Aircraft Polar, The Real Wing and Airplane, Induced Drag, Total Air-Vehicle Drag, Flapping Wings, Rotary wings. **Propulsion:**Thrust Generation and basic thrust equation, Sources of Power for UAVs- Piston, Rotary, Gas turbine engines, electric or battery powered UAVs.	
Unit –III	**08Hrs**
Airframe of UAVs: Mechanic loading, basics of types of load calculation and structural engineering, Material used for UAV (general introduction), FRP and methods of usage in UAV, Testing of FRP specimens for UAV, selection criteria for structure, Types of structural elements used in UAV their significance and characteristics, Methods of manufacturing UAV structure.	
Unit –IV	**10Hrs**
Payloads for UAVs: Barometers, Accelerometer, Magnetometer, RADAR and range finder, Non-dispensable and dispensable Payloads-Optical, electrical, weapon, imaging payloads.	
Unit –V	**08Hrs**
Mission Planning and Control: Air Vehicle and Payload Control, Reconnaissance/Surveillance Payloads, Weapon Payloads, Other Payloads, Data-Link Functions and Attributes, Data-Link Margin, Data-Rate Reduction, Launch Systems, Recovery Systems, Launch and Recovery Trade-offs.	

Course Outcomes: At the end of this course the student will be able to :	
CO1:	Understand the role of UAVs in the current generation for diverse applications ranging from commercial to military purposes
CO2:	Apply the fundamental concepts of Aerospace Engineering to Design a UAV for a particular Mission and application
CO3:	Evaluate the performance of UAV with a perspective of Aerodynamics, Propulsion, Structures for a given Mission
CO4:	Critically appraise and optimize the performance of the UAV for a given Mission profile

Reference Books	
1	Unmanned Aircraft Systems UAV design, development and deployment, Reg Austin, 1st Edition, 2010, Wiley, ISBN 9780470058190.
2	Flight Stability and Automatic Control, Robert C. Nelson, 2nd Edition, October 1, 1997, McGraw-Hill, Inc, ISBN 978-0070462731.
3	Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Kimon P. Valavanis, 1st Edition,2007, Springer ISBN 9781402061141
4	Introduction to UAV Systems, Paul G Fahlstrom, Thomas J Gleason, 4th Edition, 2012, Wiley, ISBN: 978-1-119-97866-4
5	Design of Unmanned Air Vehicle Systems, Dr. Armand J. Chaput, 3rd Edition, 2001, Lockheed Martin Aeronautics Company, ISBN: 978-1-60086-843-6

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
Healthcare Analytics **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21BT75IB**		**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 to tools and databases: Introduction to Bioinformatics, Goals, Scope, Applications, Sequence databases, Structure databases, Special databases, Applications of these databases, Database similarity search: Unique requirements of database searching, Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA, Comparison of FASTA and BLAST, Database Searching with Smith-Waterman Method	
Unit – II	**09 Hrs**
Sequence Analysis: Types of Sequence alignment -Pairwise and Multiple sequence alignment, Alignment algorithms, Scoring matrices, Statistical significance of sequence alignment. Multiple Sequence Alignment: Scoring function, Exhaustive algorithms, Heuristic algorithms, Profiles and Hidden Markov Models: Position-Specific scoring matrices, Profiles, Markov Model and Hidden Markov Model, Scoring matrices – BLOSSUM and PAM **Molecular Phylogenetics:** Introduction, Terminology, Forms of Tree Representation. Phylogenetic Tree Construction Methods - Distance-Based, Character-Based Methods and Phylogenetic Tree evaluation.	
Unit –III	**09 Hrs**
Introduction to Next-Generation Sequencing (NGS) analysis: Sanger sequencing principles - history and landmarks, of Sequencing Technology Platforms, A survey of next-generation sequencing technologies, A review of DNA enrichment technologies, Base calling algorithms, Base quality, phred values, Reads quality checks, Interpretations from quality checks. Adapter and primer contamination. Processing reads using clipping of reads-Advantages and disadvantages of processing of reads	
Unit –IV	**09 Hrs**
Structural analysis & Systems Biology: Gene prediction programs – ab initio and homology-based approaches.. Detection of functional sites and codon bias in the DNA. Predicting RNA secondary structure, Protein structure basics, structure visualization, comparison and classification. Protein structure predictive methods using protein sequence, Protein identity based on composition, Prediction of secondary structure. Scope, Applications. Concepts, implementation of systems biology, Mass spectrometry and Systems biology.	
Unit –V	**09 Hrs**
Drug Screening: Introduction to Computer-aided drug discovery, target selection, ligand preparation and enumeration, molecular docking, post-docking processing, molecular dynamics simulations, applications and test cases.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Comprehend Bioinformatics Tools: Understand and effectively utilize various bioinformatics tools and databases for sequence and structure analysis.
CO2	Investigate and apply innovative sequencing technologies and analytical methods to solve complex biological questions and advance research in genomics and molecular biology.
CO3	Analyze Next-Generation Sequencing: Proficiency in NGS technologies, including data quality assessment and read processing techniques and handle big data.
CO4	Apply bioinformatics tools to model and simulate various biological processes, leveraging gene prediction programs including both ab initio and homology-based approaches.

Reference Books	
1.	Xiong J. Essential bioinformatics. Cambridge University Press; 2006 Mar 13.
2.	Buehler LK, Rashidi HH, editors. Bioinformatics basics: applications in biological science and medicine. CRC Press; 2005 Jun 23.
3.	Ghosh Z, Mallick BM. Bioinformatics principles and Applications. Oxford University Press; 2018 Jun 13.
4.	Low L, Tammi MT. Introduction to next generation sequencing technologies. Bioinformatics. WORLD SCIENTIFIC. 2017 Jul 26:1-21.

5.	Bioinformatics: Sequence and Genome Analysis; D W Mount; 2014; CSHL Press; 2nd edn; ISBN: 9780879697129.
6.	Computational Systems Biology; A Kriete and R Eils; 2006; Academic Press; Illustrated edn; ISBN: 978-01-208-87866.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
	COMPONENTS	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only; wherein one sub division will be a caselet in the related topics)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

SUSTAINABILITY AND LIFE CYCLE ANALYSIS Category: Institutional Elective II (Theory)						
Course Code	**:**	**21CH75IC**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3Hours**

Unit-I	**09Hrs**
Introduction to sustainability: Introduction to Sustainability Concepts and Life Cycle Analysis, Material flow and waste management, Chemicals and Health Effects, Character of Environmental Problems	
Unit – II	**09 Hrs**
Environmental Data Collection and LCA Methodology: Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology. – Goal, Definition.	
Unit –III	**09 Hrs**
Life Cycle Assessment: Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Benefits and Drawbacks. **Wet Biomass Gasifiers:** Introduction, Classification of feedstock for biogas generation, Biomass conversion technologies: Photosynthesis, Biogas generation, Factors affecting bio-digestion, Classification of biogas plants, Floating drum plant and fixed dome plant their advantages and disadvantages.	
Unit –IV	**09 Hrs**
Design for Sustainability: Green Sustainable Materials, Environmental Design for Sustainability. **Dry Biomass Gasifiers:** Biomass energy conversion routes, Thermal gasification of biomass, Classification of gasifiers, Fixed bed systems:	
Unit –V	**09Hrs**
Case Studies: Odor Removal for Organics Treatment Plant, Bio-methanation, Bioethanol production. Bio fuel from water hyacinth.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the sustainability challenges facing the current generation, and systems-based approaches required to create sustainable solutions for society.
CO2	Identify problems in sustainability and formulate appropriate solutions based on scientific research, applied science, social and economic issues.
CO3	Apply scientific method to a systems-based, trans-disciplinary approach to sustainability
CO4	Formulate appropriate solutions based on scientfic research, applied science, social and economic issues.

Reference Books	
1.	Sustainable Engineering Principles and Practice, Bavik R Bhakshi, 2019, Cambridge University Press, ISBN - 9781108333726.
2.	Environmental Life Cycle Assessment , Olivier Jolliet, Myriam Saade-Sbeih, Shanna Shaked, Alexandre Jolliet, Pierre Crettaz , 1st Edition, CRC Press, ISBN: 9781439887660 .
3.	Sustainable Engineering: Drivers, Metrics, Tools, and Applications,Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams, 2019, John Wiley & Sons , ISBN-9781119493938

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						
ADVANCES IN CORROSION SCIENCE AND MANAGEMENT **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21CM75ID**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Basics of corrosion: Introduction: Galvanic series, Pilling-Bedworth ratio, Types: Galvanic corrosion, crevice corrosion, pitting corrosion, intergranular corrosion, erosion corrosion, stress corrosion, season cracking, hydrogen embrittlement, bacterial corrosion. **Corrosion in different engineering materials**: Concrete structures, duplex, stainless steels, ceramics, composites.	
Unit-II	**09 Hrs**
Corrosion mechanism: Electrochemical theory of corrosion**,** Crevice corrosion-mechanism of differential aeration corrosion, mixed potential theory for understanding common corrosion of metals and alloys. **Thermodynamics of Corrosion:** Pourbaix diagram and its importance in metal corrosion and its calculation for Al, Cu, Ni and Fe.	
Unit – III	**09 Hrs**
Effects of corrosion: The direct and indirect effects of corrosion, economic losses, Indirect losses -Shutdown, contamination, loss of product, loss of efficiency, environmental damage, Importance of corrosion prevention in various industries, corrosion auditing in industries, corrosion map of India. Corrosion issues in specific industries-power generation, chemical processing industries, oil and gas Industries, corrosion effect in electronic industry.	
Unit –IV	**09 Hrs**
Corrosion Testing and monitoring: Introduction, classification. Purpose of corrosion testing, materials, specimen. Surface preparation, measuring and weighing. Types of testing, lab, pilot plant and field tests. Measurement of corrosion rate, weight loss method, CPR numericals, Electrochemical methods, Tafel extrapolation. Linear polarization method.	
Unit –V	**09 Hrs**
Corrosion Control: Principles of corrosion prevention, material selection, design considerations, control of environment- decrease in velocity, passivity, removal oxidizer, Inhibitors and passivators, coatings- organic, electroplating of Copper, Nickel and Chromium, physical vapor deposition-sputtering, Electroless plating of Nickel.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the causes and mechanism of various types of corrosion
CO2:	Apply the knowledge of chemistry in solving issues related to corrosion.
CO3:	Analyse and interpret corrosion with respect to practical situations.
CO4:	Develop practical solutions for problems related to corrosion.

Reference Books	
1	Corrosion Engineering, M.G, Fontana, 3rd Edition, 2005, Tata McGraw Hill, ISBN: 978-0070214637.
2	Principles and Prevention of Corrosion, D. A Jones, 2nd Edition, 1996, Prentice Hall, ISBN: 978- 0133599930.
3	Design and corrosion prevention, Pludek, 1978, McMillan, ISBN: 978-1349027897
4	Introduction to metal corrosion, Raj Narain, 1983, Oxford &IBH, ISBN: 8120402995.

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						
PROMPT ENGINEERING **Category: Institutional Electives - II** **(Theory)**						
Course Code	**:**	**21CM75IE**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09Hrs**
Introduction to Prompt Engineering Raise of Context Learning, Prompts, Prompt Engineering, LLM Settings, 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	
Unit – II	**09 Hrs**
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	
Unit –III	**09 Hrs**
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	
Unit –IV	**09 Hrs**
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	
Unit –V	**09 Hrs**
Opportunities and Future Directions Model safety, Prompt Injection, Prompt Leaking, Jail Breaking; Reinforcement Learning from Human Feedback (RLHF) -- Popular examples: aClaude (Anthropic), ChatGPT (OpenAI), **Future directions:** Augmented LMs, Emergent ability of LMs, Acting / Planning - Reinforcement Learning, Multimodal Prompting, Graph Prompting	

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.
CO5	**Collaborate on projects involving prompt engineering -** work effectively in teams to design, implement, and evaluate prompt-based solutions, showcasing their ability to contribute to complex AI-related projects.

Reference Books	
1	Unlocking the Secrets of Prompt Engineering: Master the art of creative language generation to accelerate your journey from novice to pro , 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. Dec 2024, ISBN: 9781098156152
4.	The Art of Asking ChatGPT for High-Quality Answers_ A Complete Guide to Prompt Engineering, Ibrahim John , Nzunda Technologies Limited, 2023, ISBN-13: 9781234567890
5	Programming Large Language Models with Azure Open AI: Conversational programming and prompt engineering with LLMs, Francesco Esposito, Microsoft Pr, 1st Edition, April 2024,ISBN-13: 978-0138280376

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						
INTEGRATED HEALTH MONITORING OF STRUCTURES **Category: Institutional Electives - II** **(Theory)**						
Course Code	**:**	**21CV75IF**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

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

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

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

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
WEARABLE ELECTRONICS **Category: Institutional Electives - II** **(Theory)**						
Course Code	**:**	**21EC75IG**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

Unit-I	**09 Hrs**
Introduction: world of wearable (WOW), Role of wearable, The Emerging Concept of Big Data, The Ecosystem Enabling Digital Life, Smart Mobile Communication Devices, Attributes of Wearables, Taxonomy for Wearables, Advancements in Wearables, Textiles and Clothing, Applications of Wearables	
Unit – II	**09 Hrs**
Wearable Bio and Chemical Sensors: Introduction, System Design, Microneedle Technology, Sampling Gases, Types of Sensors, Challenges in Chemical Biochemical Sensing, Sensor Stability, Interface with the Body, Textile Integration, Power Requirements, Applications: Personal Health, Sports Performance, Safety and Security, Case studies.	
Unit –III	**09 Hrs**
Wearable Textile: Conductive fibres for electronic textiles: an overview, Types of conductive fibre, Applications of conductive fibres, Bulk conductive polymer yarn, Bulk conductive polymer yarn, Techniques for processing CPYs, Wet-spinning technique, Electrospinning technique, case studies, Hands on project in wearable textile: Solar Backpack, LED Matrix wallet. [Ref 2: Chapter 1,2] &. [Ref 3: Chapter 6,9]	
Unit –IV	**09 Hrs**
Energy Harvesting Systems: Introduction, Energy Harvesting from Temperature Gradient, Thermoelectric Generators, Dc-Dc Converter Topologies, Dc-Dc Converter Design for Ultra-Low Input Voltages, Energy Harvesting from Foot Motion, Ac-Dc Converters, Wireless Energy Transmission, Energy Harvesting from Light, Case studies. [Ref 1: Chapter 4.1]	
Unit –V	**09 Hrs**
Wearable antennas for communication systems: Introduction, Background of textile antennas, Design rules for embroidered antennas, Integration of embroidered textile surfaces onto polymer substrates, Characterizations of embroidered conductive, textiles at radio frequencies, RF performance of embroidered textile antennas, Applications of embroidered antennas. [Ref 2: Chapter 10]	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Describe the different types and wearable sensors, textile, energy harvesting systems and antenna
CO2:	Analysis measurable quantity and working of wearable electronic devices.
CO3:	Determine & interpret the outcome of the wearable devices and solve the design challenges
CO4:	Analyse and Evaluate the wearable device output parameter in real time scenario or given problem statement.

Reference Books	
1	Wearable Sensors: Fundamentals, Implementation and Applications, Edward Sazonov, Michael R. Neuman Academic Press, 1st Edition, 2014, ISBN-13: 978-0124186620.
2	Electronic Textiles: Smart Fabrics and Wearable Technology, Tilak Dias, Woodhead Publishing; 1 edition, ISBN-13**:** 978-0081002018.
3	Make It, Wear It: Wearable Electronics for Makers, Crafters, and Cosplayers, McGraw-Hill Education, 1st Edition, ISBN-13: 978-1260116151.
4	Flexible and Wearable Electronics for Smart Clothing: Aimed to Smart Clothing, Gang Wang, Chengyi Hou, Hongzhi Wang , Wiley, 1st Edition, ISBN-13: 978-3527345342
5	Printed Batteries: Materials, Technologies and Applications, Senentxu Lanceros-Méndez, Carlos Miguel Costa, Wiley, 1 edition , ISBN-13: 978-1119287421

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						
E-MOBILITY **Category: Institutional Electives - II** **(Theory)**						
Course Code	**:**	**21EE75IH**		**CIE**	**:**	**100Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
E-Mobility: A Brief History of the Electric Powertrain, Energy Sources for Propulsion and Emissions, The Advent of Regulations, Drive Cycles, BEV Fuel Consumption, Range, Carbon Emissions for Conventional and Electric Powertrains, An Overview of Conventional, Battery, Hybrid, and Fuel Cell Electric Systems, A Comparison of Automotive and Other Transportation Technologies. Vehicle Dynamics: Vehicle Load Forces, Vehicle Acceleration, Simple Drive Cycle for Vehicle Comparisons	
Unit – II	**09 Hrs**
Batteries: Batteries Types and Battery Pack, Lifetime and Sizing Considerations, Battery Charging, Protection, and Management Systems, Battery Models, Determining the Cell/Pack Voltage for a Given Output\Input Power, Cell Energy and Discharge Rate. **Battery Charging:** Basic Requirements for Charging System, Charger Architectures, Grid Voltages, Frequencies, and Wiring, Charging Standards and Technologies, SAE J1772, Wireless Charging, The Boost Converter for Power Factor Correction.	
Unit –III	**09 Hrs**
Battery Management System: BMS Definition, Li-Ion Cells, Li-Ion BMSs, Li-Ion Batteries, BMS Options: Functionality, CCCV Chargers, Regulators, Balancers, Protectors, Functionality Comparison, Technology, Topology. Measurement: Voltage, Temperature, Current, Management: Protection, Thermal Management, Balancing, Distributed Charging, Evaluation, External Communication: Dedicated analog and digital wires.	
Unit –IV	**09 Hrs**
Electric Drive train: Overview of Electric Machines, classification of electric machines used in automobile drivetrains, modelling of electric machines, Power Electronics, controlling electric machines, electric machine and power electronics integration Constraints. **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**
Charger Classification and standards: classification based on charging, levels (region-wise), modes, plug types, standards related to: connectors, communication, supply equipments, EMI/EMC. **Sizing the drive system:** Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems **Communications, Supporting Subsystems:** In vehicle networks- CAN	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and modelling.
CO 2	Discuss and implement different energy storage technologies used for electric vehicles and their management system.
CO 3	Analyze various electric drives and its integration techniques with Power electronic circuits suitable for electric vehicles.
CO 4	Design EV Simulator for performance evaluation and system optimization and understand the requirement for suitable EV infrastructure.

Reference Books	
	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.
2.	Battery Management system for large Lithium Battery Packs, Davide Andrea, 1st Edition, 2010, ARTECH HOUSE, ISBN-13 978-1-60807-104-3.
3.	Hybrid Vehicles from Components to System, F. BADIN, Ed, 1st Edition, 2013, Editions Technip, Paris, ISBN 978-2-7108-0994-4.
4.	Modern Electric Vehicle Technology C.C. Chan and K.T. Chau, 1st Edition, 2001, Oxford university press, ISBN 0 19 850416 0.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
PROGRAMMABLE LOGIC CONTROLLER'S AND APPLICATIONS **Category: Institutional Elective** **(Theory)**						
Course Code	**:**	**21EI75IJ**		**CIE**	**:**	**100Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**09 Hrs**
Introduction: Introduction to Industrial Automation, Historical background, Different parts and types of Industrial automation, Block diagram of PLC, PLC Versus Other types of Controls, PLC Product Application Ranges, Fixed and Modular I/O Hardware PLC Operation: Binary Data representation, Input and output status files for modular PLC, Addressing concept.	
UNIT II	**09 Hrs**
PLC Hardware: The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, Input and Output modules: Brief overview of Discrete and Analog input modules, Discrete and TTL/Relay output modules	
Unit –III	**09 Hrs**
Basics of PLC Programming: Processor memory organization, Program scan, PLC programming languages, Basic Relay Instruction, Bit or relay instructions, NO, NC, One Shot, Output latching software, negated Output and Internal Bit Type instructions, mode of operations	
Unit –IV	**09 Hrs**
Special programming Instructions: Timer and Counter Instructions: On delay and Off delay and retentive timer instructions, PLC Counter up and down instructions, combining counters and timers. **Program Control &Data manipulation Instructions**: Data handling instructions, Sequencer instructions, Programming sequence output instructions.	
UNIT V	**09 Hrs**
SCADA & DCS : Building Block of SCADA System, Hardware structure of Remote Terminal Unit, Block diagram of Distributive Control System **Case Studies**: Bottle filling system, Material Sorter. Elevator, Traffic control, Motor sequencers, Piston extraction and retraction using timers and counters.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand the basic concepts of PLC's and SCADA techniques.
CO2	Apply the programming concepts to interface peripheral.
CO3	Analyze and evaluate the automation techniques for industrial applications.
CO4	Develop a system for automation application.

Reference Books	
1.	Programmable Logic controllers, Frank D. Petruzella, Mc Graw hill, 4th Edition, ISBN:9780073510880, 2017
2.	Introduction to Programmable Logic Controllers, Garry Dunning, CENGAGE Learning, 3rd Edition, 2017, ISBN: 978-8131503027
3.	Industrial Control and Instrumentation, Bolton W, Universities Press, 6th Edition, 2006. ISBN 978-0128029299
4.	Computer Based Industrial control, Krishna Kant, PHI Publishers, 2nd Edition, 2010. ISBN 978-8120339880.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
SPACE TECHNOLOGY AND APPLICATIONS **Category:Institutional Elective** **(Theory)**						
Course Code	**:**	**21ET75IK**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
TotalHours	**:**	**45 L**		**SEE**	**:**	**3 Hours**

Unit-I	**9 Hrs**
Earth's environment: Atmosphere, ionosphere, Magnetosphere, VanAllen Radiation belts, Interplanetary medium, Solar wind, Solar- Earth Weather Relations. Launch Vehicles: Rocketry, Propellants, Propulsion, Combustion, Solid, Liquid and Cryogenic engines, Control and Guidance system, Ion propulsion and Nuclear Propulsion.	
Unit– II	**9Hrs**
Satellite Technology: Structural, Mechanical, Thermal, Power control, Telemetry, Telecomm and Quality and Reliability, Payloads, Classification of satellites. Satellite structure: Satellite Communications, Transponders, Satellite antennas.	
Unit–III	**9Hrs**
Satellite Communications: LEO, MEO and GEO orbits, Altitude and orbit controls, Multiple Access Techniques**. Space applications:** Telephony, V-SAT, DBS system, Satellite Radio and TV, Tele-Education, Telemedicine, Satellite navigation, GPS.	
Unit–IV	**9Hrs**
Remote Sensing: Visual bands, Agricultural, Crop vegetation, Forestry, water Resources, Land use, Land mapping, geology, Urban development resource Management, and image processing techniques. Metrology: Weather forecast (Long term and Short term), weather modelling, Cyclone predictions, Disaster and flood warning, rainfall predictions	
Unit–V	**9 Hrs**
Space Missions: Technology missions, deep space planetary missions, Lunar missions, zero gravity experiments, space biology and International space Missions. **Advanced space systems:** Remote sensing cameras, planetary payloads, space shuttle, space station, Interspace communication systems.	

Course Outcomes:After completing the course, the students will be able to	
CO1	Explain various Orbital Parameters,Satellite Link Parameters, Propagation considerations and Radar systems.
CO2	Apply the concepts to determine the parameters of satellite, performance of radar and navigation systems.
CO3	Analyze the design issues of satellite and its subsystems, radars and navigation systems.
CO4	Evaluate the performance of the satellite systems and its parameters, radar and navigation Systems.

Reference Books	
1.	Atmosphere, weather andclimate,RGBarry,Routledgepublications,2009,ISBN- 10:0415465702.
2.	Fundamentals ofSatellite Communication,KN RajaRao,PHI,2012,ISBN:
3.	SatelliteCommunication,Timothypratt,JohnWiley,1986ISBN: 978-0-471-37007 -9, ISBN10: 047137007X.
4	Remotesensingandapplications,BCPanda,VIVAbooksPvt.Ltd.,2009,ISBN: 108176496308.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
MOBILE APPLICATION DEVELOPMENT **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21IS75IL**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
TotalHours	**:**	**45L**		**SEE Duration**	**:**	**03 Hours**

Prerequisite: - Programming in Java.

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

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

Reference Books	
1	Android Programming, Phillips, Stewart, Hardyand Marsicano, Big Nerd Ranch Guide, 2nd Edition, 2015, ISBN-13 978-0134171494
2	AndroidStudioDevelopmentEssentials-Android6, NeilSmyth,2015, Create space Independent Publishing Platform, ISBN:9781519722089
3	Android Programming–Pushing the limits, EricHellman,2013, Wiley, ISBN-13:978-1118717370

4	Professional Android2ApplicationDevelopment, RetoMeier, Wiley India Pvt. Ltd, 1st Edition, 2012,ISBN-13:9788126525898
5	BeginningAndroid3, Mark Murphy, A press Springer India Pvt Ltd,1st Edition,2011, ISBN-13:978-1-4302-3297-1
6	AndroidDeveloperTraining-https://developers.google.com/training/android/ AndroidTestingSupportLibrary-https://google.github.io/android-testing-support-library/

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50 Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
PROJECT MANAGEMENT **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21IM75IM**		**CIE**	**:**	**100Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**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 WBS, 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, PLM concepts. Project life cycle costing.	
Unit –V	**09 Hrs**
Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the fundamental concepts of project management and its relationship with organizational strategy, operations management, and business value.
CO 2	Apply techniques for generating, screening, and evaluating project ideas, considering factors such as net present value and project rating index.
CO 3	Create Work Breakdown Structures (WBS), utilization of PERT/CPM for developing project schedule, alongside requirement collection, scope definition, scope validation, and scope control.
CO 4	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). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
SUPPLY CHAIN ANALYTICS (Institutional Elective-I) (THEORY)						
Course Code	**:**	**21IM75IN**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42L**		**SEE Duration**	**:**	**03 Hours**

Unit-I	**06 Hrs**
Introduction: Supply Chain, Supply Chain Management, Business Analytics, Supply Chain Analytics. Data-Driven Supply Chains: Data and its value in SCM, Data Source in Supply Chains, Big Data, Introduction to Python (Concepts only).	
Unit – II	**08 Hrs**
Data Manipulation: Data Manipulation, Data Loading and Writing, Data Indexing and Selection, Data Merging and Combination, Data Cleaning and Preparation, Data Computation and Aggregation, Working with Text and Datetime Data (Concepts only).	
Unit –III	**08 Hrs**
Customer Management: Customers in Supply Chains, Understanding Customers, Building a Customer-Centric SC, Cohort Analysis, RFM Analysis, Clustering Algorithms (Concepts only). Supply Management: Procurement in Supply Chains, Supplier Selection, Supplier Evaluation, Supplier Relationship Management, Supply Risk Management, Regression Algorithms (Concepts only).	
Unit –IV	**08 Hrs**
Warehouse and Inventory Management: Warehouse Management, Inventory Management, Warehouse Optimization, Classification Algorithms (Concepts only). Demand Management: Demand Management, Demand Forecasting, Time Series Forecasting, Machine Learning Methods (Concepts only).	
Unit –V	**06 Hrs**
Logistics Management: Logistics Management, Modes of Transport in Logistics, Logistics Service Providers, Global Logistics Management, Logistics Network Design, Route Optimization (Concepts only).	
Experiential Learning: Data Visualization: Data Visualization in Python, Creating a Figure in Python, Formatting a Figure, Plotting Simple Charts, Plotting with Seaborn, Geographic Mapping with Basemap, Visualizing Starbucks Locations. Python programming for various algorithms applied to supply chain processes and modelling included in the five units of the syllabus.	

Course Outcomes: After completing the course, the students will be able to know	
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.	Kurt Y. Liu, Supply Chain Analytics - Concepts, Techniques and Applications, Palgrave – Macmillan, Springer Nature Switzerland AG, 2022, ISBN 978-3-030-92224-5 (eBook)
2.	Işık Biçer, Supply Chain Analytics - An Uncertainty Modeling Approach, 2023, Springer Texts in Business and Economics, Springer Nature Switzerland AG, e-ISSN 2192-4341, e-ISBN 978-3-031-30347-0
3.	Supply Chain Management – Strategy, Planning & Operation, Sunil Chopra, Peter Meindl & D V Kalra, 6th Edition, 2016, Pearson Education Asia; ISBN: 978-0-13-274395-2.
4.	Supply Chain Management – Creating Linkages for Faster Business Turnaround, Sarika Kulkarni & Ashok Sharma, 1st Edition, 2004, TATA Mc Graw Hill, ISBN: 0-07-058135–5

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). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
NUCLEAR ENGINEERING **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21ME75IO**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

Prerequisites: Basic knowledge of Physics and Mathematics at the college level

Unit-I	**09 hrs**

Introduction to Nuclear Engineering : Historical Development of Nuclear Engineering, Overview of Nuclear Energy Applications, Nuclear Physics Fundamentals: Atomic Structure and Nuclear Models: Nuclear Forces and Interactions, Nuclear Reactions and Cross-sections, Types of Nuclear Reactions: Fission and Fusion Reactions, Neutron-Induced Reactions, Applications in Power Generation and Industry, Nuclear Power Generation: Basic Principles of Nuclear Reactors, Types of Nuclear Reactors, Radiation Basics, Types of Radiation (Alpha, Beta, Gamma), Radioactive Decay and Decay Chains, Units of Radioactivity and Radiation Measurement

Unit-II	**10 hrs**

Nuclear Reactors : Types of Nuclear Reactors, Reactor Components and Their Functions, Nuclear Reactor Kinetics and Control, Neutron Interactions and Transport, Neutron Moderation and Absorption, Reactor Kinetics and Dynamics, Specific Types of Nuclear Reactor, Light Water Reactors: Pressurized Water Reactor (PWR) and Boiling Water Reactor (BWR), Heavy Water Reactors: Canada Deuterium Uranium (CANDU), Gas-Cooled Reactors: Gas-Cooled Reactor and Fast Breeder Reactor (and HTGR), Liquid Metal-Cooled Reactors (LMFR).

Unit – III	**10 hrs**

Nuclear Fuel Cycle : Introduction to the Nuclear Fuel Cycle: Importance of Fuel Cycle Management, Uranium Mining and Ore Processing, Types of Uranium Deposits, Mining Methods and Processing Techniques, Environmental and Health Considerations, Uranium Enrichment and Fuel Fabrication: Enrichment Technologies (Centrifugation, Gaseous Diffusion), Fuel Fabrication Processes, Quality Control and Safety Measures, Nuclear Reactors and Fuel Utilization: Fuel Assembly Design and Composition.

Unit-IV	**08 hrs**

Radiation Protection and Safety: Basics of Ionizing Radiation, Types of Ionizing Radiation, Interaction of Radiation with Matter, Units of Radiation Measurement, Biological Effects of Radiation, Deterministic and Stochastic Effects, Acute and Chronic Radiation Effects, Risk Assessment and Dose, Response Relationships, Radiation Dose Assessment: External and Internal Dosimetry, Radiation Monitoring Devices, Occupational and Public Dose Limits, Radiation Safety Measures:, Emergency Response and Contingency Planning: Emergency Procedures and Drills, Communication Strategies During Radiation Incidents.

Unit-V	**08 hrs**

Environmental and Societal Aspects : Environmental Impact Assessment: Life Cycle Analysis of Nuclear Energy, Impact of Uranium Mining and Fuel Cycle Operations, Radioactive Waste Management and Environmental Considerations, Societal Perceptions and Attitudes, Factors Influencing Public Perception, Ethical Considerations: Principles of Ethics in Nuclear Engineering, Nuclear Energy and Social Justice, Ethical Dilemmas in Nuclear Technology, Nuclear Energy and Climate Change: Carbon Footprint of Nuclear Power.

Course Outcomes:	
CO1	Understand nuclear physics: grasp atomic structure, nuclear models, and the forces driving nuclear interactions
CO2	Evaluate various reactor types and advanced concepts, applying kinetics and controls to ensure safe and efficient nuclear reactor analysis and design.
CO3	Examine the nuclear fuel cycle from mining to recycling, assess environmental impact and safety, and promote responsible, sustainable practices throughout.
CO4	Apply ionizing radiation principles for safety measures; integrate communication and regulatory compliance into emergency response plans effectively.

Reference Books	
1	Bodansky, D. (2007). "Nuclear Energy: Principles, Practices, and Prospects." Springer. ISBN-13: 978-0387261994.
2	Lamarsh, J. R., & Baratta, A. J. (2001). "Introduction to Nuclear Engineering." Prentice Hall. ISBN-13: 978-0201824988.
3	Duderstadt, J. J., & Hamilton, L. J. (1976). "Nuclear Reactor Analysis." John Wiley & Sons. ISBN-13: 978-0471223634.
4	Knoll, G. F. (2008). "Radiation Detection and Measurement." John Wiley & Sons. ISBN-13: 978-0470131480

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
COGNITIVE PSYCHOLOGY **Category: Institutional Elective II** **(Theory)**						
Course Code	**:**	**21HS75IQ**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42 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	**08 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	**08 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	**08 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 behaviors and mental processes.
CO2	Define learning and compare and contrast the factors that cognitive, behavioural, 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 to their own and others' lives to better understand their personalities and experiences.

Reference Books	
1	Sterberg R.J and Sternberg Karin(2012) Cognitive Psychology 6th Edition Woods worth Cenguage 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). 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						
PRINCIPLES AND PRACTICES OF CYBER LAW **Category: Institutional Elective** **(Theory)**						
Course Code	**:**	**21HS75IR**		**CIE**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08 Hrs**
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. **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.Activities:Case Studies and Practical Applications	
Unit – II	**08 Hrs**
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. **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 Act 2000, Issues and challenges of E-Commerce. Activities: Case Studies and Practical Applications	
Unit –III	**08 Hrs**
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. **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. Activities: Case Studies and Practical Applications	
Unit –IV	**08 Hrs**
IP Protection Issues in Cyberspace **Copyright Issues in Cyberspace**- Copyright infringement in digital environment. Indian legal protection of copyright in cyberspace. **Trademark Issues in Cyberspace** - Domain Name Vs Trademark, Domain Name dispute and Related Laws, Different Form of Domain in Cyberspace. **Patent Issues in Cyberspace** - Legal position on Computer related Patents - Indian Position on Patents. Activities: Case Studies and Practical Applications	
Unit –V	**07 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: Dreamtech Press, ISBN-10: 9789351194736, ISBN-13: 978-9351194736.
3	Cyber Forensics in India: A Legal Perspective by Nishesh Sharma, 1st Edition, ISBN: 9788131250709.
4	Cyber Laws, Justice Yatindra Singh, 6th Edition, Vol. 1, ISBN : 9789351437338

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**M**
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						
SUMMER INTERNSHIP						
Course Code	**:**	**21ET76I**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Hours/Week	**:**	**04**		**SEE Duration**	**:**	**2 Hours**

GUIDELINES

1. The duration of the internship shall be for a period of ***6/8 weeks*** on full time basis after VI semester final exams and before the commencement of VII semester.
2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3. Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
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.
7. The broad format of the internship final report shall be as follows
    - 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

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.

Scheme of Continuous Internal Evaluation (CIE):

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:

Reviews	Activity	Weightage
Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments.	25 Marks
Review - II	Importance of resource management, environment and sustainability, presentation skills and report writing	25 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: VII						
MINOR PROJECT						
Course Code	**:**	**21ET77P**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Hours/Week	**:**	**04**		**SEE Duration**	**:**	**2 Hours**

GUIDELINES

1. The minor project is to be carried out individually or by a group of students. (maximum of 4 members and minimum of 3 students).

2. Each student in a team must contribute equally in the tasks mentioned below.

3. Each group has to select a current topic that will use the technical knowledge of their program of study after detailed literature survey.

4. The project should result in system/module which can be demonstrated, using the available resources in the college.

5. The CIE evaluation will be done by the committee constituted by the department. The committee shall consist of respective guide & two senior faculty members as examiners. The evaluation will be done for each student separately.

6. The final copy of the report should be submitted after incorporation of any modifications suggested by the evaluation committee.

The minor-project tasks would involve:

1. Carrying out the Literature Survey of the topic chosen.
2. Understand the requirements specification of the minor-project.
3. Detail the design concepts as applicable through appropriate functional block diagrams.
4. Commence implementation of the methodology after approval by the faculty.
5. Conduct thorough testing of all the modules developed and carry out integration testing.
6. Demonstrate the functioning of the minor project along with presentations of the same.
7. Prepare a project report covering all the above phases with proper inference to the results obtained.
8. Conclusion and Future Enhancements must also be included in the report.

The students are required to submit the report in the prescribed format provided by the department.

Course Outcomes:

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

CO1: Interpreting and implementing the project in the chosen domain by applying the concepts learnt.

CO2: The course will facilitate effective participation by the student in team work and development of communication and presentation skills essential for being part of any of the domains in his / her future career.

CO3: Appling project life cycle effectively to develop an efficient product.

CO4: Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

Scheme of Continuous Internal Evaluation (CIE):
The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in three review phases. The evaluation criteria shall be as per the rubrics given below:

ReviewPhase	Activity	Weightage
Phase-I	Synopsis submission, approval of the selected topic, Problem definition, Literature review, formulation of objectives, methodology	10 Marks
Phase - II	Mid-term evaluation to review the progress of implementation, design, testing and result analysis along with documentation	15 Marks
Phase -III	Submission of report, Final presentation and demonstration	25 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	**:**	**21ET81P**		**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):

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

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

Scheme for Semester End Evaluation (SEE):

The following are the weightages given during Viva Examination.

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

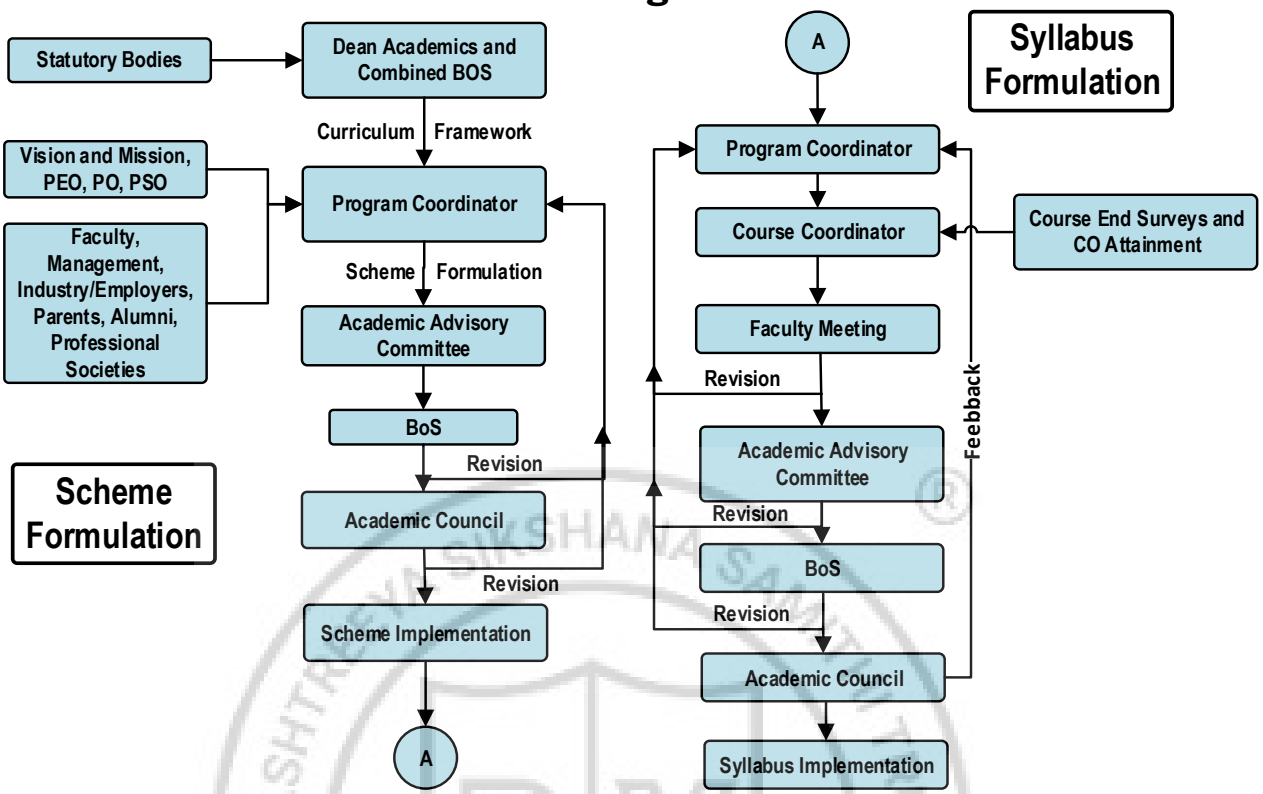
Calendar of Events for the Project Work:

Week	Event
Beginning of 7th Semester	Formation of group and approval by the department committee.
7th Semester	Problem selection and literature survey
Last two weeks of 7th Semester	Finalization of project and guide allotment
II Week of 8th Semester	Synopsis submission and preliminary seminar
III Week	First visit of the internal guides to industry(In case of project being carried out In industry)
III to VI Week	Design and development of project methodology
VII to IX Week	Implementation of the project
X Week	Submission of draft copy of the project report
XI and XII Week	Second visit by guide to industry for demonstration. Final seminar by Department project Committee and guide for internal assessment. Finalization of CIE.

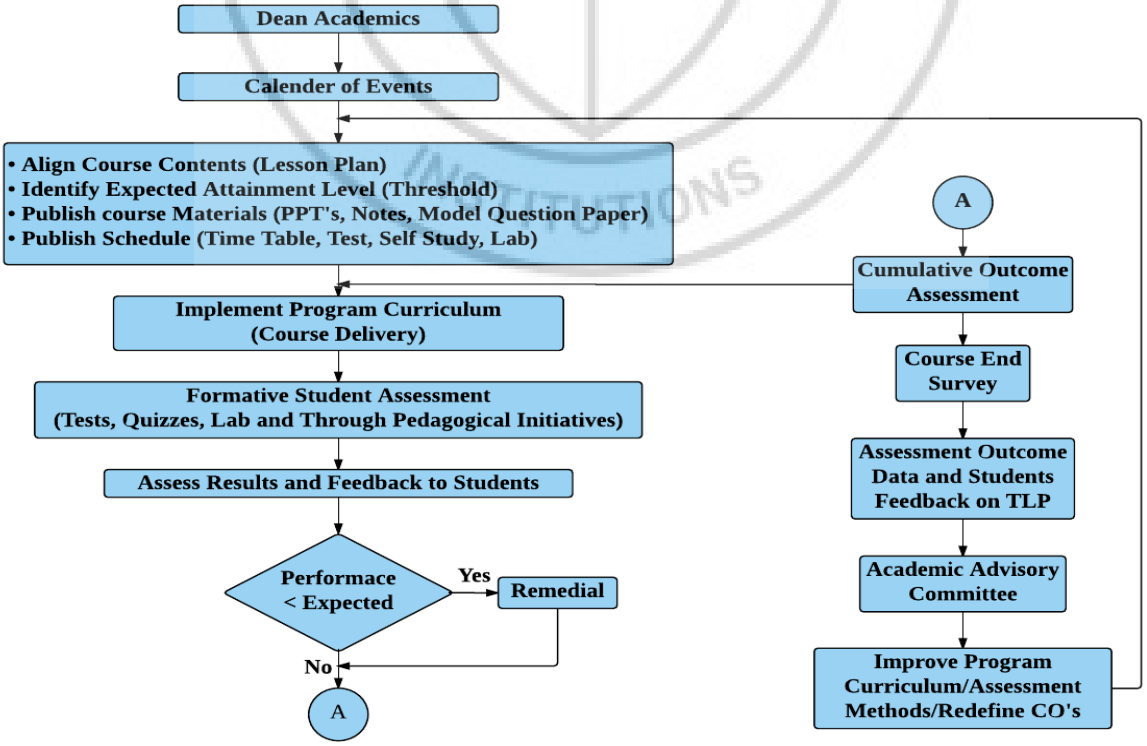
Evaluation & Scheme for CIE and SEE

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	25%	Project Demo/Presentation	30%
Project Evaluation III	25%	Methodology and Results Discussion	30%
Project Evaluation Phase-IV (Submission of Draft Project Report for Verification)	30%	Project Work Report	10%
Project Evaluation Phase-V (Project Final Internal Evaluation)	10%	Viva-voce	20%
Total	100	Total	100

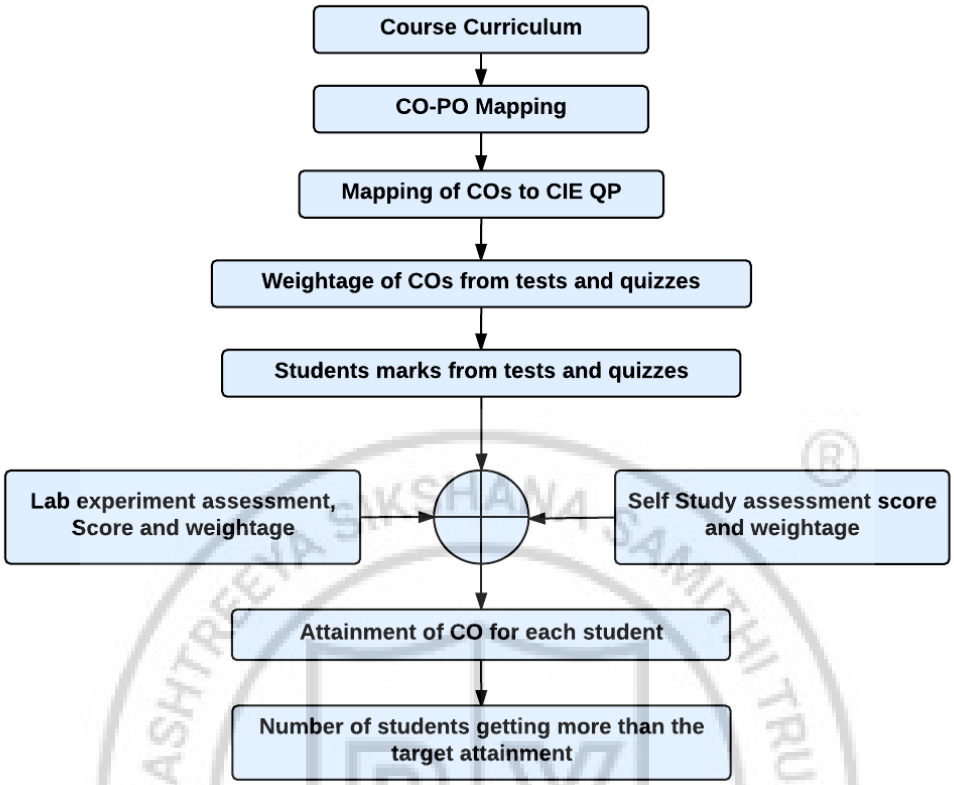
Curriculum Design Process



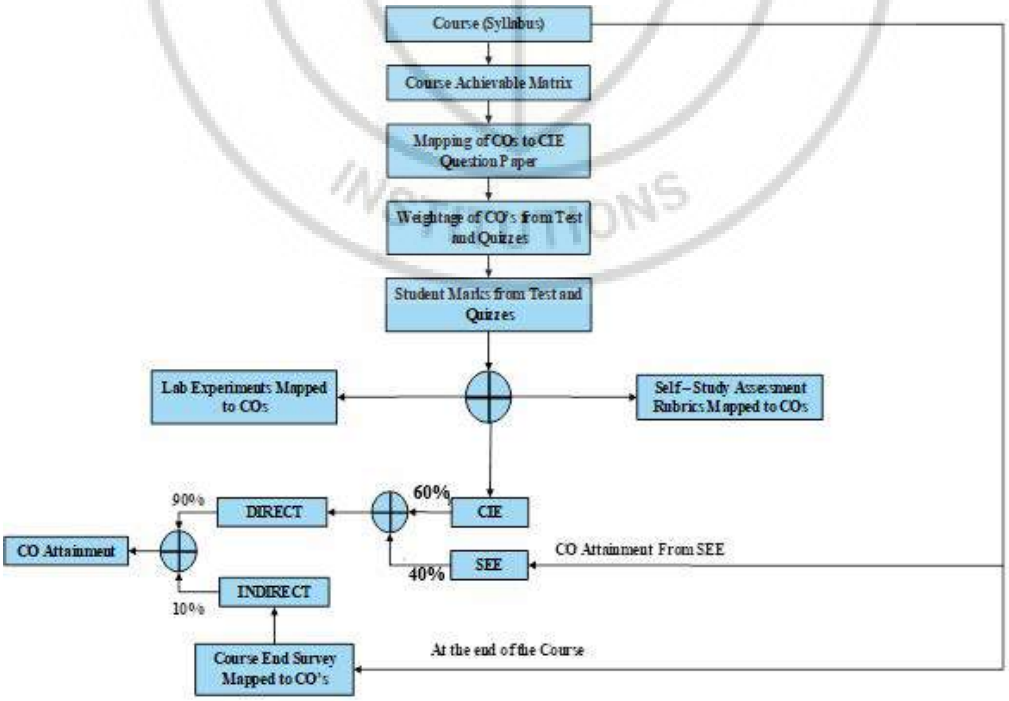
Academic Planning and Implementation



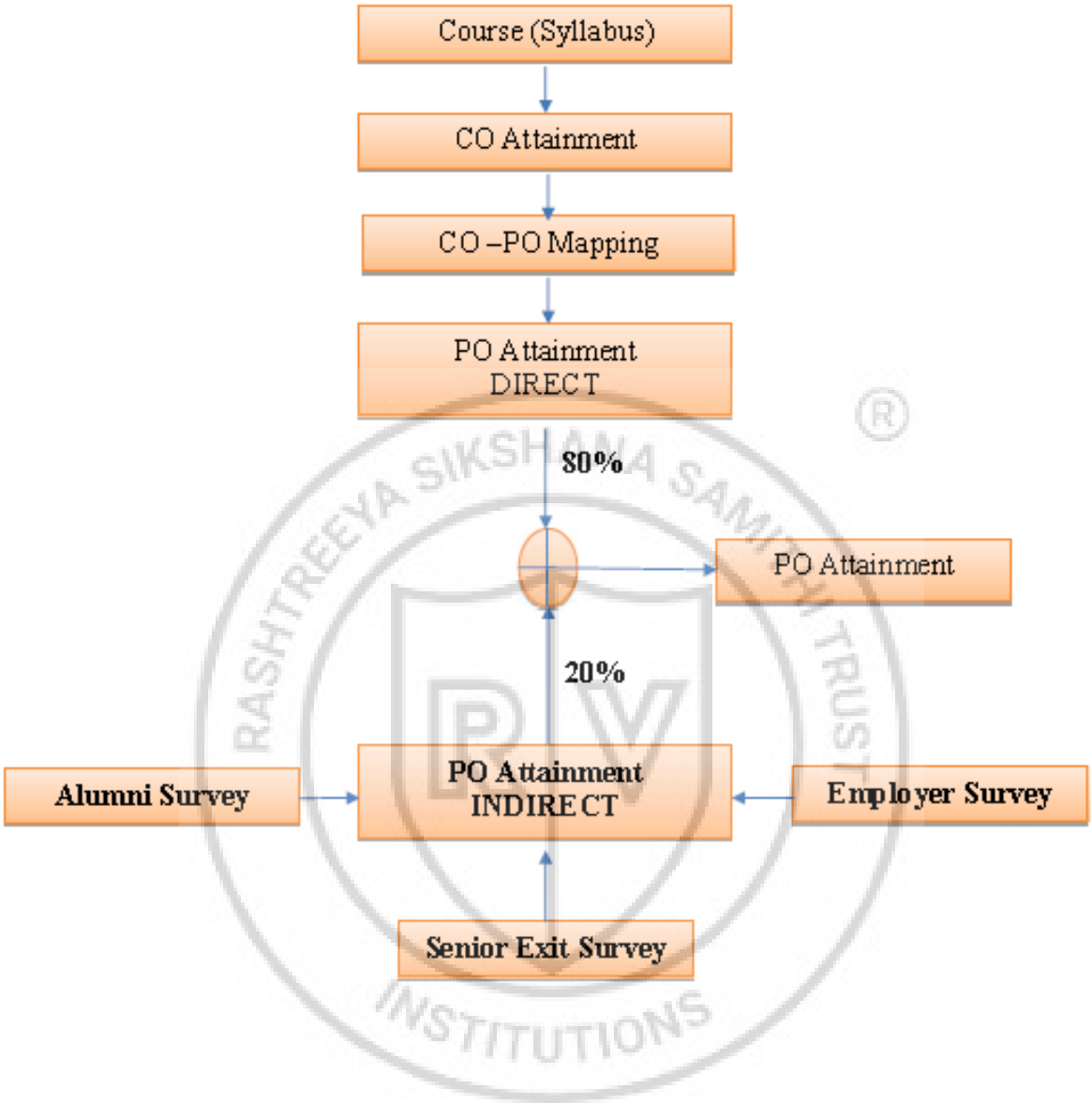
Process For Course Outcome Attainment



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.

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

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

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

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

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

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

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

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

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

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

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

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

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

Cultural Activity Teams

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

NSS of RVCE

NCC of RVCE

VISION

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

MISSION

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

QUALITY POLICY

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

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation