RV College of Engineering®

Civil 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

RV College of Engineering®

Civil 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

Vision

Excel in Education, Research and Consultancy in Civil Engineering with emphasis on Sustainable Development

Mission

1. Disseminating and integrating the knowledge of civil Engineering and allied fields
2. Enhancing industry-institute interaction leading to interdisciplinary research.
3. Imbibing wide-range of skills in cutting-edge technology for sustainable development.
4. Motivate entrepreneurship and professional ethics to serve the society.

Program Educational Objectives

After successful completion of the program, the graduates will be able to PEO1:

Successfully address technological and managerial challenges.

PEO2: Professionally design and execute Civil Engineering projects.

PEO3: Pursue advanced education, research and continue life-long learning process to remain active professionals.

PEO4: Play key roles in addressing societal needs through interdisciplinary approach.

Program Specific Outcomes

1. Apply knowledge of fundamental aspects to analyze and design civil engineering structures.
2. Provide sustainable solutions to civil engineering problems.
3. Employ codal provisions to arrive at comprehensive solutions to address societal needs
4. Exhibit communication and teamwork skills.

ABBREVIATIONS

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

INDEX

B.E. IN
CIVIL ENGINEERING

VII SEMESTER														
Sl. No.	**Course Code**	**Course Title**	**Credit Allocation**				**BoS**	**Category**	**CIE Duration (H)**	**Max Marks CIE**		**SEE Duration (H)**	**Max Marks SEE**	
			L	**T**	**P**	**Total**				**Theory**	**Lab**		**Theory**	**Lab**
1	21HS71	Constitution of India and Professional Ethics	3	0	0	3	HS	Theory	1.5	100		3	100	
2	21CV72	Estimation & Costing	3	0	1	4	CV	Theory + Lab	1.5	100	50	3	100	50
3	21CV73GX	Professional Core Elective-IV (Group-G)	3	0	0	3	CV	Theory	1.5	100		3	100	
4	21CV74HX	Professional Core Elective-V (Group-H)	3	0	0	3	CV	Theory	1.5	100		3	100	
5	21XX75IX	Institutional Electives -II (Group I)	3	0	0	3	CV	Theory	1.5	100		3	100	
6	21CV76I	Summer Internship	0	0	2	2	CV	Internship	1.5		50	2		50
7	21CV77	Extensive Survey Camp	0	0	2	2	CV		1.5		50	2		50
		Total				**20**								
Note: Summer Internship- will be undertaken after VI semester for a period of 06 Weeks (this will have both CIE & SEE)														

GROUP-G		
Sl. No.	**Course Code**	**Course Title**
1	21CV73G1	Pavement Materials and Design
2	21CV73G2	Hydraulic Structure
3	21CV73G3	Foundation Engineering
4	21CV73G4	Valuation Engineering
5	21CV73G5	Structural Dynamics

GROUP-H		
Sl. No.	**Course Code**	**Course Title**
1	21CV74H1	Design of Steel Structural Components
2	21CV74H2	Environmental Impact Assessment
3	21CV74H3	Urban Transport Planning
4	21CV74H4	Pre-stressed Concrete
5	21CV74H5	Reinforced Earth Structures

Sl. No.	**BoS**	**Course Code**	**Course Title**
1	AS	21AS75IA	Unmanned Aerial Vehicles
2	BT	21BT75IB	Bioinformatics
3	CH	21CH75IC	Sustainability and Life Cycle Analysis
4	CM	21CM75ID	Advances in Corrosion Science & Management
5	CV	21CV75IF	Integrated Health Monitoring of Structures
6	EC	21EC75IG	Wearable Electronics
7	EE	21EE75IH	E-Mobility
8	EI	21XEI75IJ	Programmable Logic Controllers & its applications.
9	IS	21IS75IL	Mobile Applications Development
10	IM	21IM75IM	Project Management
11	IM	21IM75IN	Supply Chain Analytics
12	ME	21ME75IO	Nuclear Engineering
13	HS	21HS75IQ	Cognitive Psychology
14	HS	21HS75IR	Principle and Practices of Cyber Law

Semester: VII						
CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS **Category:** **Stream:** **(Theory)**						
Course Code	**:**	21HS71		**CIE**	**:**	100
Credits: L:T:P	**:**	3:0:0		**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. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire	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&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						
ESTIMATION & COSTING (Theory & Practice)						
Course Code	**:**	**21CV72**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**40L+26P**		**SEE Duration**	**:**	**3Hours+ 3 Hours**

Unit-I — **08 Hrs**

Estimation: Different type of estimates, study of various drawing attached with estimates, important terms, units of measurement, abstract of estimate, approximate methods of estimating buildings, cost from materials and recommended labour coefficients.

Building Estimate: Methods of taking out quantities and cost-centre line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – Masonry structures, framed structures with flat, slopped RCC roofs with all building components. Culverts (includes box culvert, pipe culvert and RC slab culverts) manhole and septic tank.

Unit – II — **08 Hrs**

Specifications: Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of item of works in buildings, specifications of aluminium and wooden partitions, false ceiling, aluminium and fibre doors and windows. Various types of claddings.

Unit –III — **08 Hrs**

Contracts: Types of contract-essential of contract –legal aspects, penal provision on breach of contract. Definition of the terms-Tender, Earnest money deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor refund of deposit. Administrative approval - Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Unit –IV — **08 Hrs**

Measurement of Earth Work for Roads: Methods for computation of earthwork-cross sections-med section formula, trapezoidal or average end area or mean sectional area formula, prismoidal formula.
Project Preparation: Preliminary Survey Report and Detailed Project Report

Unit –V — **08 Hrs**

Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works or doors, windows and ventilators.

Laboratory

Development of model and preparation of detailed estimation using BIM tools for the following

1) Building
2) Masonry structures
3) Framed structure
4) Slopped roof with building components
5) Culverts (Box, pipe and RC slab culverts)
6) Manhole
7) Septic tank

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Extract quantities of construction items by reading engineering / construction drawings and specifications followed in executing projects
CO2	Prepare of estimates using different methods for building projects (RCC, Steel Structures, Masonry, Road and Hydraulic Structures)
CO3	Apply the method of working out unit rate analysis of different construction items for finally prepared tendered documents
CO4	Create tender document, billing of qualities of works and other financial related issues

Reference Books	
1.	N. Chakraborti, "Estimating, costing, specification and Valuation in Civil Engg", Published by author, Culcutta, 20th Edition, 2007
2.	B.N. Dutta, "Estimating & Specification", USB Publishers and Distributors, New Delhi, 25th Revised Edition, 2006, ISBN 817476383X, ISBN 9788174763839
3.	S.C. Rangawala, "Estimating and Specification", Charotar Publishing House, Anand, 2008
4.	G.S. Birdie, "Text book of Estimating and Costing", Dhanpath Rai and Sons, New Delhi, 1st Edition, 2008

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**
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 & LABORATORY	**150**

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 & 3	Unit 1 : (Compulsory) Question 2 or 3	20
4 & 5	Unit 2 : Question 4 or 5	15
6 & 7	Unit 3 : Question 6 or 7	15
8 & 9	Unit 4 : Question 8 or 9	15
10 & 11	Unit 5 : Question 10 or 11	15
	TOTAL	**100**

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

Semester: VII						
PAVEMENT MATERIALS AND DESIGN **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV73G1**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3Hours**

Unit-I	**08 Hrs**
Types , Component and functions of flexible and rigid Pavements Factors affecting Design and Performance of flexible Pavements: Traffic and loading- ESWL, tyre pressure, contact pressure, load repetitions. Material characterization, Climatic and environmental factors- No numerical	
Unit – II	**08 Hrs**
Design of flexible pavements Design of flexible as per IRC 37-2018- The Principle and approach followed in IRC guidelines. Use of IITPAVE software. Numerical on design of Conventional Bituminous Pavement with Granular Base and Sub-base.	
Unit –III	**08 Hrs**
Stresses in rigid pavements Wheel Load Stresses, Temperature Stresses, Friction Stresses, Critical combination of Stresses - Numerical on stresses Types of Joints in Cement Concrete Pavements and their Functions.	
Unit –IV	**08 Hrs**
Design of rigid pavements Design of plain jointed rigid pavements for highways as per IRC 58-2015, Design of dowel bars, Design of tie bars. .	
Unit –V	**08 Hrs**
Recycling of pavements – Types of recycling **Alternate Materials for pavement construction:** Industrial waste materials – fly ash, pond ash, GGBS, waste plastics, fibres – recycled aggregate and RAP. Nanomaterials for pavements: Nano clay, Nano silica, Carbon Nano Tube	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Identify the suitable pavement materials, pavement components and its function
CO2	Determine stresses and deflection in flexible and rigid pavements
CO3	Design and evaluate flexible pavement using IRC method
CO4	Design and evaluate rigid pavement using IRC method

Reference Books	
1.	S.K. Khanna, C.E.G. Justo, A. Veeraragavan Nemchand ; ISBN 13, 9788185240930 ; Publisher, Nemchand ; Edition, 10th
2.	Yoder and Witczak, Principles of Pavement Design, 1975, John Wiley and sons, 0471977802, 9780471977803
3.	Yang, Design of functional pavements, 1973, McGraw-Hill, ISBN: 0070722439 9780070722439.
4.	Relevant IRC codes
5	S.K. Khanna, C.E.G. Justo, A. Veeraragavan Nemchand ; ISBN 13, 9788185240930 ; Publisher, Nemchand ; Edition, 10th

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						
HYDRAULIC STRUCTURES **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV73G2**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**07 Hrs**
Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.	
Unit – II	**08 Hrs**
Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.	
Unit –III	**08 Hrs**
Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.	
Unit –IV	**08 Hrs**
Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices. **Diversion Headwork's:** Design of aprons - Failure of hydraulic structures instituted on perviousfoundations. Bligh's Creep theory for seepage flow, Lane's weighted Creep theory, Khosla's theory and concept of flow nets.	
Unit –V	**09 Hrs**
Canal Regulation Works: Canal regulation works, canal regulators, alignment of the off taking channels, Distributary head regulator and cross regulator. **Canal falls:** Necessity and types - Trapezoidal notch fall, Syphon well drop, Simple vertical drop fall,Sarda type fall, Straight glacis fall, Baffle fall or Inglis fall. **Canal Outlets or Modules:** Requirements of good Module, types of Modules, Criteria for judging the performance of modules, certain other important definitions connected with modules, types of non-modular outlets, types of semi modules or Flexible outlets, types of rigid modules.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Check the stability of gravity dam sand design the dam.
CO2:	Estimate the quantity of seepage through earth dams.
CO3:	Design spillways and aprons for various diversion works.
CO4:	Select particular type of canal regulation work for canal network.

Reference Books	
1	Dam Hydraulics, D. L. Vischer, W. H. Hager, Wiley Publishers, March 1998 ISBN: 978-0-471-97289-1.
2	Irrigation Engineering and Hydraulic Structures, S.K.Garg, Khanna Publishers, New Delhi, 2006, ISBN-10: 8174090479, ISBN-13: 978-8174090478.

3	Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, Edition, 2005
4	Irrigation and Water Power Engineering, Punmia and Pandey Lal, Askok Kumar Jain, Arun Kumar Jain, 16th Edition, 2019,Lakshmi Publications, New Delhi, ISBN:8131807630, 978-81318076373.
5	Irrigation, Water Power and Water Resources Engineering, K.R.Arora,4th Revised Edition, 2014, Standard Publishers, ISBN 8180140075, 978-8180140075.
6	R.K.Sharma, Irrigation Engineering, S Chand Publishing; 1st edition, 2017, ISBN: 9789352533770.
7	Irrigation water resources and water Power Engineering, P.N.Modi, Standard book house, New Delhi, 9th edition, 2008, ISBN 8189401297, ISBN-13: 978-8189401290
8	Irrigation Engineering and Hydraulic Structures, S.R. Sahasrabudhe, S.K. Kataria& Sons, 2013Edition, ISBN-10: 9350141310, ISBN-13: 978-9350141311.

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

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. No.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : 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						
FOUNDATION ENGINEERING **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV73G3**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.0 Hours**

Unit-I	**07 Hrs**
Site Investigation: Introduction, site reconnaissance, objective of site exploration, methods of site exploration, soil samples and samplers, methods of sampling, penetration and sounding tests, geophysical methods.	
Unit – II	**09 Hrs**
Stress Distribution in Soil Mass: Introduction, Boussinesq's analysis, isobar and pressure bulb, vertical stress distribution on horizontal plane and on vertical line, vertical stress under uniformly loaded circular area and under strip load, vertical stress due to line load, uniformly loaded rectangular area, equivalent point load method, Newmark's influence chart, Westergaard analysis, comparison of Boussinesq and Westergaard theories. **Stability of Slopes:** Introduction, Types and causes of slope failures, Infinite and Finite slopes, Slope stability analysis by Method of Slices, Fellinious method, Friction circle method, Slope stability analysis by Taylor stability norms.	
Unit –III	**08 Hrs**
Bearing Capacity: Introduction, Terzaghi's analysis, Meyerhof's analysis and effect of water tableon bearing capacity, effect of eccentricity of loading, I.S. Code method for computing bearing capacity, plate load test, penetration tests.	
Unit –IV	**08 Hrs**
Pile Foundations: Introduction, Classification of piles, pile driving, load carrying capacity of piles, dynamic formulae, static formulae, pile load tests, group action in piles, negative skin friction,under-reamed pile foundations.	
Unit –V	**08 Hrs**
Earth Pressure: Introduction, earth pressure at rest, active earth pressure: Rankine's theory, active earth pressure of cohesive soils, passive earth pressure: Rankine's and Coulomb's wedge theory, Rebhann's and Culmann's graphical method for active and passive pressure.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1:	Understand the soil behavior under different sub soil conditions, loading conditions and design parameters of sub-structure
CO2:	Gain Knowledge in the domain of foundation Engineering by applying the soil behaviour theory and its pattern involved in sub-structure design
CO3:	Recommend suitable type of foundation and the stability of slopes based the investigated soil data and load distribution pattern
CO4:	Design suitable foundation system and evaluate the stability of sub-soil condition including slopes being subjected to loading conditions

Reference Books	
1.	Bowles. J.E,Foundation Analysis and Designs, McGraw Hill Publishing Co., New York. .1996, 5th Edition. ISBN: 978-0071188449
2.	Terzaghi, Peck and Mesri, "Soil Mechanics in Engineering Practice, 3rd Edition, Wiley publication,2012, ISBN:978-0134115856.
3.	Gopal Ranjan and Rao ASR ,Basic and Applied Soil Mechanics, New Age International (P) ltd, New Delhi, 2000, ISBN: 788122412239
4.	VNS Murthy, Soil Mechanics and Foundation Engineering, First Edition, UBS Publishers and Distributors, New Delhi, 2007, ISBN:9788174763228

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						
VALUATION ENGINEERING **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV73G4**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3Hours**

Unit-I	**08 Hrs**
Introduction: Purpose of valuation, Different forms of values. **Outgoings:** Municipal & Govt. Taxes, insurance, Loss of rent, collection charges, sinking fund, Annual repairs & maintenance. Depreciation. Methods of calculation of depreciation: Year's Purchase, Capitalized value, Obsolescence, Amortization.	
Unit – II	**08 Hrs**
Methods of valuation: Open land valuation, Factors affecting intrinsic values of land, Comparative method, Abstractive method, Belting method. **Rent:** Definition, Forms of rents. Cost of structure, BIS rules for measuring plinth area and cubical contents. Rights and Liabilities of Lessor & Lessee, Leasehold properties, freehold Properties.	
Unit –III	**08 Hrs**
Valuation of land with buildings: Rental method, Land and building method, Valuation on profit basis, Direct comparison of capital value, Residual or Development method. Valuation of agricultural/farm lands.	
Unit –IV	**08 Hrs**
Easements: Self-imposed, Legally created, Dominant and Servient heritage. Effect of easements on valuation. **Market:** Real Estate market and market value, fair market value, open market value, affecting parameters. **Investments:** Bonds, debentures, capital gains, Wealth Tax and Income Tax.	
Unit –V	**08 Hrs**
Case Studies: Valuation of immovable properties. Preparation of valuation reports for various types of buildings, land with buildings, plant and equipments. Case Laws, Real Estate regulatory acts,Valuers association.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the different types of properties, outgoings, depreciations, Investments, valuation etc.
CO2	Apply the different methods of calculation of depreciation, valuation of buildings, open lands.
CO3	Analyze and evaluate the rent and value of the property scientifically.
CO4	Develop the valuation reports of the real properties.

Reference Books	
1.	John A Parks., Banerjee D.N. "Principles and Practice of Valuation". 1998, Eastern law house ISBN:8171770940 9788171770946
2.	M Chakraborti, "Estimating,Costing,Specification & Valuation In Civil Engineering" Twentyninth revised & Enlarged Edition (1 January 2006), ISBN-10 : 818530436X, ISBN-13 : 978-8185304366.
3.	Mitra A.K., "Theory and Practice of Valuation " 1986.Eastern law house ISBN : 087094-917-9
4.	Rao Gopinath C H, "Valuation Practices of Immovable Properties." 2002. ISBN: 336.2220954 G 647
5	Rangwala "Estimating, Costing And Valuation", Charotar Publishing House Pvt. Ltd.; 17th Edition (1 January 2017); Charotar Publication, ISBN-10 : 9385039059, ISBN-13 : 978-9385039058.

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						
STRUCTURAL DYNAMICS **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV73G5**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.0 Hours**

Unit-I	**08 Hrs**
Introduction - Basic concepts of vibration, definition and types of vibration, Static loads & dynamic loads - comparison and types, Causes of dynamic effects, response of systems, degrees of freedom, effects of vibration, vibration control and design of structures.	
Unit – II	**08 Hrs**
Equation of motion - Introduction, vibration analysis, mathematical modelling - lumped mass system, Equivalent stiffness of springs in series, parallel configuration, Derivation of equation of motion - Simple Harmonic Motion (SHM), Newton's Second Law of Motion, Energy Method, Rayleigh Method and D'Alemberts principle.	
Unit –III	**08 Hrs**
Vibration analysis of Single Degree of Freedom System (SDOF) - Undamped free vibration of SDOF, Damped free vibration of SDOF, Types of Damping, Measurement of Damping, Response of SDOF to harmonic excitation, Vibration Measurement and vibration isolation concepts (Derivations, numericals and expressions).	
Unit –IV	**08 Hrs**
Seismology - Basic terminologies, Causes and types of earthquakes, Concept of seismic waves, measurement of earthquakes, seismic zones, Response spectrum and design spectra concept, Liquefaction concept & forms.	
Unit –V	**08 Hrs**
Seismic resistant design - Seismic resistant design concepts, Seismic analysis of RC structures as per IS Code, Ductile detailing of RC structures as per IS Code, Earthquake resistance of low strength masonry buildings.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1:	Understand the concept of vibrations and interpret it's effects on structures.
CO2:	Develop equations of motion for varied systems through analytical approach.
CO3:	Analysis of vibration characteristics through idealized models for different configuration.
CO4:	Identify the potential causes, remedial measures for earthquakes as per standard provisions.

Reference Books	
1.	Structural Dynamics: Theory and Computation, Mario Paz, William Leigh, 5th Edition, Springer-Verlag New York Inc.; ISBN-10:1402076673, ISBN-13 - 978-1402076671
2.	Dynamics of Structures, Anil K Chopra, 3rd Edition, Pearson Education India publishers, ISBN – 10: 8131713296, ISBN – 13: 978 – 8131713297.
3.	Structural Dynamics: Vibrations & Systems, Madhujit Mukhopadhyay, ANE Books Publishers (1 December 2008), ISBN – 10: 9788180520907, ISBN – 13: 978 – 8180520907.
4.	Theory of Vibrations With Applications, William T Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, 5th Edition, Pearson Education Publishers (1 January 2008), ISBN – 10: 8131704823, ISBN – 13: 978 – 8131704820.

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						
DESIGN OF STEEL STRUCTURAL COMPONENTS **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV74H1**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**		**SEE**	**:**	**100Marks**
Total Hours	**:**	**40L+28T**		**SEE Duration**	**:**	**3.0 Hours**

Unit-I	**09 Hrs**
Introduction: Advantages and limitations of steel structures, load and load combinations, design philosophies, structural forms. **Bolted connections**: Advantages, Types, Modes of failures, Introduction to simple , semi rigid and rigid connections, Eccentric connections(plane of connection parallel and perpendicular to the plane of moment), Detailing of Simple beam to beam and beam to column connections:Framed and seated(stiffened and unstiffened) connections.	
Unit – II	**08 Hrs**
Welded connections: Advantages, disadvantages. Types of joints, weld symbols, Design of simple joints, eccentric connections, (plane of connection parallel and perpendicular to the plane of moment). Detailing of Simple beam to beam and beam to column connections: Framed and seated(stiffened and unstiffened) connections.	
Unit –III	**07 Hrs**
Design of tension members: Modes of failures, Analysis and design of tension members- angles.	
Unit –IV	**08 Hrs**
Design of compression members: Failure modes, section used for compression member, member classification, analysis and design of simple axially loaded members. Design of lacing, battens.	
Unit –V	**09 Hrs**
Design of beams: Beam types, section classification, Introduction to plastic hinge, Plastic section modulus, Plastic moment, shape factor for rectangle, circle, square, I section, T section and hollow rectangular, circular sections, Concept of collapse load, Design of laterally supported beams.	

Course Outcomes: After completing the course, the students will be able to: -
Explain the engineering properties and behavior of structural steel
Apply the behavior of steel members and connections to analyze structural components
Analyze and evaluate critical capacity of structural steel sections and connections
Design and detail steel members and connections

Reference Books	
1	Subramanian N, _Design of Steel structures‘, Oxford University press, 2nd Edition, 2016, ISBN 9780199460915
2.	S K Duggal, _Limit state design of steel structures‘, Tata McGraw Hill Education Private Limited, 2017, 2nd edition, ISBN-13 978-9351343493
3.	Bhavikatti S S, _Design of Steel structures‘, I K International Publications, 2016, 3rd edition ISBN9789382332091
4.	Shiyekar, M. R., Limit state design in Structural Steel,PHI Learning pvt ltd, 3rd Edition, ISBN : 9788120353503
5	BIS Codes: i) IS-800-2007, General construction in steel-code of practice. ii) IS 875-1987, Code of practice for design loads, iii) SP6(6)- 1972, IS handbook for structural engineers-application of plastic theory in design of steel structures. iv) SP6(1)-1964,Reaffirmed in 2003 Handbook for structural engineers- Structural steel sections

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

ENVIRONMENTAL IMPACT ASSESSMENT
Category: Professional Core Elective
(Civil Engineering)
(Theory)

Course Code	**:**	**21CV74H2**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives: The students will be able to

1	To study factors to be considered for preparing an Environmental Impact statement for developmental projects.
2	To study the principles and techniques of Environmental impact assessment (EIA)
3	Mitigation techniques and study of alternatives
4	Make specific case studies

Unit-I	**08 Hrs**

Introduction:
Impact of developmental projects – sustainable development – Need for Environmental Impact Assessment (EIA) - Introduction, Environmental Impact statement (EIS) – EIA capability and limitations – Legal provisions on EIA – stages of EIA , Types of EIA ,carrying capacity concept.

Unit – II	**08 Hrs**

Role of NEPA in EIA, CEQ, Environmental documents.
EIA/ EIS & FONSI relationship, Processing of EIA/EIS, Environmental attributes.
Methodologies: Criteria to be considered for the selection of EIA methodologies, Adhoc, overlays, Checklists – Matrices – Networks – Cost-benefit analysis with their advantages and limitations.

Unit –III	**08 Hrs**

Prediction and Assessment: Assessment of Impact on land, water, air and noise, Socio Economic and humanhealth and on Flora and fauna – Mathematical models –. Risk Assessment, ISO 14000 and Environmental Auditing, Disaster Management plan, Post project Audit.

Unit –IV	**08 Hrs**

Environment management plan: Plan for mitigation of adverse impact on Environment – Options for mitigation of impact on water, air, land, Ecology and socio-economic Environment – Addressing the issues related to project affected people. Post project monitoring, EIA legislations in India. Effective PublicParticipation, Benefits and Procedures.

Unit –V	**07 Hrs**

EIA for the infrastructure projects –Airport, Dam, Highway, Mining, fertilizer, Construction, Water and waste water treatment plants, Hazardous waste landfill site.

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

CO1:	Carryout scoping and screening of developmental projects for environmental and social assessments.
CO2:	Explain different methodologies for environmental impact prediction and assessment.
CO3:	Plan Environmental impact assessments and Environmental management plans.
CO4:	Evaluate environmental impact assessment reports.

Reference Books	
1	Canter, R.L., "Environmental Impact Assessment", McGraw-Hill Inc., New Delhi, 1st October 1995. ISBN-10, 0070097674**,** ISBN-13,978-0070097674**.**
2	Petts, J., Handbook of Environmental Impact Assessment Vol. I and II, Wiley- Blackwell Science, London, 2009. ISBN: 978-0-632-04773-4, May 1999.
3	Y.Anjaneyulu, Valli Manickam , Environmental Impact Assessment Methodologies, Second Edition, B.S.Publications, ISBN 978817800224, 2010.
4	David P Lawrence, "Environmental Impact Assessment – Practical Solutions to Recurrent Problems", 2013, ISBN-13: 978-0471457220.
5	Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992, ISBN 10: 8171692087 / ISBN 13: 9788171692088.

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

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

Semester: VII						
URBAN TRANSPORT PLANNING **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	21CV74H3		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3 Hours**

Unit-I	**08 Hrs**
Introduction: Elements in urban transit system, NUTP, MPO plan. Transportation Planning Process: Land use transportation planning; Systems approach, integration of transport planning, traffic and land use planning, Corridor Management and Preservation.	
Unit – II	**08 Hrs**
Transportation Surveys: Definition of study area, zoning, various types of surveys and interpretation, travel demand and forecasting. Trip Generation and Distribution: Trip generation - regression, category analysis Trip distribution - growth factor, Fratar and Furness methods, calibration of Gravity model, intervening opportunities model, competing Opportunities model, Gravity model.	
Unit –III	**08 Hrs**
Modal Split : Factors affecting modal split; Modal split in transport planning. Traffic Assignment: Description of transport network, route choice behavior. Assignment techniques- All-or-Nothing assignment, multipath traffic assignment, capacity restrained traffic assignment**.**	
Unit –IV	**08 Hrs**
Evaluation: Identification of corridor; Formulation of plans; Economic Evaluation. Mass Transit Systems: capacity, operation and management of Fleet planning and Scheduling.	
Unit –V	**08 Hrs**
Case Studies: Case studies on metropolitan transportation planning, integration of multimodal transport systems, best practices and emerging technologies in transportation planning	

Reference Books :-	
1.	Traffic Engineering and Transport Planning, L R Kadiyali, Khanna Publishers, ISBN 139788174092205, 2011.
2.	Urban Transportation: Planning, Operation and Management", Ponnuswamy S, Johnson Victor D ,1st Edition, 2012, McGraw Hill Education (India) Private Limited, ISBN- 9781259002731.
3.	Transportation Engineering –An Introduction, JotinKhisty and Kent Lall B, 3rd Indian Edition, 2006, PHI, New Delhi, ISBN-13: 978-0130335609.
4.	Principles of Urban Transport System Planning, Hutchinson, B.G., McGraw-Hill Inc.,US , ISBN-13: 978-0070315396,1974.

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

PRE-STRESSED CONCRETE
Category: Professional Core Elective
(Civil Engineering)
(Theory)

Course Code	**:**	21CV74H4		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3Hours**

Unit-I — **08 Hrs**

Introduction to Pre stressed concrete and Codal Provisions

Historic development- general principles of Prestressing, Types of pre stressing, pre-tensioning and post tensioning, advantages and limitation of prestressed concrete, Materials for pre stressed concrete- high strength steel and concrete, properties, Stress-strain characteristics of high strength steel and concrete

Basic principles of pre stressing, fundamentals of prestressing, Stress concept, Strength concept, Load balancing concept, , Pretensioning and post tensioning methods-Analysis of post tensioning, Systems of pre stressing, End anchorages, Codal Provisions

Unit – II — **08 Hrs**

Analysis of sections for Flexure:
Elastic analysis of pre stressed concrete beams with straight, parabolic, triangular, trapezoidal cable profiles, Eccentric and concentric pre stressing, Numerical problems

Unit –III — **08 Hrs**

Losses of Pre stress:
Loss of prestress due to elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage and frictional losses, Computation of Loss of Prestress for Pretensioned and Post Tensioned members, Numerical problems

Unit –IV — **08 Hrs**

Deflection of pre stressed concrete beams:
Short term and long-term deflections, Elastic deflections due to different loads and cable profiles, Deflection limits as per IS:1343, Effect of creep on deflection, Load versus deflection curve, methods of reducing deflection, Numerical problems.

Limit state of Collapse:
Flexure- IS code recommendations, Ultimate flexural strength of sections for pretensioned and post tensioned members with and without bonding, IS code recommendations on shear strength, Shear resistance of sections, shear reinforcement, Limit state of serviceability- Control of deflection and cracking, Numerical Problems

Unit –V — **08 Hrs**

Design of Beams:
Design of pre stressing force and eccentricity for post tensioned prismatic beams, permissible stresses, Limiting zone and cable profile, Numerical Problems, Concept of design of end blocks

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the fundamental concepts of stress analysis
CO2	Apply systems of pre-stressing for various sections of structural elements
CO3	Analyse and evaluate the stresses under various conditions
CO4	Design the prestressed concrete members for various loading conditions

Reference Books
Pre stressed concrete, N Krishna Raju, Tata McGraw Hill Publishers, 2018, ISBN-10 9387886204
Pre stressed Concrete, P Dayarathnam, Oxford and IBH Publishing Co., 6th Edition, 2018, ISBN 8120417917
Design of pre stressed concrete structures, T Y Lin and Ned H Burns, John Wiley & Sons, New York, Third Edition, 2010, ISBN 9788126528035
Fundamental of pre stressed concrete, N C Sinha and S K Roy, 3rd Edition, S Chand and Company Ltd, 2011, ISBN 9788121924276
Prestressed Concrete, Muthu K.U, Ibrahim Azmi, Janardhana Maganti, Vijayanand M, Prentice Hall India Learning Private Limited,2016, ISBN 9788120351691
Code Books: IS 1343:2012; Pre stressed Concrete: Code of practice

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)	
COMPONENTS	**MARKS**
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**
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**
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						
REINFORCED EARTH STRUCTURES **Category: Professional Core Elective** **(Civil Engineering)** **(Theory)**						
Course Code	**:**	**21CV74H5**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.0 Hours**

Unit-I	**04Hrs**
Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth construction, Sandwich technique for clayey soil.	
Unit – II	**10 Hrs**
Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics. **Properties and Tests on Materials** Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.	
Unit –III	**10 Hrs**
Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Stability analysis: external and Internal stability, effect of vertical and horizontal line loads, construction of a reinforced soil wall, drainage and design procedure. **Soil Nailing Techniques:** Concept, Advantages and limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.	
Unit –IV	**08 Hrs**
Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.	
Unit –V	**08 Hrs**
Geosynthetics for filter, drain and landfills: Filter and Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability. Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1:	Illustrate the principles and mechanisms of reinforced soil
CO2:	Understand the laboratory testing concepts of Geo synthetics.
CO3:	Illustrate the issues of stability and construction of RE Wall.
CO4:	Asses the use of Geo synthetics in roads, slopes, filters, drainage and landfills.

Reference Books	
1	Koerner. R.M, "Design with Geo synthetics", Prince Hall Publications.
2	Koerner. R.M. & Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York.
3.	Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, Hyderabad.
4.	Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi.

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						
INTELLIGENT TRANSPORTATION SYSTEMS **Category: Global Elective** **(Theory)**						
Course Code	**:**	21XX75I1		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3Hours**

Unit-I	**08 Hrs**
Introduction to Intelligent Transportation Systems **(**ITS): Historical background, Urbanisation, Motorisation, Transport system characteristics, Transport problems and issues, Challenges and opportunities in ITS: ITS-Today and tomorrow, ITS training and education needs, Role and importance of ITS in context of Indian Transport system and opportunity for sector growth of ITS.	
Unit – II	**08 Hrs**
ITS Architecture: introduction, Functionalities required for User service, Logical architecture, Physical architecture, Equipment and Market packages, Need of ITS Architecture to solve problems in Urban area. Technology building blocks for ITS: Introduction, Data acquisition, Communication tools, Data analysis and Traveller information. Various detection, Identification and collection methods for ITS.	
Unit –III	**08 Hrs**
Traffic management system components and ITS: Introduction, objectives, traffic management measures, ITS for traffic management, Development of traffic management system, Traffic Management Centre, Advance Traffic Management System, Advanced Traveller Information System, Advance Vehicle Control Systems, Advance Public Transport System, Commercial Vehicle Operations, ITS For Intermodal Freight Transport.	
Unit –IV	**08 Hrs**
ITS Evaluation – Project selection at the planning level, Deployment Tracking, Impact Assessment, Benefits by ITS components, Evaluation Guidelines. ITS for Law Enforcement: Introduction, Enhance and support the enforcement traffic rules and regulations, ITS Funding options.	
Unit –V	**08 Hrs**
ITS Standards-Standard development process, National ITS architecture and standards, ITS standards application areas, National Transportation Communications for ITS Protocol, Standards testing. ITS for smart cities and Case studies.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Identify and apply ITS applications at different levels
CO2	Illustrate ITS architecture for planning process
CO3	Examine the significance of ITS for various levels
CO4	Compose the importance of ITS in implementations

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						
UNMANNED AERIAL VEHICLES **Category: Institutional Electives-II Group I** **(Theory)**						
Course Code	**:**	21AS75IB		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**08 Hrs**
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	**11 Hrs**
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	**08 Hrs**
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	**10 Hrs**
Payloads for UAVs: Barometers, Accelerometer, Magnetometer, RADAR and range finder, Non-dispensable and dispensable Payloads- Optical, electrical, weapon, imaging payloads.	
Unit –V	**08 Hrs**
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 Tradeoffs	

Course Outcomes: At the end of this course the student will be able to :	
CO1:	Appraise the evolution of UAVs and understand the current potential benefits of UAVs
CO2:	Apply the principles of Aerospace Engineering in design and development of UAVs
CO3:	Evaluate the performance of UAV designed for various Missions and applications
CO4:	Assess the performance and airworthiness of the designed UAV

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 adding up to 20 Marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII						
Bioinformatics **(Category: Institutional Electives)** **(Theory)**						
Course Code	**:**	**21BT75IB**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**42 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**

Semester VII						
Sustainability and Life Cycle Analysis **Category: Institutional Elective** **(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	
2.	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 (2021 Scheme)						
ADVANCES IN CORROSION SCIENCE AND MANAGEMENT (Theory)						
Course Code	**:**	21CM75ID		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42		**SEE Duration**	**:**	03 Hours

Course Learning Objectives: The students will be able to	
1	Understand the fundamental & socio, economic aspects of corrosion.
2	Identify practices for the prevention and remediation of corrosion.
3	Analyzing methodologies for predicting corrosion tendencies.
4	Evaluate various corrosion situations and implement suitable corrosion control measures.

Unit-I	**08 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	**08 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	**08 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.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	2	3	2	2	2	-	-	-	-	1	-	1
CO3	3	3	2	1	-	-	-	-	-	1	-	1
CO4	3	3	3	3	2	-	-	-	-	1	-	1

High-3: Medium-2: Low-1

Semester: VII						
Wearable Electronics **(Group H: Open Elective)**						
Course Code	**:**	21EC75I1		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	39L		**SEE Duration**	**:**	03 Hours

Course Learning Objectives: The students will be able to

1	Explain the types and application of wearable sensor.
2	Describe the working of sensitivity, conductivity and energy generation in wearable devices.
3	Explain the various facets of wearable application, advantage & challenges.
4	Understand different testing and calibration in wearable devices.

Unit-I	**07 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. [Ref 1: Chapter 1.1]	
Unit – II	**08 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. [Ref 1: Chapter 2.1]	
Unit –III	**07 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	**08 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	**08 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						
INTEGRATED HEALTH MONITORING OF STRUCTURES **Category: Institutional Electives - I** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	21CV75IF		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	42L		**SEE Duration**	**:**	**3Hours**

Unit-I	**08 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	**08 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	**08 Hrs**
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.	
Unit –IV	**08 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	**08 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						
E-MOBILITY **Category: Professional Elective Course** **(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	
1.	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: Institution Elective** **(Theory)**						
Course Code	**:**	21XEI75IJ		**CIE**	**:**	100Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45 L		**SEE Duration**	**:**	3 Hours

Unit-I	**06 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	
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	
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						
MOBILE APPLICATION DEVELOPMENT **Category: INSTITUTIONAL ELECTIVE** **GROUP I**						
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: Professional Elective Course** **(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	**06 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	
5.	Project Management Institute, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9
6.	Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.
7.	Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.
8.	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 **Category: Professional Elective Course** **(Theory)**						
Course Code	**:**	21IM75IN		**CIE**	**:**	100Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45 L		**SEE Duration**	**:**	3 Hours

Unit-I	**06 Hrs**
Introduction: Supply Chain, Supply Chain Management, Business Analytics, Supply Chain Analytics. Data-Driven Supply Chains and Intro to Python: Data and Its Value in SCM, Data Source in Supply Chains, Big Data, Introduction to Python	
Unit – II	**09 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, 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	
Unit –III	**09 Hrs**
Customer Management: Customers in Supply Chains, Understanding Customers, Building a Customer-Centric SC, Cohort Analysis, RFM Analysis, Clustering Algorithms. Supply Management: Procurement in Supply Chains, Supplier Selection, Supplier Evaluation, Supplier Relationship Management, Supply Risk Management, Regression Algorithms.	
Unit –IV	**09 Hrs**
Warehouse and Inventory Management: Warehouse Management, Inventory Management, Warehouse Optimization, Classification Algorithms. Demand Management: Demand Management, Demand Forecasting, Time Series Forecasting, Machine Learning Methods.	
Unit –V	**09 Hrs**
Logistics Management: Logistics Management, Modes of Transport in Logistics, Logistics Service Providers, Global Logistics Management, Logistics Network Design, Route Optimization.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand supply chain concepts, systemic and strategic role of SCM in global competitive environment.
CO 2	Evaluate alternative supply and distribution network structures using optimization models.
CO 3	Develop optimal sourcing and inventory policies in the supply chain context.
CO 4	Select appropriate information technology frameworks for managing supply chain processes.

Reference Books	
9.	Kurt Y. Liu, Supply Chain Analytics - Concepts, Techniques and Applications, Palgrave – Macmillan, Springer Nature Switzerland AG, 2022, ISBN 978-3-030-92224-5 (eBook)

10.	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
11.	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.
12.	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						
Course Code	**:**	**21ME75IO**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45**		**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-2	**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 - 3	**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-4	**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-5	**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). THREE tests will be conducted. Each test will be evaluated for 50 Marks, adding up to 150 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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

Semester: VII – 2021 Scheme – Institutional Elective						
Cognitive Psychology (Theory)						
Course Code	**:**	21HS75IQ		**CIE**	**:**	100
Credits: L:T:P	**:**	03		**SEE**	**:**	100
Total Hours	**:**	42 Hrs		**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. Metacognition: Problem-solving, steps in problem solving, types, methods, obstacles, and aids of problem-Solving. Concept of Design Thinking	
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 behaviours 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 into their own and others' lives in order to better understand their personalities and experiences.

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

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

Semester: VII						
PRINCIPLES AND PRACTICES OF CYBER LAW **Category:** **Stream:** **(Theory)**						
Course Code	**:**	21HS75IR		**CIE**	**:**	100
Credits: L:T:P	**:**	03		**SEE**	**:**	100
Total Hours	**:**	03		**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.

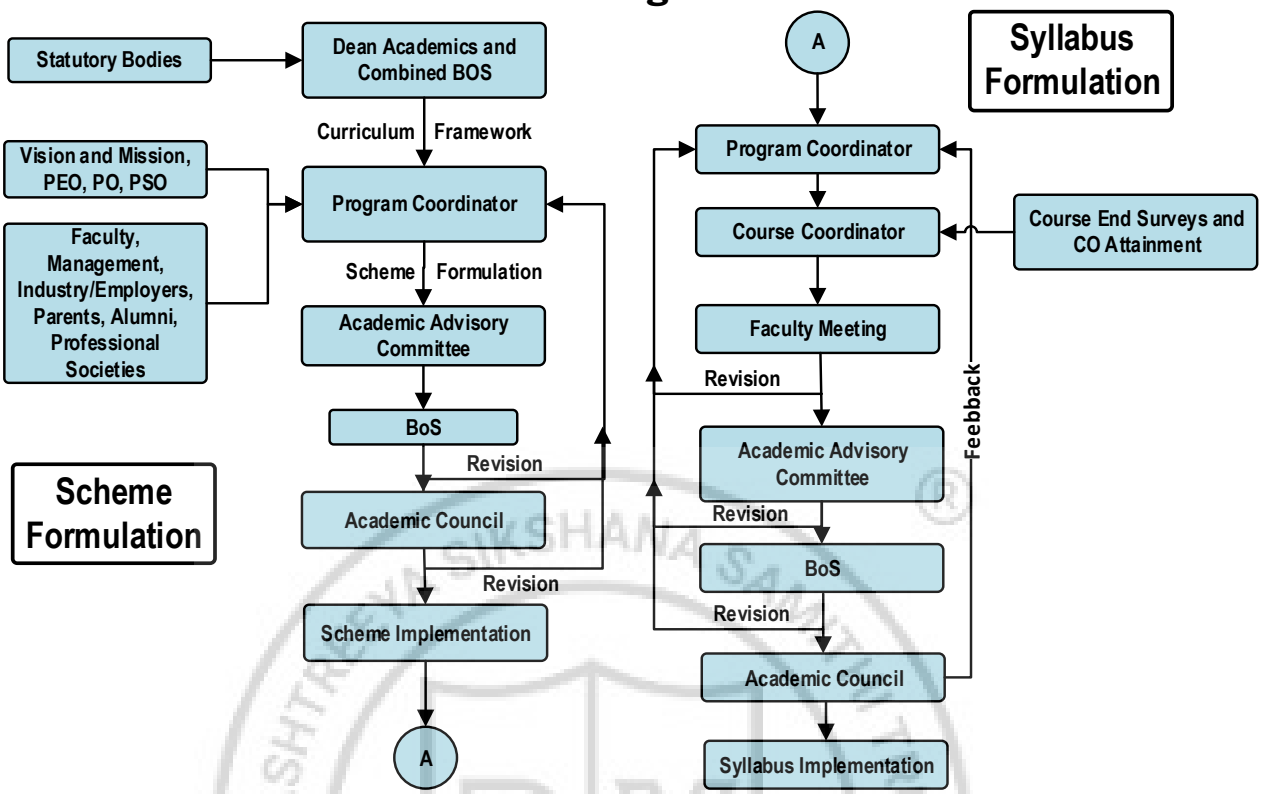
Reference Books	
4.	Cyber Law by Dr. Pavan Duggal Publisher: LexisNexis, ISBN-10: 8196241070, ISBN-13: 978-8196241070
5.	Introduction to Information Security and Cyber Laws by Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla ASIN: 9351194736, Publisher: Dreamtech Press, ISBN-10: 9789351194736,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

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
4.	**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**
5.	**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**
6.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar / presentation / demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
MAXIMUM MARKS FOR THE CIE		**100**

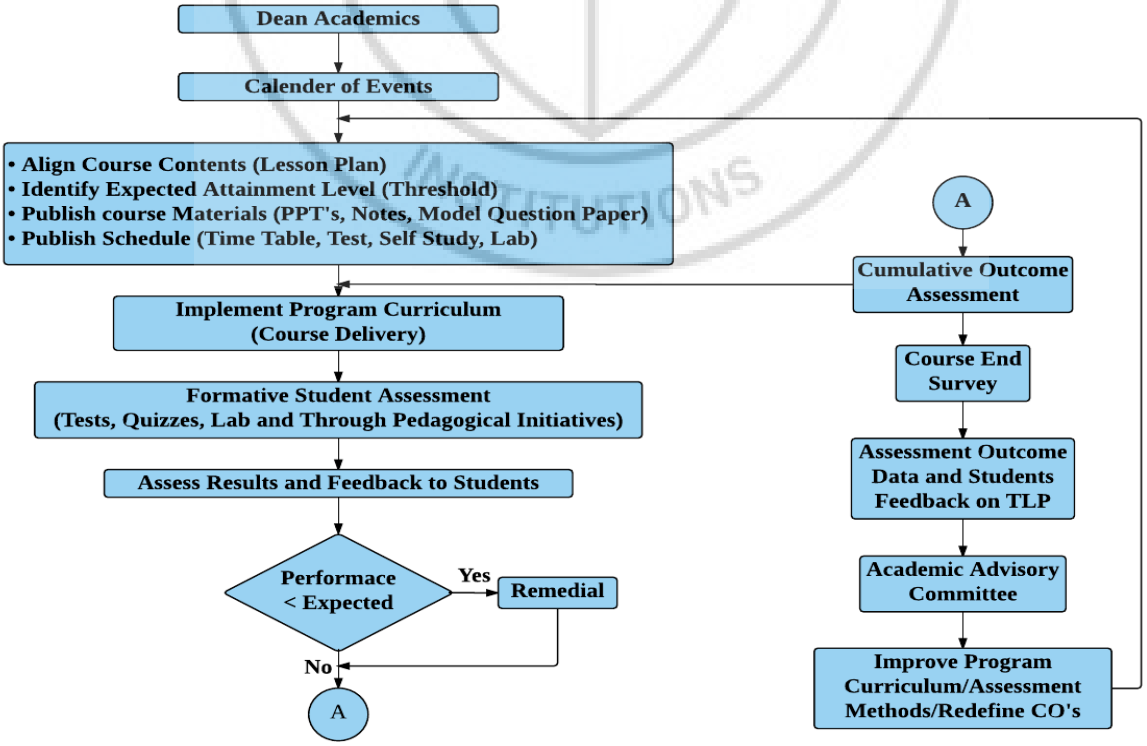
RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire (Maximum	20
	PART B (Maximum of TWO Sub-divisions only) * (Small case lets and case example in one subdivision)	
2	Unit 1: (Compulsory)	16
3&4	Unit 2: Question 3 or 4	16
5&6	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**

EIGHTH SEMESTER								
Slo. No.	**BoS**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Category**
1	CV	21CV81P	Major Project	0	0	12	12	Project
						Total	**12**	

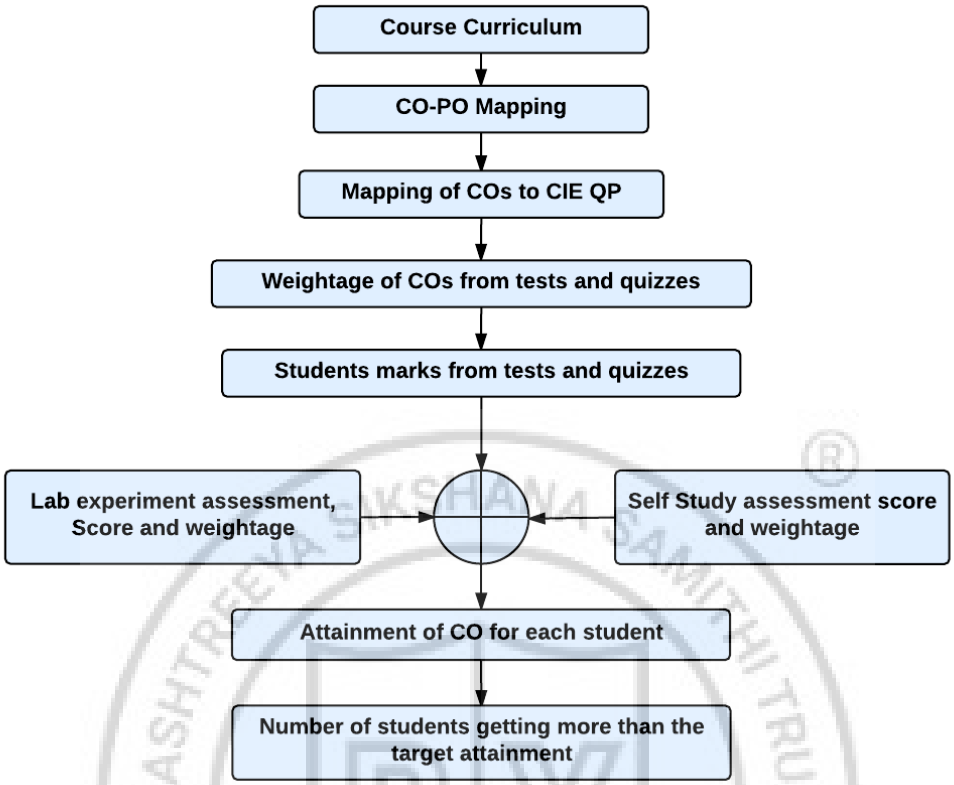
Curriculum Design Process



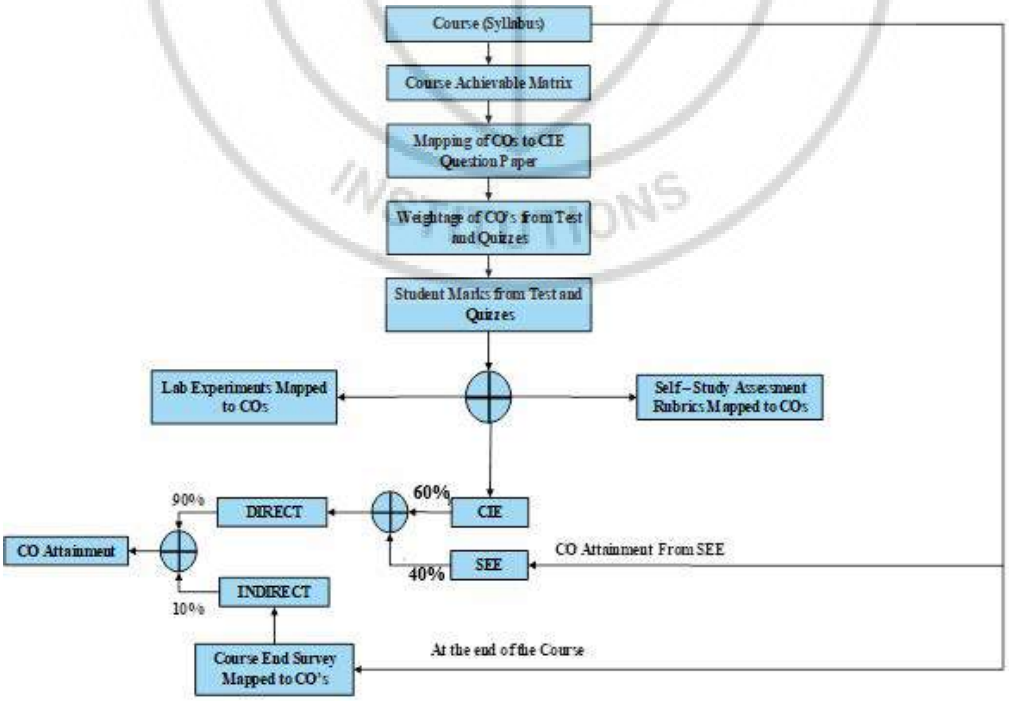
Academic Planning and Implementation



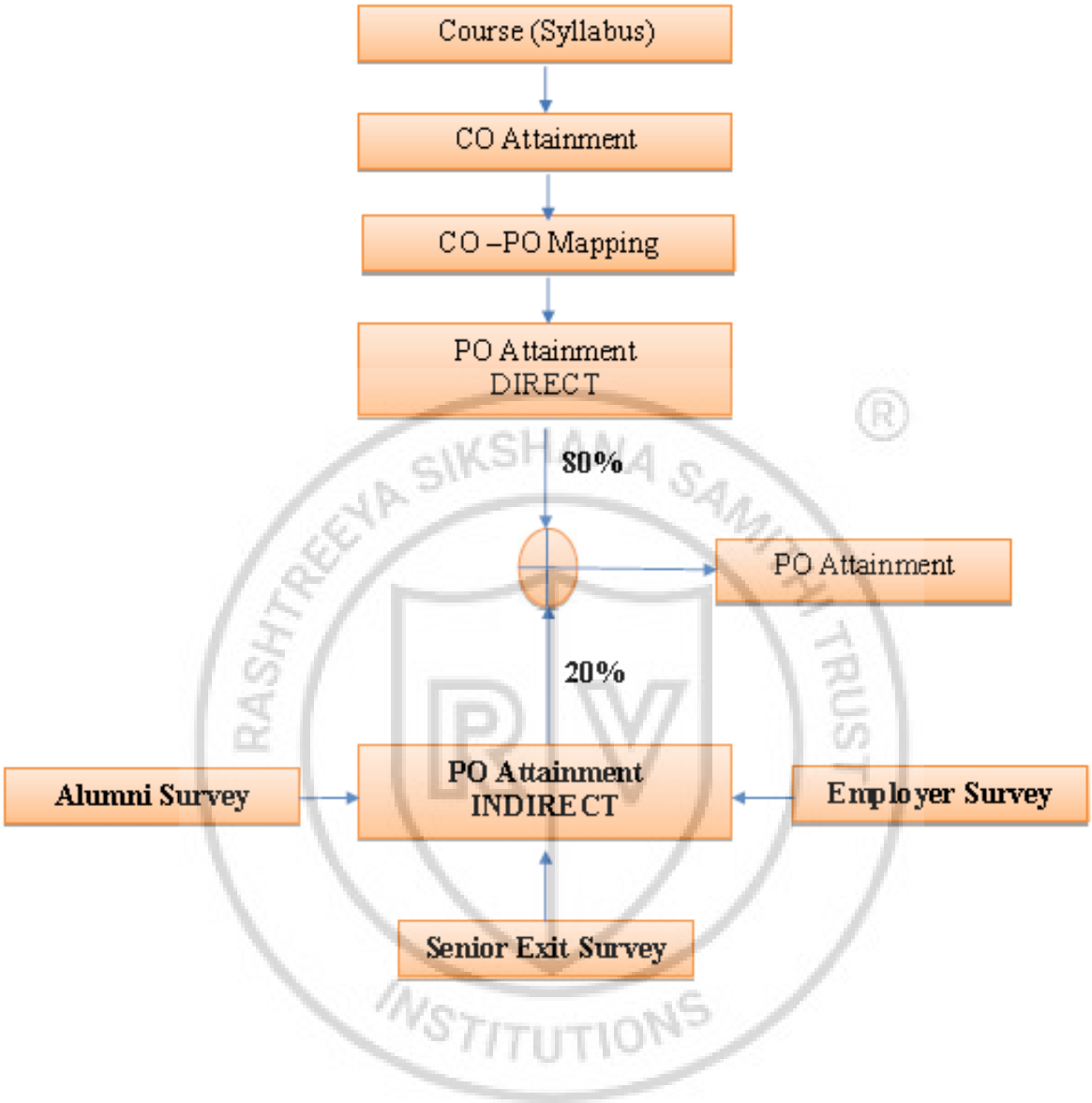
Process For Course Outcome Attainment



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