SCHEME & SYLLABUS

OF

VII & VIII SEMESTERS

B.E. CIVIL ENGINEERING

2025-26

Vision of the Department of Civil Engineering

To become a premier Civil Engineering Department offering excellent engineering education in design methods and advanced technologies to the students, to pursue research in thrust areas and to offer professional services to the society.

Mission of the Department of Civil Engineering

The Department is committed to develop competent professionals by offering need based curriculum in Civil Engineering areas, promoting research and innovation to prepare the students for higher study, life-long learning and societal responsibility. The department is also committed to provide good learning environment to develop professional ethics and skills in our students and to provide engineering services to the society.

Programme Educational Objectives of Civil Engineering

PEO#1	Graduates of the program will practice Engineering profession as competent professionals applying fundamentals, state-of-the-art knowledge, and technical skills. ***[Theme: Practice Engineering profession as competent professionals]***
PEO#2	Graduates of the program will excel in higher education with life-long learning. ***[Theme: Higher education and life-long learning]***
PEO#3	Graduates of the program will exhibit leadership qualities, communication skills and team spirit. ***[Theme: Communication and teamwork]***
PEO#4	Graduates of the program will contribute to societal needs with ethical attitude. ***[Theme: Initiated to Society and ethical practice]***

Programme Outcomes of Civil Engineering

The following list of program specific outcomes describe what graduates are expected to know and be able to do at the time of graduation. Graduates will have:

PSO#1	An ability to conduct standardized field testing on civil engineering materials, interpret experimental data and provide conclusions. Demonstrate the construction of masonry, reinforcement fabrication for beams columns, slabs, etc., electrical wiring, assembling of water supply and sanitary layouts, application of painting and welding of joints. *[Short title: CE Field experiments and demonstration]*.
PSO#2	An ability to estimate material quantities, cost estimates, prepare specifications, produce engineering drawings by conducting appropriate survey works and 3D modeling of systems/components using modern tools for technical projects *[Short title: CE technical reports and 3D modeling]*.
PSO#3	Able to perform analysis and design in at least three to four of the technical areas appropriate to Civil Engineering. *[Short title: CE Technical areas]*.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **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)
4. **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)
5. **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)
6. **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).
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **Communication:** Communicate effectively and inclusively within the engineering 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.
10. **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.
11. **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)

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU

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B.E. in Civil Engineering

SCHEME OF TEACHING AND EXAMINATION (2022 Scheme)(w.e.f. 2025-26)

VII Semester (Swappable VII and VIII Semester)

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	IPCC	S7CVI01	Design of steel structure		42	0	28	50	3	50	50	100	4
2.	IPCC	S7CVI02	Estimation costing, Valuation & Contract Management		42	0	28	50	3	50	50	100	4
3.	PCC	S7CV01	Pre-stressed Concrete Structures		42	2	0	48	3	50	50	100	4
4.	PEC	S7CVPEXX	Professional Elective Course-III		42	0	0	48	3	50	50	100	3
5.	OEC		Open Elective Course-II		42	0	0	48	3	50	50	100	3
6.	PROJ	S7CVP2	Major Project Phase II		0	0	12		3	100	100	200	6
			Total							**350**	**350**	**700**	**24**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Course; **PEC**: Professional Elective Course**; OEC:** Open Elective Course; **PROJ:** Project Phase –II;
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course (PEC) (Offered by the Department)

S7CVPE31	Bridge Engineering	**S7CVPE35**	Structural Health Monitoring
S7CVPE32	QAQC and Safety in construction	**S7CVPE36**	Finite Element Method
S7CVPE33	Railway, Airport and Harbor Engineering	**S7CVPE37**	Intelligent Transportation System
S7CVPE34	Solid Waste Management	**S7CVPE38**	Hydrology & Irrigation Engineering

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B.E. in Civil Engineering

SCHEME OF TEACHING AND EXAMINATION (2022 Scheme)(w.e.f. 2025-26)

VIII Semester (Swappable VII and VIII Semester)

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PEC		Professional Elective (Online Courses) *[Details of the scheme will be intimated soon]*		42	0	0		3	50	50	100	3
2.	OEC		Open Elective (Online Courses) *[Details of the scheme will be intimated soon]*		0	28	0		3	50	50	100	3
3.	INT	S8CVII	Internship (Industry/Research) (14-20 weeks)		0	0	12		3	100	100	200	10
			Total							**200**	**200**	**400**	**16**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: **PEC**: Professional Elective Course**; OEC:** Open Elective Course (Online); **INT:**Industry Internship / Research Internship / Rural Internship
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective (Online Courses – suggested by BoS, NPTEL)

1	Groundwater Engineering	**11**	Admixtures and Special Concretes
2	Geosynthetics and Reinforced Soil Structures	**12**	Dynamics of Structures
3	Advanced Concrete Technology	**13**	Optimization Methods for Civil Engineering
4	Pavement Construction Technology	**14**	Municipal Solid Waste Management
5	Sustainable Transportation Systems	**15**	Geotechnical Earthquake Engineering
6	Environmental Modeling and Simulation	**16**	Bridge Engineering
7	Pavement Materials (Under Pavement Engineering)	**17**	Rock Mechanics and Tunneling
8	Advanced Geomatics Engineering	**18**	Ground Improvement
9	Environmental Geomechanics	**19**	Integrated Waste Management for a Smart City
10	Structural Dynamics: Theory and Computation	**20**	Remote Sensing for Natural Hazard Studies

Open Elective (Online Courses – suggested by BoS, NPTEL)			
1	Environmental Chemistry	**11**	Urban Land use and Transportation Planning
2	Underground Space Technology	**12**	Mental Health and Wellbeing
3	Building Materials as a Cornerstone to Sustainability	**13**	An Introduction to Climate Dynamics, Variability and Monitoring
4	Architectural Approaches to Decarbonization of Buildings	**14**	Data Structures and Algorithms Design
5	Drone Systems and Control	**15**	Artificial Intelligence: Search Methods for Problem Solving
6	Operations Research	**16**	Cloud Computing
7	Micro Irrigation Engineering	**17**	Programming In Java
8	Irrigation and Drainage	**18**	Software Testing
9	Carbon Accounting and Sustainable Designs in Product Lifecycle Management	**19**	Cyber Security and Privacy
10	Urban Utilities Planning: Water Supply, Sanitation and Drainage	**20**	Artificial Intelligence: Concepts and Techniques

Design of Steel Structures

Contact Hours/ week: (L-T-P-S)	3-0-2-3	**Credits:**	4
Total Lecture Hours:	120 = 42 (L)+0(T)+28(P)+50(S)	**CIE Marks:**	50
Sub. Code:	S7CVI01	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	To introduce the students to the advantages and limitations of steel structures
2	Analysis and design of tension members and compression members as per relevant standards
3	Design of beams and column bases as per relevant standards
4	Design of different types of connections like bolted and welded connections for different structural elements.

NOTES:

UNIT I (8 Hours)

INTRODUCTION & DESIGN OF BOLTED CONNECTIONS • Advantages and disadvantages of steel structures, loads and load combinations, Design considerations, Limit state method(LSM) of design, codes, specifications and section classification. Introduction, advantages, modes of failures, problems on lap and butt joints, Eccentric connections (plane of connection and parallel and perpendicular to the plane of moment). •

UNIT II (8 Hours)

DESIGN OF WELDED CONNECTIONS • Advantages, disadvantages, types of welded joints, design of fillet and butt weld joints, Eccentric connections (plane of connection and parallel and perpendicular to the plane of moment). •

UNIT III (8 Hours)

DESIGN OF TENSION MEMBERS • Introduction, sections used for tension members, Design of axially loaded tension members with bolted/welded connections, design of lug angles •

UNIT IV (8 Hours)

DESIGN OF COMPRESSION MEMBERS • Design of compression members under concentric and eccentric loading, Design of compression members in a roof truss, Design of built-up compression members including design of lacings •

UNIT V (8 Hours)

DESIGN OF BEAMS, SLAB, AND GUSSETED BASE • Introduction, sections for beams, design of laterally supported beams, check for strength, shear, and deflection. Design of slab base and Gusseted base. •

LAB COMPONENT (16 Hours)

Detailing of various types of steel sections using AUTO CAD • Detailing of lap and butt joints • Detailing of beam-column and beam-beam connections • Detailing of

beam-column welded connections • Detailing of beam-beam welded connections • Analysis of truss using STAAD.Pro software • Detailing of the structural members of truss using AUTO CAD • Detailing of slab base using AUTO CAD • Detailing of Gusseted base using AUTO CAD • Anaysis and design of Industrial building using STAAD.Pro software •

TEXT BOOKS:

1	S.K.Duggal	Limit state Design of steel structures, Tata McGraw-Hill, Edition 2nd, 2014. ISBN-978-0-07-070023-9
2	N.Subramanian	"Design of steel structures by Limit state method", Oxford University Press, First edition, 2014.

REFERENCES:

1	Ramachandra & Veerendra Gehlot	"Limit state Design of steel structures", Scientific Publishers (India). First Edition, 2013, ISBN: 8172336144
2	S. M. A. Kazimi, R. S. Jindal	"Design of steel structures", Prentice-Hall of India, 2nd edition, 1990,
3	S.S. Bhavikatti,	"Design of Steel Structures Limit State Method as per IS:800-2007", WILEY, 5th edition

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Design the bolted connection using structural steel members.
CO2	Design the welded connection using structural steel members.
CO3	Design the tension members.
CO4	Design the compression members.
CO5	Design the flexural members and base plates.
CO6	Prepare detailed drawings for the designed members and connections

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			3											2
CO2			3											2
CO3			3											2
CO4			3											2
CO5			3											2
CO6					3									3

Estimation costing, Valuation and Contract Management

Contact Hours/ week: (L-T-P-S)	3-0-2-3	**Credits:**	4
Total Lecture Hours:	120 = 42 (L)+0(T)+28(P)+50(S)	**CIE Marks:**	50
Sub. Code:	S7CVI02	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	•To prepare the different types of estimates for various structures, taking out quantities, preparing specifications and rate analysis for buildings.
2	•To understand the types of Valuation including its preparation, documentation.
3	•To understand the Alternate Dispute Resolution and its mechanisms.

NOTES:

UNIT I (9 Hours)

Introduction: Importance of estimation in civil engineering, different type of estimates, methods of estimations, study of various drawings and preparing estimates. Concept and units of measurement. • Estimation: Calculating the quantities and cost by center line, long wall and short wall methods. Preparing of detailed and abstract of estimates for the buildings of flat roof. •

UNIT II (9 Hours)

Building Components: Estimating the quantities and cost of RCC beams, columns and footings, roof slabs, water supply and sewerage works like manhole, septic tank.
• Specifications: Definition, objective and writing general and detailed specifications of item of works in buildings, roads, minor bridges and industrial structures. • Rate analysis from first principles: Definition and purpose, working out quantities and rates for standard items of earthwork, cement concrete mixes, brick and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items. •

UNIT III (8 Hours)

Contracts - Types of contract-essentials of contract agreement- legal aspects, penal provisions on breach of contract. Definition of the terms-Tender, earnest money deposit, security deposit, tender forms, documents and types. Pre-qualification tenders, Comparative statements, acceptance of contract documents and issue of work orders. Duties and liabilities, arbitration, termination of contract, completion certificate, quality control certification, right of contractor, refund of deposit. Administrative approval-Technical sanction. Nominal muster roll, measurement books-procedure for recording and checking measurements preparation of bills. • Measurements of Earth work for roads: Methods for computation of earth work-cross sections- Mean depth or mid-section formula, mean sectional area or Trapezoidal formula. Prismoidal formula, with and without cross slopes. •

UNIT IV (8 Hours)

Valuation: Purpose and different forms of valuations and methods, factors affecting intrinsic values of land, comparative method, abstractive method, belting method. Cost of structure, BIS rules for measuring plinth area and cubical contents. Valuation of land with buildings: Rental, land and building, valuation on profit basis, direct comparison of capital value, residual or development methods. Rights and liabilities of lessor and lessee, leasehold properties, freehold properties. •

UNIT V (8 Hours)

Introduction to ADR: • Definition, nature, and scope of ADR, History and development of ADR in India, Advantages and disadvantages of ADR, Comparison with the traditional judicial system • Types of ADR Mechanisms: • Negotiation: Definition, features, and types of negotiation, Techniques and strategies • Mediation: Concept and role of a mediator, Types of mediation (facilitative, evaluative, transformative), Mediation process and stages, Ethical concerns in mediation • Conciliation: Legal framework (Arbitration and Conciliation Act, 1996), Differences between mediation and conciliation • Arbitration: Meaning, features, and types of arbitration (institutional and ad hoc arbitration), Arbitrability of disputes, Composition of arbitral tribunals, Arbitration process and proceedings •

LAB COMPONENT (0 Hours)

Develop an excel spread sheet to estimate quantity and cost of the building materials required for the construction of residential building. • Develop an excel spread sheet for the quantity estimation and preperation of bar bending schedule (BBS) for RCC elements. • Perform quantity and cost estimation of a residential building using Revit Architecture. • Generate bar bending schedule (BBS) and estimate the quantity for a RCC elements using Revit Architecture. • Prepare a detailed tender document for the civil engg work as per the Govt. norms. • Prepare a detailed valuation report of a building or land property using standard valuation methods. •

TEXT BOOKS:

1	Dutta B. N.	"Estimating & Costing in civil engineering- theory and practice including Specifications & valuation", 28th Rev. Ed., CBS publications and distributors, New Delhi, 2020, ISBN-10:8174767703, ISBN- 13:978-8174767707
2	Rangwala, S.C.	"Valuation of Real properties", 10th Ed., Charotar Publishing House, Anand, New Delhi, 2015, ISBN-10:9385039016, ISBN-13:978-9385039010
3	Narang, S. S.	Alternative Dispute Resolution: An Indian Perspective, Eastern Book Company, First Edition, 2022

REFERENCES:

1	Rangwala, S.C.	"Estimating, costing and valuation", 17th Ed., Charotar Publishing House, Anand, New Delhi, 2017, ISBN:978-93-85039-05-8.
2	Chakraborti, N.	"Estimating, Costing, specification & valuation in Civil Engg.",28th Edition 2010, M K Publisher and Distributor,Calcutta.ISBN-10:8185304366, ISBN-13:978-8185304366

3	Singh, S. K.	Understanding Arbitration and Conciliation, LexisNexis India, First Edition, 2021

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Estimate the quantity and cost of the building and its components as per standard procedures
CO2	Write specifications and estimate the quantity and cost for different civil engineering items and perform rate analysis.
CO3	Write departmental procedure for preparing contracts, agreements, legal aspects, tenders etc. Estimate the quantities and cost of road work.
CO4	Identify the different valuation methods for different types of real properties and perform valuation.
CO5	Understand the basic terminologies and mechanisms of Alternate Dispute Resolution (ADR)
CO6	Develop an Excel spreadsheet and use Revit Architecture to estimate the quantity and cost of building and RCC elements. Also, able to prepare detailed tender report and valuation report.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1										1			3	
CO2										1			3	
CO3										1			2	
CO4										1			1	
CO5						2				1			1	
CO6					2								2	

Prestressed concrete structures

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	0
Sub. Code:	S7CV01	**SEE Marks:**	0

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Introduce to the basic concepts of PSC, stress analysis.
2	Analyze the loss of prestress
3	Analyze the importance of Deflection of prestress members.
4	Analyze Flexural Strength of PSC members
5	Analyze Shear and Torsional resistance of PSC members

NOTES:

UNIT I (9 Hours)

Introduction to PSC structures: Introduction to Prestressed concrete structures- Basic concepts of Pre-stressing. Historical development, Advantages of pre-stressed concrete. Applications of pre-Stressed concrete, Need for High strength concrete and steel. Basic Principles of Prestressing. Tensioning Devices. Pre-tensioning and Post Tensioning Systems. Thermo-Electric Pre-stressing. Chemical Pre-stressing and shear stress. Analysis of Pre-stress and Bending Stresses Basic assumptions, Analysis of Pre-stress. Resultant stresses at a section. Pressure line or Thrust line and internal Resisting couple. Stresses in Tendons. Cracking Moment •

UNIT II (9 Hours)

Losses of Prestress: Losses of Pre stress. Loss due to elastic deformation of concrete, due to shrinkage of concrete, Creep of concrete, Relaxation of stress in steel, Due to anchorage slip. Total losses allowed for in the design. Determination of jacking force •

UNIT III (8 Hours)

Deflection of Prestressed concrete members. Importance of control of deflections. Factors influencing deflections. Short- and long-term Deflection. Elastic Deflections under transfer loads and due to different cable profile. Deflection limits as per IS 1343. Effect of creep on deflection. Load verses deflection curve •

UNIT IV (8 Hours)

Flexural Strength of PSC members: Flexural Strength of Prestressed concrete members. Types of Flexural Failure. Strain compatibility method. Simplified code procedures. •

UNIT V (8 Hours)

Shear and Torsional resistance of PSC members: Shear and Torsional resistance of pre-stressed concrete. Shear and principal stresses. Pre-stressed concrete members in torsion. Ultimate shear resistance of pre-stressed concrete sections. Design of shear reinforcement • Maintenance and repair of PSC members •

TEXT BOOKS:		
1	Krishnaraju, N.	Prestressed Concrete, McGraw Hill Education, Sixth edition, 2018
2	James R., Modern	Prestressed concrete, Springer Publishers, 1st Edition,1990.
3	T.Y. Lin and N.H. Burns	Design of Pre-stressed Concrete Structures, John Willey & Sons, 3rd Ed., 1981
4	Dayaratnam, P., Sarah, P.	Prestressed Concrete Structures, Oxford & IBH Publishing Co Pvt.Ltd, 6th Edition, 2018

REFERENCES:		
1	Y.C. Loo and Cornfreig	Reinforced and prestressed concrete, University Press, 2nd Ed., London, 2012.
2	Dennis Mitchel Edward G Nawy	Prestressed Concrete Structures, Prentice Hall,5th Edition 2002.
3	M. Collins and D. Mitchell	Prestressed Concrete Structures, Prentice Hall, 1991.

COURSE OUTCOMES: On completion of the course the student will be able to:	
CO1	Describe the basic concept and principles of PSC. Calculate the stress conditions in PSC members due to pre-stress, dead load, and live loads
CO2	Calculate the losses of pre-stress in pretension and post tension members
CO3	Calculate the deflection of pre-stress in pretension and post tension members
CO4	Analyze and design of PSC members for flexure, as per IS1343 Code
CO5	Analyze and design of PSC members for shear and torsion, as per IS1343 Code.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1			3										
CO2			3										
CO3			3										
CO4			3										
CO5			3										

Bridge Engineering

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE31	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Understand the different types of bridges, their components, design principles, selection of bridge site, loads coming on bridges.
2	Apply the concept of moving loads to analyse different components of culverts, slab bridges, T-beam bridges, steel bridges and foundations
3	Apply the concepts of RCC design and steel design for designing different components of culverts, slab bridges, T-beam bridges, steel bridges and foundations

NOTES:

UNIT I (8 Hours)

Introduction: • Components of a bridge, classification of bridges, Historical development, Types of bridge superstructures- Design principles (No problems), selection of bridge site. • Loads on Bridges: Dead loads, Vehicle live load, Impact effect, Wind loading, Longitudinal forces, centrifugal forces, Buoyancy, water current forces, Thermal forces, seismic forces. •

UNIT II (10 Hours)

Design concepts of pipe and Box culvert • Introduction to slab bridges, Effective length of dispersion, effective width of dispersion. Design of deck slab bridges for IRC AA (Tracked vehicle), IRC class A vehicle. •

UNIT III (8 Hours)

Design of T-beam Reinforced Concrete Bridges: • Introduction to T-beam bridges, Pigeaud's curves for deck slab analysis, Analysis using Courbon’s method, Design of T-beam bridge deck and girders for different IRC AA (Tracked vehicle), IRC class A vehicle •

UNIT IV (8 Hours)

Design of plate girder and truss bridges for IRC Loading: • Plate girder bridge: General features, Structural elements of plate girder, design principles, design example • Trussed bridges: General features, types of trusses, design features, Design example of steel truss bridge • Basic features of cable-stayed bridges and cable- suspension bridges •

UNIT V (8 Hours)

Substructures and Foundations: • Bearings and types, Types of abutments, piers and wing walls, forces to be considered for the design, Design of Pier. Design of Abutment. Types of foundations and forces to be considered for the design •

TEXT BOOKS:

1	N Krishna Raju	"Design of Bridges", Oxford & IBH Publishing Co., New Delhi, 1998
2	Johnson Victor	"Essentials of Bridge Engineering", Oxford & IBH publishing Co. Pvt. Ltd. New Delhi, 6th edition, 2009
3	Jagadish T.R. & Jayaram M.A	Design of Bridge Structures – 2nd Edition, 2009, PHI, New Delhi.

REFERENCES:

1	S.Ponnaswamy	Bridge Engineering, 2nd Edition, 2007
2	N.Rajagopalan	Bridge Superstructure", Alpha Science International- Technology & Engineering Series, 2006
3	Libby	Modern Pre-Stressed Concrete Bridges. 4th Edition, 1990

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Select the type of bridge based on the site investigation and compute the design discharge, linear waterway, economic span and depth of scour.
CO2	Design different types of culvert and slab bridges, for different IRC loadings.
CO3	Design of RCC T-beam bridges for IRC loading
CO4	Design of plate girder and truss bridges for IRC Loading
CO5	Design of bridge sub-structures and foundations

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3													1
CO2	2	3	2											1
CO3	2	3	2											1
CO4	2	3	2											1
CO5	2	3												1

QA & QC and Safety in Construction

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE32	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Understand the concepts and importance of quality assurance, quality control, and safety in construction projects.
2	Learn the processes and procedures involved in QA/QC planning and implementation.
3	Develop skills in identifying, assessing, and mitigating construction-related risks.
4	Familiarize students with relevant safety regulations and standards.
5	Cultivate a mindset of continuous improvement and accountability in construction projects.

NOTES:

UNIT I (8 Hours)

Introduction to Quality Assurance, Quality Control, and Safety • Definitions and concepts Importance in construction projects Regulatory framework • Quality Management Systems (QMS) • ISO 9001 standards Implementation of QMS in construction projects Continuous improvement and feedback mechanisms •

UNIT II (10 Hours)

QA/QC Planning and Implementation • Development of QA/QC plans – Project Quality Plan (PQP) (briefing only), Inspection Test Plans (ITPs) Inspection and testing procedures – Work Instructions, Method Statements • Formats and Checklist
• NCR Format, Concrete Order Form, Job Description (JD) formats Checklists - RCC, Plastering, Painting checklists Documentation and record-keeping •

UNIT III (6 Hours)

Risk Management in Construction • Identification of construction-related risks Flow chart for Risk management in Construction Risk assessment techniques Mitigation strategies •

UNIT IV (8 Hours)

Construction Safety Regulations and Standards • Overview of safety regulations (OSHA, ANSI, etc.) Personal protective equipment (PPE) Safety training and education • Safety Inspections and Audits • Conducting site inspections Reporting and documenting safety violations Corrective actions and follow-up • Common hazards in constructions • Safety Checklists Fishbone diagram for Excavation Cave- in accidents •

UNIT V (8 Hours)

Safety Management Systems (SMS) • Overview of ISO 45001 standards Development and implementation of SMS in construction (Briefing only) Hazard identification and risk assessment • Integrated Quality and Safety Management Systems • Integration of

QMS and SMS Benefits and challenges Case studies •

TEXT BOOKS:		
1	Amitava Mitra	Fundamentals of Quality Control and Improvement, Wiley, 2016
2	Dr. Rajendra Prasad D S	A Simple Practical Approach to ISO 9001:2015 Quality Management Systems – Implementation, Sapna Book House, Bangalore
3	Gary E. MacLean	Documenting Quality for ISO 9000 and other Industry Standards, Tata McGraw Hill Book Company Limited
4	Martin Loosemore and Gerard De Valence	Construction Quality Management

REFERENCES:		
1	David L. Goetsch and H. David Goetsch	Construction Safety and Health Management
2	Timothy W. Mullen	Construction Quality Management: Principles and Practice
3	Charles A. Cianfrani, John E. Jack	West, and Joseph J. Tsiakals ISO 9001:2015 Explained
4	BIS ISO 9001:2015	Quality Management System- Requirements
5	BIS ISO 45001:2019	Occupational Health & Safety Management System-Requirements
6	Excerpts from Internet Downloads	Information on QA/QC and Safety

COURSE OUTCOMES: On completion of the course the student will be able to:	
CO1	Explain the difference between quality assurance and quality control. Develop a QA/QC plan for a construction project, including inspection and testing procedures.
CO2	Apply risk management techniques to identify and prioritize construction-related risks.
CO3	Interpret and comply with safety regulations and standards applicable to construction sites.
CO4	Demonstrate the ability to conduct safety inspections and implement corrective actions. Evaluate the effectiveness of QA/QC measures and safety protocols in construction projects.
CO5	Communicate effectively with project stakeholders regarding QA/QC issues and safety concerns. Collaborate with multidisciplinary teams to promote a culture of quality and safety in construction.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														

Railway, Airport and Harbor Engineering

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE33	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Gain the knowledge of different modes of transportation such as railways, air ports and Harbours.
2	Understand the design of the runways and taxiways.
3	Learn the importance and various components of water ways and tunnel engineering, besides comparing the merits and demerits of different modes of transportation system.

NOTES:

UNIT I (8 Hours)

Introduction to Railway Engineering - Historical development of railways, Permanent way and its requirements, Gauges in railway track, railway track cross sections, Stresses in railway track, Traction and tractive resistance, Coning of wheels. •

UNIT II (8 Hours)

Rails – Rails and its requirements, types of rail sections, Selection of rails, Length of rails, Rail failures, Rail joints-requirements and different types, creep of rails. • Sleepers —Functions, Requirements, Types and merits and demerits. • Ballast - functions, requirements, types. •

UNIT III (8 Hours)

Geometry of the track—Gradients, Speed of the train, radius, super elevation, Negative super elevation, curves, pints and crossings- Need, turnouts, points of switches and types, crossings and types, Design of turn outs and numerical problems.

UNIT IV (7 Hours)

Introduction to Airport Engineering - Air craft characteristics, Air port planning, Run way design, Taxiway design, Terminal area, Airport layout, Visual aids. •

UNIT V (8 Hours)

Harbours-Introduction to water transportation, types of harbours, Features of harbours, Tides, Wind and wave, Break waters and their classification, Navigational aids • Tunnels- Introduction, Classification of tunnels, Tunnel surveys, Transferring the centreline, Methods of tunnelling in soft soil, Tunnelling in rock, Tunnel lining, Drainage, ventilation Lighting and dust prevention •

TEXT BOOKS:

1	S.C. Saxena , S.P. Arora	Railway Engineering, Dhanpat rai Publications, ISBN-978-81-89928-83-4, 7th edition

2	S.K.Khanna, M.G.Arora, S.S.Jain	Airport planning and design, Nem chand and Bro, ISBN-81-85240-68-x, 6th edition
3	R. Sreenivasan, S.C. Rangwala	Harbour, Docks and Tunnel Engineering, Charotar Publishing house, 2016. ISBN-10 : 9385039326, ISBN-13 : 978-9385039324

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Describe the functions and requirements of rails, ballast and sleepers and analyze the stresses in railway track and tractive resistances
CO2	Design the geometry of the railway alignment
CO3	Design the runway length & its orientation, taxiways
CO4	Explain the functions of different components of Harbours.
CO5	Explain the methods of tunneling in soft soil and hard rock

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														

Solid Waste Management

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE34	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	The objective of the course is to explain the types, quantity, and nature of solid and hazardous wastes, estimate the composition and characterization of solid waste, strategic planning for collection and transport of solid waste.
2	The course also introduces various treatment methods and safe disposal of solid waste, environmental concerns regarding disposal of treated solid waste, reuse and recycling of solid and hazardous waste.

NOTES:

UNIT I (8 Hours)

Introduction: Definition, scope and importance of solid waste management, functional elements of solid waste management. Sources, classification and characteristics of municipal, commercial & industrial wastes, methods of quantification, sampling procedure, physical & chemical properties, biological properties, problems on moisture content, density determination, energy content. •

UNIT II (8 Hours)

Factors affecting waste generation (geographical, physical), measure & methods of assessing solid waste quantities, typical problem, systems of collection. Collection and transportation: hauled & stationery containers systems, problems. Collection equipment, garbage chutes, transfer stations bailing and compacting, route optimization techniques - problems. •

UNIT III (8 Hours)

Treatment/Processing Techniques: Components separation, volume reduction, size reduction, screening-types, density separation, magnetic separation, chemical reduction through incineration and pyrolysis, air pollution control systems. Biological reduction though composting: Aerobic and anaerobic composting, principles of composting process, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Problems on oxygen requirement & methane release. •

UNIT IV (8 Hours)

Sanitary Landfilling: definition & terms, site selection, different types, trench area, ramp and pit methods, reactions occurring in landfills, estimation of landfill area, leachate-formation, movement, collection system control, generation of landfill gases and their phases, collection and control methods, geosynthetic fabrics in sanitary landfills, bioreactor landfills. •

UNIT V (8 Hours)

Hazardous Waste Management: Characteristics of hazardous waste; transportation and disposal of hazardous waste including biomedical waste, control of hazardous waste. Recycle and Reuse: Material and energy recovery operations, reuse in other industries, all type of plastic wastes, e-waste, aluminum cans, paper & cardboard, glass, ferrous metals, construction & demolition wastes, waste oil, batteries, used tires, environmental significance and reuse. •

TEXT BOOKS:

1. Tchobanoglous, G., Theisen, H., Vigil, S. A. (2014). Integrated Solid Waste Management: Engineering Principles and Management Issues. India: McGraw-Hill Education (India) Private Limited. ISBN:9789339205249
2. Khandve, P. (2023). Municipal Solid Waste Management. (2023). United States: Notion Press. ISBN:9798890264114

REFERENCES:

1. Ministry of Environment, Forest and Climate Change, Government of India. (2016). Municipal Solid Waste Management Rules 2016.
2. Peavy, H. S., Rowe, D. R., Tchobanoglous, G. (2013). Environmental Engineering. India: McGraw-Hill Education. ISBN: 9789351340263

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Estimate the quantity and explain the properties of solid and hazardous waste.
CO2	Analyze existing solid waste management systems to identify their drawbacks.
CO3	Evaluate different solid waste treatment and processing techniques.
CO4	Explain the modern and scientific methods to dispose solid waste with due concern to environmental issues.
CO5	Explore the possibilities of reuse, recycling, and recovery of materials from the solid and hazardous waste.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						2								
CO2						3								
CO3						2								
CO4						3								
CO5						2								

Structural Health Monitoring

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE35	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	The objective of the course is to: Provide in-depth knowledge of technologies in structural health monitoring using smart materials as sensing and actuating elements to interrogate the structures.
2	Vibration-based damage detection technique, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Fibre Optics Based Techniques, Remote & Wireless techniques will be discussed and applied to different types of structures.
3	Use advanced tools like, neural network, Machine learning to quantify the damages.
4	Decide the suitable repair and retrofitting techniques to increase the remaining life of the structure.

NOTES:

UNIT I (7 Hours)

Introduction of Structural Health Monitoring • Need of Structural Health Monitoring, Definition & Concept of SHM, Types & Components of SHM, Procedure of SHM, Objectives & Operational Evaluations of SHM, Advantages of SHM. •

UNIT II (9 Hours)

Instrumentations & Sensors for SHM • Basics of Instrumentations & Measurements, Classifications, Input-Output Configurations of Instruments, Static & Dynamic Characteristics, Functions. Various Types of Electromechanical, Electronics & Digital Instruments for SHM. Data Acquisition Systems-Types, Hardware & It's Components. Basics of Sensors, Classification of Sensors, Characteristics & Working Principles of Various Types of Sensors like Strain Gauges, LVDT, Accelerometers. Concept of Smart Materials & Smart Structures with SHM, Basics of Smart Materials like Piezoelectric, and Shape Memory Alloys. •

UNIT III (8 Hours)

Methods of SHM • Methodologies and Monitoring Principles, Local & Global Techniques for SHM, Static & Dynamic Field Testing, Short & Long-Term Monitoring. Vibration Based SHM Techniques, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Fibre Optics Based Techniques, Remote & Wireless SHM Techniques, IoT Application in SHM, Artificial Intelligence & Machine Learning in SHM. •

UNIT IV (7 Hours)
Health Assessment of Structure • Structural Assessment: Introduction to health assessment of structures, structural damages & failures, Principles of structural assessment, Classification & levels of assessment. Demonstrative experiment of damage detection in model structure using accelerometers and DAS •
UNIT V (8 Hours)
Repair and Retrofitting of Structures • Concept of repair & retrofitting of structures: Case studies of structural & foundation failure, causes of distress in structural members, design and material deficiencies, factors causing extensive Deterioration. Retrofitting of structures: Fundamental of retrofitting, Flow of retrofitting process, Methods of retrofitting, Materials for retrofitting (conventional and smart materials), selection of retrofitting methods •

TEXT BOOKS:

1	"Structural Health Monitoring",Daniel Balageas, Peter Fritzen, Alfredo Guemes,John Wiley & Sons, 2006
2	"Structural Sensing, Health Monitoring, and Performance Evaluation", D. Huston, CRC Press, Taylor & Francis

REFERENCES:

1	"Advanced Structural Health Monitoring",Hugo Rodrigues and Ivan Duvnjak,From Theory to Applications, SN Applied Sciences,2022
2	"Structural Health Monitoring with Wafer Active Sensors",Victor Giurglutiu, Academic Press Inc,2008,ISBN 978-0-12-088760-6, https://doi.org/10.1016/B978-0-12-088760-6.X5001-6

COURSE OUTCOMES: On completion of the course the student will be able to:	
CO1	Acquire knowledge of need, type, and evaluation of Structural Health Monitoring of various structural systems.
CO2	Identify suitable instrumentation technique for structural condition assessment.
CO3	Assess the health of structures using different techniques of SHM
CO4	Identify different structural damages in structures and assess Decide the appropriate strengthening & retrofitting techniques to regain the structural strength
CO5	Decide the appropriate strengthening & retrofitting techniques to regain the structural strength.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														

Finite Element Method

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE36	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Solve partial differential equations in a complex shaped domain
2	Use interpolation functions to estimate values over a domain
3	Apply environmental conditions on numerical models
4	Use numerical methods for integration and solution of linear equations

NOTES:

UNIT I (8 Hours)

Introduction: Historical background, basic concept of the finite element method, comparison with finite difference method; Variational methods: calculus of variation, the Rayleigh-Ritz and Galerkin methods; •

UNIT II (8 Hours)

Finite Element Analysis of 1D problems: Formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its postprocessing. Applications in heat transfer, fluid mechanics and solid mechanics. Bending of beams, analysis of truss and frame •

UNIT III (8 Hours)

Finite element analysis of 2-D problems: Finite element modelling of single variable problems, triangular and rectangular elements; Applications in heat transfer, fluid mechanics and solid mechanics; •

UNIT IV (8 Hours)

Numerical considerations: Numerical integration, error analysis, mesh refinement using shape functions, static condensation, data storage and solvers . •

UNIT V (8 Hours)

Special applications of FEM: Bending of plates; Eigen value problems and time dependent problems; Nonlinear analysis •

TEXT BOOKS:

1	An introduction to the Finite Element Method, J. N. Reddy, 3rd edition, McGraw-Hill, 2006.
2	Introduction to Finite element Method, Desai C &Abel J F., East West Press Pvt. Ltd
3	Concepts and Applications of Finite Element Analysis, R. D. Cook, D. S. Malkus and M. E. Plesha, 4th edition, John Wiley, 2007

REFERENCES:

1	The Finite Element Method, O. C. Zienkiewicz and R. L. Taylor 7th edition, Butterworth-Heinemann, 2013
2	A first course on Finite element Method, Daryl L Logan, Cengage Learning
3	Finite Element Procedures in Engineering analysis, Bathe K J, Prentice Hall

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Formulate finite element equations for a given phenomenon
CO2	Solve a given one-dimensional problem using FE procedure
CO3	Solve a given two-dimensional problem using FE procedure
CO4	Apply numerical methods to solve Finite Element equations
CO5	Apply finite element principles to dynamic problems

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		2												
CO2	3													
CO3	3													
CO4	3													
CO5	3													

Intelligent Transport Systems

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE37	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:

1 Learn the concepts of intelligent transport system, user services, advanced traveler information systems, sensor technologies in ITS, functional areas of ITS and applications of ITS.

NOTES:

UNIT I (9 Hours)

Introduction to Intelligent Transportation Systems (ITS): Transport problems and issues, Challenges and opportunities in ITS: ITS-Today and tomorrow, Role and importance of ITS in context of Indian Transport system and opportunity for sector growth of ITS. • Overview of ITS Architecture: Basic system components (sensors, communication, control, users), Concept of regional and national ITS architecture (simple block diagram), Purpose of ITS architecture: Integration, interoperability, planning, High-level functions: Data collection, processing, decision-making, control. •

UNIT II (8 Hours)

Sensor Technologies and Communication in ITS • Importance of telecommunications in ITS, Overview of Traffic Management Centres (TMC) and their roles, Introduction to sensor technologies for traffic monitoring, Traffic flow sensor types: inductive loops, piezoelectric, magnetic, infrared, ultrasonic, Communication systems in ITS: Wired, wireless, vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V), Transponders and RFID applications in ITS, Numerical Applications. •

UNIT III (8 Hours)

Data Collection and Vehicle Tracking Systems • ITS data collection techniques: Detectors (fixed/mobile), Automatic Vehicle Location (AVL) systems, Automatic Vehicle Identification (AVI), Video data collection methods. Basics of Geographic Information Systems (GIS) in ITS, Data fusion techniques and integration at TMC, Elements of route navigation and vehicle tracking, Conceptual overview of GPS integration in ITS. Numerical Applications. •

UNIT IV (9 Hours)

ITS Functional Areas: Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS). • ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management. •

UNIT V (8 Hours)

ITS Applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road- pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications, Numerical Applications. • ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries. •

TEXT BOOKS:

1	Mashrur A. Chowdhury, Adel Wadid Sadek	"Fundamentals of intelligent transportation systems planning", Artech House, 2003
2	Lawrence A. Klein	"Sensor technologies and Data requirements of ITS", Artech House, 2001
3	Sussman, J. M	"Perspective on ITS", Artech House Publishers, 2005
4	Kan Paul Chen, John Miles	"PIARC ITS Hand Book: Recommendations for World Road Association", 2nd Edition, 2004.

REFERENCES:

1	Samuel Morgan	"Intelligent Transportation Systems: Technologies and Applications", Clanrye International, 2015
2	Marco Picone	"Advanced Technologies for Intelligent Transportation Systems", New York, NY, Springer, 2014
3	Sussman, Joseph	"Perspectives on Intelligent Transportation Systems (ITS)", New York, NY, Springer, 2010
4	US Department of Transportation	"National ITS Architecture Documentation", 2007

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Explain the scope, challenges, and architecture of ITS with relevance to the Indian transport system.
CO2	Describe the role of sensors, communication systems, and TMCs in ITS.
CO3	Apply data collection and GPS-based vehicle tracking techniques for ITS planning.
CO4	Identify and differentiate among the functional areas and user services of ITS.
CO5	Evaluate ITS applications for traffic management, tolling, and public transport, and compare global ITS programs.

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			3	1										
CO2			3	2										
CO3			3	2										
CO4			3	1										
CO5			3	2										

Hydrology & Irrigation Engineering

Contact Hours/ week: (L-T-P-S)	3-0-0-3	**Credits:**	3
Total Lecture Hours:	90 = 42 (L)+0(T)+0(P)+48(S)	**CIE Marks:**	50
Sub. Code:	S7CVPE38	**SEE Marks:**	50

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:

1 The main objective of the course is to enable the students to learn the basics of Hydrology and Irrigation Engineering which will help them in computation of water availability for a given basin and to design a canal system for irrigation.

NOTES:

UNIT I (8 Hours)

Introduction, practical applications of Hydrology, water resources, Hydrological cycle (Horton's Quantitative representation), concept of catchment, water budget equation. Precipitation: Definition and forms of precipitation, types of precipitation, measurement of precipitation, non-recording and recording type rain gauges, computation of average depth of precipitation over an area, Arithmetic-mean method, Thiessen polygon and Isohyetal methods, estimation of missing rainfall data, mass curve and consistency of data, rain gauges network, optimum number of rain gauges, problems. •

UNIT II (8 Hours)

Water Losses: Infiltration- Definition, factors affecting infiltration, measurement of infiltration (Double ring infiltrometer), Horton's infiltration curves, infiltration indices, problems. Evaporation-Factors affecting evaporation, measurement using IS Class A Pan, estimation using empirical formulae, measurement of evapotranspiration, Blaney-Criddle method, problems. Runoff: Components, factors affecting runoff, basin yield, rainfall–runoff correlation using simple regression analysis, problems, computation of runoff by empirical equations-Binnie's percentage, Strange's table and curves, Inglis and Desouza formula, Khosla's formula. •

UNIT III (7 Hours)

Hydrograph Theory: Components of a hydrograph, separation of base flow, unit hydrograph theory, derivation and application of unit hydrograph, computation of unit hydrograph, unit hydrograph of different duration, S-curve and it use, problems.

UNIT IV (8 Hours)

Definition, necessity of irrigation, Benefits and ill effects of irrigation, sources of water for irrigation, systems of irrigation, methods of irrigation. Water Requirement of crops: Duty, delta, base period, crop period, relationship between duty and delta, factors affecting duty of water, methods of improving duty of water, crops and crop seasons in India, crops grown in Karnataka, irrigation efficiency and frequency of irrigation, problems. •

UNIT V (8 Hours)

Classification of canals, alignment of canals, Bandhara irrigation scheme, GCA, CCA, intensity of irrigation, Time factor, crop factor, Kennedy's theory, Lacey's theory, procedure for design of channel by Kennedy's and Lacey's methods. Drawbacks in Kennedy's and Lacey's theories, problems. •

TEXT BOOKS:

1	H.M. Raghunath, "Hydrology:- Principles, Analysis and Design", New Age international publishers, New Delhi, Ed. 2, 2006
2	B.C. Punmia and Pande. B.B. Lal, "Irrigation and Waterpower engineering", Laxmi publications, New Delhi, Edition 16th 2009

REFERENCES:

1	K. Subramanya, "Engineering Hydrology", TMH, New Delhi, 4th Ed., 2013
2	Santhosh Kumar Garg, "Irrigation Engineering and Hydraulic structures", Khanna publishers, Delhi, Edition 19th 2005
3	P.N. Modi, "Irrigation, water resources and waterpower engineering", Standard book house, Rajsons pub. New Delhi, Edition 7th 2008

COURSE OUTCOMES: On completion of the course the student will be able to:

CO1	Estimate the quantity of precipitation available for a given catchment and a River basin
CO2	Determine water losses from precipitation, the rain gauge network and compute the average depth of rain fall over a basin
CO3	Predict the surface runoff based on hydrograph theory
CO4	Estimate water requirements of the crops
CO5	Design the regime canals for irrigation and other purposes

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														

Major Project Phase 2

Contact Hours/ week: (L-T-P-S)	1-0-6-5	**Credits:**	6
Total Lecture Hours:	180 = 14 (L)+0(T)+84(P)+82(S)	**CIE Marks:**	0
Sub. Code:	S7CVP2	**SEE Marks:**	0

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
1	Encourage independent learning and the innovative attitude of the students
2	Develop interactive attitude, communication skills, organization, time management, and presentation skills
3	Impart flexibility and adaptability
4	Inspire team working
5	Expand intellectual capacity, credibility, judgment and intuition
6	Adhere to punctuality, setting and meeting deadlines
7	Install responsibilities to oneself and others
8	Present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas

NOTES:	
CIE procedure for Project Work:	For Single discipline projects: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates For Interdisciplinary project: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates
SEE procedure for Project Work:	SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

COURSE OUTCOMES: On completion of the course the student will be able to:	
CO1	Identify a problem through literature survey and knowledge of contemporary engineering technology
CO2	To consolidate the literature search to identify issues/gaps and formulate the engineering problem

CO3	To prepare project schedule for the identified design methodology and engage in budget analysis, and share responsibility for every member in the team.
CO4	To provide sustainable engineering solution considering health, safety, legal, cultural issues and also demonstrate concern for environment
CO5	To identify and apply the mathematical concepts, science concepts, engineering and management concepts necessary to implement the identified engineering problem
CO6	To select the engineering tools/components required to implement the proposed solution for the identified engineering problem.
CO7	To analyze, design, and implement optimal design solution, interpret results of experiments and draw valid conclusion
CO8	To demonstrate effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE/Springer/ paper format of the work
CO9	To engage in effective oral communication through power point presentation and demonstration of the project work.
CO10	To demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics.
CO11	To perform in the team, contribute to the team and mentor/lead the team

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3										3			
CO2		3												
CO3										3				
CO4						3								
CO5	3	3												
CO6					3						3			
CO7			3	3										
CO8									3					
CO9									3					
CO10							3							

Internship (Industry/Research)

Contact Hours/ week: (L-T-P- S)	1-0-0-19	**Credits:**	10
Total Lecture Hours:	300 = 14 (L)+0(T)+0(P)+286(S)	**CIE Marks:**	100
Sub. Code:	S8CVII	**SEE Marks:**	100

CIE- Continuous Internal Evaluation, SEE-Semester End Examination

COURSE OBJECTIVES: This course will enable students to:	
NOTES:	
General	Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.
Duration and eligibility	The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.
Research internship:	A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.
Rural Internship:	Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.
Role of the faculty coordinator or mentor:	The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.
Place of Internship	The students are permitted to carry out the internship anywhere in India or abroad. With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.
Internship expenses	Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization.

Industry internship:	Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

COURSE OUTCOMES: On completion of the course the student will be able to:

CO-PO Mapping: 1=> Low, 2=> Medium, 3 => Strong mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														