



NRI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Permanently Affiliated to JNTUK, Kakinada)
 (Accredited by NAAC with "A" Grade and ISO 9001:2015 Certified Institution)
 POTHAVARAPPADU (V), (VIA) NUNNA, AGIRIPALLI (M), PIN – 521 212

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE FOR THIRD YEAR B.TECH PROGRAMME

IV YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	18A4101401	Pre-stressed concrete Structures	2	1	0	3	40	60	100	3
2	18A4101402	Design of steel structures	2	1	0	3	40	60	100	3
3	18A4101403	Construction Technology & Project Management	2	0	0	2	40	60	100	2
4	18A4101404	Quantity Surveying & Public works	2	1	0	3	40	60	100	3
5	18A4101511	Professional Elective -4 Finite Element Methods	3	0	0	3	40	60	100	3
	8A4101512	Advanced Foundation Engineering								
	18A4101513	Environmental Impact Assessment								
	18A4101514	Traffic Engineering								
	18A4101515	Sustainable Water Resources Development								
6	18A4101607	Open elective -4 Project management	3	0	0	3	40	60	100	2
	18A4101608	Remote sensing and GIS techniques								
7	18A4101491	Structural Designing and drawing using Software's	0	0	3	3	40	60	100	1.5
8	18A4101492	Environmental Engineering Lab	0	0	3	3	40	60	100	1.5
9	18A4101791	Project - I	0	0	6	6	40	60	100	1.5
10	18A4101792	Summer Internship/ Design Project	0	0	0	0	40	60	100	1.5
11	18A4100801	Entrepreneurship	2	0	0	2	40	60	100	0
Total			16	3	12	31	440	660	1100	23



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Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
		Professional Elective -5/MOOCs 1/ Swayam								
	18A4201511	Civil Infrastructure for Smart City Development (Swayam)								
	18A4201512	Geo-techniques for Design of Underground Structures	2	1	0	3	40	60	100	3
	18A4201513	Remote Sensing and GIS								
	18A4201514	Road safety Engineering								
	18A4201515	River Basin Management								
		Professional Elective -6/ MOOCs 2/ Swayam								
	18A4201521	Advanced Structural Design								
	18A4201522	Geosynthetics	2	1	0	3	40	60	100	3
	18A4201523	Environmental Economics								
	18A4201524	Urban Transportation Planning								
	18A4201525	Water Shed Management								
	18A4201791	Project - II	0	0	16	16	40	160	200	14
		Total	4	2	16	22	120	280	400	20

18A4101401- PRESTRESSED CONCRETE STRUCTURES

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Strength of Materials, Structural Analysis												
Course Objectives:												
<ol style="list-style-type: none"> 1. Analyze PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design beams of rectangular and I sections for flexure. 2. Design shear reinforcements, structural elements for shear, torsion and anchorage as per the provisions of BIS. 3. Interpret the transmission mechanism of pre-stressing force by bond and compute deflection of beams under loads 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Explain the concepts of pre-stressing and methods of pre stressing.											
CO2	Compute losses of pre-stress in pre-stressed concrete members.											
CO3	Design PSC beams under flexure.											
CO4	Design PSC beams under shear.											
CO5	Determine the short and long term deflections of PSC beams											
CO6	Implement prestressing concepts for composite beams.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	-	-	-	3	-	-	-	-
CO2	3	3	3	-	-	-	-	3	-	-	-	-
CO3	3	3	3	-	-	-	-	3	-	-	-	-
CO4	3	3	3	-	-	-	-	3	-	-	-	-
CO5	3	3	3	-	-	-	-	3	-	-	-	-
CO6	2	2	2	-	-	-	-	2	-	-	-	-
UNIT I												
Principles of Pre-Stressing:												
Principles of pre-stressing – pre stressing systems - pre-tensioning and post tensioning- Advantages and limitations of Pre stressed concrete- need for high strength materials. Methods of pre-stressing: Pre-tensioning (Hoyer system) and Post-tensioning methods (Freyssinet system and Gifford- Udall System).												
LO: 1. Understand pre tensioning and post tensioning												
2. Identify different type of prestressing system												
UNIT II												
Losses of pre-stress:												
Loss of pre-stress in pre-tensioned and post-tensioned members due to elastic shortening, shrinkage and creep of concrete, relaxation of stress in steel, anchorage slip and frictional losses.												
LO: 1. Classify different types of losses in prestressing												
2. Estimate losses of pre stress												
UNIT III												
Flexure and shear:												
Analysis of beams for flexure and shear - beams pre-stressed with straight,												

concentric, eccentric, bent and parabolic tendons- Kern line - Cable profile - design of PSC beams (rectangular and I sections) using IS 1343. Analysis and design of rectangular and I beams for shear. Introduction to Transmission length and End block (no Design and Analytical problems).

LO: 1. Analyze beams for flexure and shear

2. Understand prestressing with different types of tendons on beams of varying shape

3. Explain end block characteristics and its significance

UNIT IV

Deflections:

Control of deflections- Factors influencing deflections - short term deflections of uncracked beams- prediction of long time deflections.

LO: 1. Distinguish between short term and long term deflections in PSC beams

2. Estimate the short and long term deflections of PSC beam.

Composite beams:

Different Types- Propped and Unpropped- stress distribution- Differential shrinkage- Analysis of composite beams.

LO: 1. Identify different types of composite beams

2. Analyze PSC composite beams.

TEXT BOOKS:

1. Prestressed Concrete, N. Krishna Raju, Tata Mc.Graw Hill Publications.
2. Prestressed Concrete Design, Praveen Nagrajan, Pearson publications, 2013.

REFERENCE BOOKS:

1. Design of Prestressed Concrete Structures, T.Y. Lin & Ned H. Burns, John Wiley & Sons.
2. Prestressed Concrete, S. Ramamrutham, Dhanpatrai Publications.
3. Prestressed concrete, Rajagopalan, Narosa Publishing House.

E-RESOURCES:

- <http://www.nptelvideos.in/2012/11/prestressed-concrete-structures.html>

18A4101402-DESIGN OF STEEL STRUCTURES

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Reinforced Concrete Structures, Strength of materials												
Course Objectives:												
<ol style="list-style-type: none"> 1. Analyze PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design beams of rectangular and I sections for flexure. 2. Design shear reinforcements, structural elements for shear, torsion and anchorage as per the provisions of BIS. 3. Interpret the transmission mechanism of pre-stressing force by bond and compute deflection of beams under loads 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Explain different types of Connections and relevant IS code provision.											
CO2	Design beams and columns.											
CO3	Design of truss elements											
CO4	Design of column bases											
CO5	Design Plate Girders with curtailment of flanges.											
CO6	Design principles of Gantry Girders with curtailment of flanges.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	-	-	-	3	-	-	-	-
CO2	3	3	3	-	-	-	-	3	-	-	-	-
CO3	3	3	3	-	-	-	-	3	-	-	-	-
CO4	3	3	3	-	-	-	-	3	-	-	-	-
CO5	3	3	3	-	-	-	-	3	-	-	-	-
CO6	2	2	2	-	-	-	-	2	-	-	-	-
UNIT I												
Connections:												
Riveted connections – Rivet value, Welded connections: Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to in plane and out of plane.												
LO: 1. Understand riveted and welded connections												
2. Estimate strength of welds												
3. Design Welded and reverted connections as per IS Codal provisions												
Beams:												
Allowable stresses, design of simple beams-Curtailment of flange plates - IS Code-provision - Beam - to - beam connection, shear, buckling, check for deflection and bearing, laterally unsupported beams.												
LO: 1. Understand behaviour of simple beams												
2. Visualize importance of curtailment of flange plates												
3. Design and detail of steel beams under different conditions adopting IS Code.												
UNIT II												
Tension Members and Compression members:												
Design of members in direct tension and bending –effective length of columns.												

Slenderness ratio – permissible stresses. Design of compression members. Roof Trusses: types of trusses – Design loads – Load combinations as per IS Code, detailing – Design of simple roof trusses elements (purlins, members and joints)

LO: 1. Understand behaviour of tension members

2. Understand behaviour of compression members

3. Design and detail of Tension and compression members under different conditions adopting IS Code.

4. Design simple roof trusses and elements

UNIT III

Design of built-up columns:

Built-up columns with lacing and/or battening system. Design of Eccentrically loaded columns, Splicing of columns.

LO: 1. Understand behaviour of built-up columns

2. Design and detail of built-up columns adopting IS Code.

Design of Column bases:

Slab base and gusseted base under axial load and moment.

LO: 1. Understand behaviour of column bases

2. Design and detail of column bases adopting IS Code.

UNIT IV

Plate Girders:

Design of plate girder – IS code Provisions – Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Gantry Girder:

Design principles of Gantry Girder - impact factors – longitudinal forces.

LO: 1. Identify different components of plate girder

2. Design and detail of components of plate girder confirming to IS Code

3. Understand the functioning of gantry girder for different types of loads

TEXT BOOKS:

1. Steel Structures Design and Practice, N. Subramanian, Oxford University Press.

2. Design of steel structures, S. K. Duggal, Tata Mc Graw Hill, New Delhi.

REFERENCE BOOKS:

1. Structural Design in Steel, SarwarAlamRaz, New Age International Publishers, New Delhi

2. Design of Steel Structures, M. Raghupathi, Tata Mc. Graw-Hill.

3. Structural Design and Drawing, N. Krishna Raju; University Press.

4. Indian Standard Code for General Construction in Steel, 3rd revision, Indian Standards Institution, New Delhi, 2008.

5. IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.

6. Steel Tables.

E-RESOURCES:

- <https://www.alljntuworld.in/download/steel-structures-design-drawing-dss-materials-notes/>
- <http://www.nptelvideos.in/2012/11/design-of-steel-structures.html>

18A4101403- CONSTRUCTION TECHNOLOGY & PROJECT MANAGEMENT

Lecture – Tutorial:	2-0Hours	Internal Marks:	40
Credits:	2	External Marks:	60

Prerequisites: Building Materials, Concrete Technology

Course Objectives:

- To introduce to the student the concept of project management including network drawing and monitoring
- To introduce various equipment's like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to construction.
- To introduce the importance of safety in construction projects

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Explain the importance of construction planning
CO2	Assess the project management and construction techniques
CO3	Describe about project evaluation and review technique.
CO4	Explain the methods of production of aggregate products
CO5	Explain the functioning of various earth moving equipment
CO6	Explain Concreting and usage of machinery required for the works

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	-	-	1	-	-	3	-
CO2	1	-	-	-	-	-	-	1	-	-	3	-
CO3	3	-	-	-	-	-	-	1	-	-	3	-
CO4	2	-	-	-	-	-	-	1	-	-	3	-
CO5	1	-	-	-	-	-	-	1	-	-	3	-
CO6	1	-	-	-	-	-	-	1	-	-	3	-

UNIT I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical Path Method – Applications

Project Evaluation and Review Technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

UNIT II

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling

equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers- draglines - clamshell buckets

UNIT III

Concreting equipment – crushers – jaw crushers – gyratory crushers – impact crushers – selection of crushing equipment - screening of aggregate – concrete mixers

– mixing and placing of concrete – consolidating and finishing

UNIT IV

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering

TEXT BOOKS:

1. Construction Project Management Theory and Practice, Kumar NeerajJha (2011), Pearson.
2. Construction Technology, Subir K. Sarkar and SubhajitSaraswati, Oxford University press.
3. Project Planning and Control with PERT and CPM, B. C. Punamia and K KKhandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

REFERENCE BOOKS:

1. Construction Project Management - An Integrated Approach, Peter Fewings , Taylor and Francis
2. Construction Management Emerging Trends and Technologies, TreforWilliams , Cengage learning.
3. Hand Book of Construction Management, P. K. Joy, Trinity Press Chennai, New Delhi.
4. Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgrawhill

E-RESOURCES:

- <https://nptel.ac.in/courses/105/103/105103093/>

18A4101404- QUANTITY SURVEYING & PUBLIC WORKS

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Building Materials, Concrete Technology												
Course Objectives:												
<ol style="list-style-type: none"> 1. To impart basic knowledge on different types of estimation 2. To enrich with specifications and tender procedures. 3. To give insights on various types of contract agreements. 4. To inculcate data preparation for abstract estimation 5. To teach procedure for valuation of buildings. 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Explain the methods of Estimation											
CO2	Evaluate the quantities for structural components											
CO3	Prepare detailed and general specifications for a project											
CO4	Prepare documents for different types of contracts											
CO5	Explain procedures for entries in measurement books and its importance											
CO6	Evaluate valuation of buildings.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	2	-	1	-	-	-	-
CO2	3	3	-	-	-	2	-	1	-	-	-	-
CO3	3	2	-	-	-	2	-	1	-	-	-	-
CO4	3	1	-	-	-	2	-	1	-	-	-	-
CO5	3	2	-	-	-	2	-	1	-	-	-	-
CO6	3	2	-	-	-	2	-	1	-	-	-	-
UNIT I												
Estimation												
Methods of estimation-advantages-types of estimates-detailed estimates of residential buildings-single storied and multi-storeyed buildings-earthwork-foundations-Super structure-Fittings including sanitary and electrical fittings-paintings.												
LO: 1. Understand methods of Estimation												
2. Carryout estimation of quantities for structural components												
3. Estimate cost while using different types of sanitary and electrical fittings												
UNIT II												
Rate Analysis and Preparation of Bills												
Data-Rate analysis-abstract estimate-report to accompany estimate-measurement book –bills-types												
LO: 1. Calculate data for different materials												
2. Understand procedures for entries in measurement books and its importance												
3. Prepare abstract estimates based on SSR.												
UNIT III												
Specifications and Tenders												
Specifications-Detailed and general specifications-construction specifications-												

sources- types of specifications-Tender notices-types-corrigendum notice-tender procedures Drafting model tenders.

LO: 1. Prepare detailed and general specifications for a project

2. Understand tender schedule and tender notices

3. Draft tender documents for projects

UNIT IV

Contracts

Types of contracts-formation and conditions of contract-problems-contract for labour, material, design and construction-drafting of contract documents-construction contracts- arbitration and legal requirements.

LO: 1. Prepare documents for different types of contracts

2. Identify arbitration and legal issues and mitigation methods

Valuation

Principles of valuation-Value and Cost-value engineering-value analysis-phases in value engineering-information-function-escalation-evaluation-recommendation-implementation-Audit.

LO: 1. Carry out valuation of buildings.

2. Explain Auditing procedures and implementation

TEXT BOOKS:

1. Estimating and Costing in Civil Engineering (Theory & Practice), Dutta, B. N., UBS Publishers, 2016

2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press Pvt Ltd, Hyderabad. 4th Edition 2015.

REFERENCE BOOKS:

1. , Estimation, Costing and Specifications, M. Chakraborti, Laxmi publications.

2. A Textbook of Estimating and Costing(Civil), S. Chand and Company Limited, D. D. Kohli& R. C. Kohli, New Delhi

3. Standard Schedule of rates and standard data book by public works department.

4. I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)

E-RESOURCES:

- <http://www.btechmaterials.com/download/estimating-costing-materials-notes/>
- <https://lecturenotes.in/subject/439/estimating-costing-EC>

PROFESSIONAL ELECTIVE-IV
18A4101511-FINITE ELEMENT METHODS

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

1. Introduce fundamentals of elasticity and steps involved in FEM.
2. To describe element stiffness matrix formulation for 1D and 2D cases.
3. To impart isoparametric formulation concepts.
4. To teach formulation of stiffness matrix for axi-symmetric problems.
5. To demonstrate numerical solution techniques used in FEM.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

C01	Develop finite element formulations of 1D & 2D problems.
C02	Solve complex problems using FEM.
C03	Formulate isoparametric elements with different irregular boundaries.
C04	Implement solution techniques for higher order problems in practice.
C05	Explain concepts for carrying out research.
C06	Explain concepts for modelling of non-linear materials and geometry

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	3	-	-	-	-	-	1	-	-	-	-
C02	3	3	-	-	-	-	-	1	-	-	-	-
C03	3	3	-	-	-	-	-	1	-	-	-	-
C04	3	2	-	-	-	-	-	1	-	-	-	-
C05	3	-	-	-	-	-	-	1	-	-	-	-
C06	3	-	-	-	-	-	-	1	-	-	-	-

UNIT I

Basic Concepts of FEM:

Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh –Ritz method of functional approximation. Principles of Elasticity: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

LO: 1. Update basic concepts of theory of elasticity

2. Understand stages involved in FEM

UNIT II

One Dimensional & Two Dimensional Elements: Stiffness matrix for bar element – shape functions – 1D and 2D elements – types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

LO: 1. Study types of elements and their degrees of freedom

2. Develop stiffness matrices for 1D and 2D elements

UNIT III

Element stiffness matrix:

Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.

LO: 1. Study types of elements and their degrees of freedom**1. Develop stiffness matrices for triangular and rectangular elements.****Solution techniques:**

Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

LO: 1. Apply numerical solution techniques in FEM.**UNIT IV****Isoparametric Formulation:**

isoparametric elements for 2D analysis –formulation of CST element, 4 – noded and 8-noded iso-parametric quadrilateral elements –Lagrangian and Serendipity elements.

Axi-symmetric analysis: Basic principles-Formulation of 4-noded isoparametric axi-symmetric element

LO: 1. Study types of elements and their degrees of freedom**2. Develop stiffness matrices for 2D and axisymmetric solution techniques.****TEXT BOOKS:**

1. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad. 2003.
2. Finite Element analysis-Theory & Programming, C. S. Krishna Murthy, Tata McGraw Hill Publishers.

REFERENCE BOOKS:

1. Finite element analysis and procedures in engineering, H.V. Lakshminaryana, 3rd edition, Universities press, Hyderabad.
2. Robert D. Cook, Michael E Plesha, Concepts and applications of Finite Element Analysis, Robert D. Cook, Michael E Plesha, John Wiley & sons Publications
3. Finite element analysis in Engineering Design, S. Rajasekharan, S. Chand Publications, New Delhi.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/107/105107209/>

PROFESSIONAL ELECTIVE-IV
18A4101512- ADVANCED FOUNDATION ENGINEERING

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives: Soil Mechanics, Foundation Engineering

1. To impart how Meyerhof's general bearing capacity equations are important over Terzaghi's bearing capacity equation.
2. To teach special methods of computation of settlements and the corrections to be applied to settlements and to understand the advanced concepts of design of pile foundations.
3. To throw light on pile and mat foundation designs.
4. To teach the difference between isolated and combined footings, the determination of bearing capacity of mats and proportioning of footings.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

C01	Compute the safe bearing capacity of footings subjected to vertical and inclined loads.
C02	Explain the advanced methods of settlement computations and proportion foundation footings.
C03	Explain the methods of computing the pull-out capacity and negative skin friction of piles and compute the settlements of pile groups in clays.
C04	Evaluate the problems posed by expansive soils and the different foundation practices devised.
C05	Differentiate between isolated footings and combined footings and mat foundations.
C06	Design of piles and pile caps in different soils

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	3	-	-	-	-	-	-	-	-	-	-
C02	2	2	-	-	-	-	-	-	-	-	-	-
C03	1	1	-	-	-	-	-	-	-	-	-	-
C04	3	3	1	-	-	-	-	-	-	-	-	-
C05	1	1	-	-	-	-	-	-	-	-	-	-
C06	3	3	3	-	-	-	-	-	-	-	-	-

UNIT I

Concepts of Bearing capacity:

Bearing capacity of Foundations using general bearing capacity equation – Meyerhof's, Brinch Hansen's and Vesic's methods- Bearing capacity of Layered Soils: Strong layer over weak layer, Weak layer on strong layer – Bearing capacity of foundations on a top of slope – Bearing capacity of foundations at the edge of the slope.

LO: 1. Understand bearing capacity of soils

2. Determine the bearing capacity of soils.

UNIT II

Settlement analysis:

Immediate settlement of footings resting on granular soils – Schmertmann & Hartman method – De Beer and Martens method - Immediate settlement in clays – Janbu’s method – correction for consolidation settlement using Skempton and Bjerrum’s method – Correction for construction period.

LO: 1. Understand settlement analysis by various methods.

2. Study corrections for construction period

UNIT III**Mat foundations**

Purpose and types of isolated and combined footings – Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations – allowable bearing capacity of mats founded in clays and granular soils – compensated rafts.

LO: 1. List Mat foundations for various types applications

2. Design mat foundations for different types of soils.

UNIT IV**Pile foundations**

Single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays – laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms’ analysis.

LO: 1. Explain conditions for adopting pile foundations

2. Design piles and pile caps in different soils.

TEXT BOOKS:

1. J. E. Bowles Foundation Analysis and Design, John Wiley
2. Soil Mechanics and Foundation Engineering, V. N. S. Murthy, CBS Publishers

REFERENCE BOOKS:

1. Foundation Design, W.C. Teng, Prentice Hall Publishers
2. Analysis and Design of Substructures, Saran S., Taylor & Francis Publishers, 2006
3. Design of Foundation Systems: Principles and Practices, Kurien, N.P., Narosa Publishing House, New Delhi, 1999
4. Pile Foundation Analysis and Design, Poulos, H. G., and Davis, E. H., John Wiley, 1980.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/105/105105207/>

PROFESSIONAL ELECTIVE-IV

18A4101513-ENVIRONMENTAL IMPACT ASSESSMENT

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites:												
Course Objectives:												
1. To impart knowledge on different concepts of Environmental Impact Assessment												
2. To teach procedures of risk assessment												
3. To teach the EIA methodologies and the criterion for selection of EIA methods												
4. To teach the procedures for environmental clearances and audit												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Explain the role of stakeholder and public hearing in the preparation of EIA.											
C02	Identify the risks and impacts of a project.											
C03	Choose an appropriate EIA methodology.											
C04	Evaluate the EIA report.											
C05	Estimate the cost benefit ratio of a project.											
C06	Prepare EMP, EIS, and EIA report.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	2	-	-	-	-	3	-	-	-	-	-
C02	3	-	-	1	-	-	3	-	-	-	-	-
C03	3	-	-	1	-	-	3	2	-	-	-	-
C04	3	-	1	-	-	-	3	-	-	-	-	-
C05	3	-	2	-	-	-	3	-	-	-	2	-
C06	3	-	-	1	-	2	3	3	-	-	-	-
UNIT I												
Environmental Acts and Notifications:												
The Environmental protection Act, The water preservation Act, The Air (Prevention & Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.												
LO: 1. Understand the importance of environmental protection acts												
2. Explain acts and notifications in Environmental legislation												
UNIT II												
Impact of Developmental Activities and Land Use												
Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.												
LO: 1. Study the factors causing impact of development activities												
2. Decide mitigation measures of pollution on environment												
UNIT III												

Assessment of Impact on Vegetation, Wildlife and Risk Assessment

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-advantages of Environmental Risk Assessment

LO: 1. Understand effect of development activities on environment.

2. Design procedures for assessment of environmental risk

UNIT IV

Methodologies of EIA

Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

LO: 1. Understand the elements of EIA.

2. Explain criteria for selection of EIA methodology

TEXT BOOKS:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, Y.Anjaneyulu,B. S. Publication, Hyderabad.

REFERENCE BOOKS:

1. Environmental Engineering, Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985
2. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers
3. Environmental Science and Engineering, Suresh K. Dhaneja,S.K., Katania& Sons Publication, New Delhi.
4. Environmental Pollution and Control, H. S. Bhatia , Galgotia Publication (P) Ltd, Delhi

E-RESOURCES:

- https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/Teachers_Manual/Teacher_manual_master_EIA.pdf
- <https://lecturenotes.in/subject/608/environmental-impact-assessment-management>

PROFESSIONAL ELECTIVE-IV
18A4101514- TRAFFIC ENGINEERING

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

1. To teach basic science principles in estimating stopping and passing sight distance requirements.
2. Identify and teach traffic stream characteristics
3. Understand elements of highway safety and approaches to accident Studies.
4. To teach the importance of road safety
5. Design a pre-timed signalized intersection, and determine the signal splits.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Explain principles in estimating stopping and passing sight distance requirements.
CO2	Analyse Traffic Problems And Plan For Traffic Systems Various Uses.
CO3	Conduct different types of Traffic Surveys.
CO4	Explain traffic regulation and control devices.
CO5	Design Channels, Intersections, Signals and Parking Arrangements.
CO6	Develop Traffic Management Systems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	2	-	2	-	-	-	-
CO2	3	2	1	-	-	2	-	2	-	-	-	-
CO3	3	-	-	-	-	2	-	1	-	-	-	-
CO4	3	-	-	-	-	2	-	2	-	-	-	-
CO5	3	3	3	-	-	2	-	1	-	-	-	-
CO6	3	1	-	-	-	2	-	2	-	-	-	-

UNIT I

Traffic Planning and Characteristics:

Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

LO: 1. Understand the concepts of road and road user characteristics

2. Outline the traffic problems in rural and urban India

3. Suggest sustainable approaches for proper land use and transport

UNIT II

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and

significance.

- LO: 1. Understand importance of traffic surveys**
- 2. List out methods of interpretation of survey data**
- 3. Forecast traffic adopting statistical data**
- 4. Carryout origin and destination surveys**

UNIT III

Traffic Design and Visual Aids:

Intersection Design- channelization, Rotary intersection design, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.

LO: 1. Design various intersection points to control traffic.

Traffic Safety:

Accident Studies And Analysis; Causes Of Accidents - The Road, The Vehicle, The Road User and The Environment; Engineering, Enforcement and Education Measures For The Prevention of Accidents. Accident Data Recording – Condition Diagram, Collision Diagram.

LO: 1. Understand importance of accident studies

2. List out measures for prevention of accidents

3. Develop condition diagrams and collision diagrams

UNIT IV

Traffic Control, Regulation Signal Coordination:

Traffic Signals –Types Of Signals; Design Of Isolated Traffic Signal By Webster Method, Warrants For Signalization. Optimum Cycle Time- Saturation Flow Rate – Corrections for Left and Right Turns. Signal Coordination: Signal Co-Ordination Methods, Simultaneous, Alternate, Simple Progression and Flexible Progression Systems.

LO: 1. Gain knowledge on methodology to control traffic

2. Design signalling system.

TEXT BOOKS:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
2. Principles Of Highways Engineering and Traffic Analysis – Fred Mannering & Walter Kilareski, John Wiley & Sons Publication

REFERENCE BOOKS:

1. Transportation Engineering- An Introduction, C. Jotin Khisty, Prentice Hall Publication.
2. Fundamentals of Transportation Engineering - C. S. Papa Costas, Prentice Hall India.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/101/105101008/>

PROFESSIONAL ELECTIVE-IV

18A4101515- SUSTAINABLE WATER RESOURCES DEVELOPMENT

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

1. Demonstrate Role of water in National Development
2. Explain Water Resources Systems Analysis
3. Impart on Evaluation and monitoring of water quality and management of water distribution networks
4. Teach different methods for water balancing
5. Visualize Interstate Water Dispute Acts

Course Outcomes:

Upon successful completion of the course, the student will be able to:

C01	Demonstrate role of water in national development
C02	Explain the planning requirements of irrigation project.
C03	Design distribution networks for irrigation flood control and power generation
C04	Explain the water management strategies
C05	Explainthe importance of interlinking of rivers
C06	Explain interstate water disputes and arrive at feasible solutions

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	-	-	-	-	2	2	-	-	-	-	-
C02	3	-	-	-	-	2	2	-	-	-	-	-
C03	3	2	3	-	-	2	2	-	-	-	-	-
C04	3	-	-	-	-	-	2	-	-	-	-	-
C05	3	-	-	-	-	-	2	-	-	-	-	-
C06	3	-	-	-	-	-	2	-	-	-	-	-

UNIT I

Assessment of Water Resources of the country:

Water Resources Potential, Demand and Development -Role of water in National Development - Assessment of Water Resources of the country - River Basins - Hydro-meteorological and Hydrological Data. Assessment of Utilizable flows - Conventional and non-conventional methods - Estimation of Water need- National Water Policy. Conjunctive use of surface and ground water. Future Water Requirements - Scope of development.

LO: 1. Demonstrate role of water in national development

2. Assess water resources in country

3. Estimate future water need

UNIT II

Water Resources Planning and Project Formulation:

Water Resources Planning - Single and Multipurpose Projects - Project Formulation, Comparison of Alternatives - Cost Benefit Analysis. Cost Allocation among various purposes. Water Resources Systems Analysis - Optimization Approaches.

LO: 1. Understand the planning requirements of a irrigation project.

2. Compare alternative methods based on cost aspects

3. Optimization of approaches

Environmental Aspects of Integrated water Resources Development:

Evaluation and monitoring of water quality and management of water distribution networks for Irrigation, Flood control and Power generation - Catchment Treatment and Watershed Management. Command Area Development - Resettlement and Rehabilitation.

LO: 1. Evaluate and monitor water quality

2. Design distribution networks for irrigation flood control and power generation

UNIT III

Management Strategies for Excess and Deficit Water Balances

Flood Control & Management - Various methods of Control - Administrative Planning - Management Programmes and Flood Cushioning -Structural Methods. Non-structural Methods - Flood forecasting & Warning, Flood plain zoning and Flood proofing. Drought Prone Area Development - Soil Conservation Methods.

LO: 1. Understand the water management strategies

2. Explain flood forecasting and planning

3. Develop procedure to meet requirements in drought prone area

UNIT IV

Riparian Rights and Inter Basin Linking of Rivers:

Indian Scenario - Various Proposals and their Status - Dr. K. L. Rao's Proposal, Capt. Dastur's Garland Canal, National Perspective Plan, NWDA Link and Peninsular Rivers Development Component - Overall Benefits and Major constraints. Water Laws of India - Regulating Authorities - Interstate Water Dispute Acts - River Water Tributes - Cauvery, Krishna Godavari and Vamsadahra Tribunals.

LO: 1. Understand importance of interlinking of rivers

2. Explain water laws of India

3. Study interstate water disputes and arrive at feasible solutions

TEXT BOOKS:

1. A Textbook Of Irrigation Engineering and Hydraulic Structures, S K Sharma, S. Chand and Company Limited, New Delhi
2. Water Resource Engineering: R. L. Linsley& J. B. Fragini, MCGrohly

REFERENCE BOOKS:

1. Irrigation and Water Resources & Water Power, P. N. Modi,Standard Book House.
2. Principles of Water Resource engineering: A.S. Gordman
3. Irrigation engineering and Hydraulic structures, S. K. Garg, Standard Book House.
4. Irrigation and water power engineering, Punmia& Lal, Laxmi Publications pvt. Ltd., New Delhi.

E-RESOURCES:

- <https://ascelibrary.org/doi/book/10.1061/9780784414767>

Open Elective-4 (Offered by Department of civil engineering)
18A4101607- PROJECT MANAGEMENT

Lecture – Tutorial:	3-0 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites: -----

Course Objectives:

- To get introduction to concepts of projects formulation.
- To learn project planning and scheduling of activities.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- CO1 Understand the project management and causes of failures
- CO2 Knowledge on different methods of Planning
- CO3 Knowledge on different methods of scheduling
- CO4 Knowledge on project management through networks
- CO5 A complete idea on developing networks using PERT method.
- CO6 A complete idea on developing networks CPM method.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	2	-	2	-	-	-	-
CO2	3	2	-	-	-	1	-	2	-	-	-	-
CO3	2	2	-	-	-	1	-	2	-	-	-	-
CO4	3	-	-	-	-	1	-	2	-	-	-	-
CO5	2	2	-	-	-	-	-	2	-	-	-	-
CO6	3	1	-	-	-	2	-	2	-	-	-	-

UNIT I

Construction projects; Project management; Main causes of project failure.

PLANNING Steps involved in planning; Objectives; Principles; Advantages; Limitations; Stages of planning.

UNIT II

SCHEDULING Scheduling, Preparation of construction schedules; Methods of scheduling; Bar charts; Mile stone charts; Controlling; Job layout; Factors affecting job layout; Project work break down; Activities involved; Assessing activity duration

UNIT III

PROJECT MANAGEMENT THROUGH NETWORKS Objectives of network techniques; Fundamentals of network analysis; Events; Activities; Dummies; Types of networks; Choice of network type; Advantages of network techniques over conventional techniques.

UNIT IV

PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT) Introduction; Time estimates; Earliest expected time; Latest allowable occurrence time; Slack; Critical path; Probability of completion time for a project.

CRITICAL PATH METHOD (CPM) Introduction; Difference between CPM and PERT; Earliest event time; Latest event time; Activity time; Float; Critical activities and

critical path.

TEXT BOOKS:

1. Construction Engineering and Management by Dr.Seetharaman S., Umesh Publications, NaiSarark, Delhi, 2000.
2. Fundamentals of PERT/CPM and Project Management, (1st edition) by Bhattacharjee S.K., Khanna Publishers, NaiSarak Delhi, 2011.

REFERENCE BOOKS:

1. Construction Management & Planning by Sengupta,B. and Guha H., Tata McGraw – Hill, New Delhi, 1995.
2. Construction Planning, Equipment & Methods by Peurifoy R.L., McGraw – Hill International Book Company, 2006.
3. PERT & CPM Principles and applications by Srinath,L.S. Affiliated East West Press, 1971.

E-RESOURCES:

NPTEL

Open Elective-4 (Offered by Department of civil engineering)

18A4101608- REMOTE SENSING AND GIS TECHNIQUES

Lecture – Tutorial:	3-0 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Engineering chemistry, engineering geology and physics												
Course Objectives:												
➤ To use the techniques of Remote Sensing and GIS Technology has opened the door for immense opportunities in large scale mapping, updating existing maps and practical planning and decision making. To gain the basic concepts of Remote sensing& GIS and their applications in Civil engineering field.												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Understand the aerial photographs, stereoscopy											
CO2	Understand remote sensing sensors and platforms, their properties and											
CO3	Understand the image processing sequence and its importance in Remote											
CO4	Understand the geographical information system and its fundamental											
CO5	Understand the classification of maps, types of projections.											
CO6	Understand the GIS data representation and their types											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	2	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	2	-	-	-	1	-	-	-	-	-	-
UNIT I												
PHOTOGRAMMETRY Principle of photogrammetry and types of Aerial photographs, stereoscopy, Map Vs Mosaic, ground control, Stereoscopic Parallax, Orth photograph.												
UNIT II												
REMOTE SENSING Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation.												
UNIT III												
GEOGRAPHICAL INFORMATION SYSTEM Introduction & Definition of GIS (GEOGRAPHICAL INFORMATION SYSTEM). GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS, Classification of Maps, and Types of Projections.												
UNIT IV												

GIS DATA REPRESENTATION Types of Data Representation, Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management

TEXT BOOKS:

1. Remote Sensing and Geographical Information systems, (2nd edition) by Anji Reddy M.B.S. Publications, JNTU Kakinada, 2008.
2. Remote Sensing and GIS, (2nd edition) By Basudeb Bhatta Oxford Higher Education.

REFERENCE BOOKS:

1. Remote Sensing and Image Interpretation, (6th edition) by Thomas Lillesand.M and Ralph Kiefer W., 2007
2. Basics of Remote Sensing & GIS by Kumar S.Laxmi Publications, 2005.

E-RESOURCES:

<http://nptel.ac.in/courses.php>
<http://jntuk-coeerd.in/>

18A4101491-STRUCTURAL DESIGNING AND DRAWING USING SOFTWARE

Practical	3 Hours	Internal Marks:	40
Credits:	1.5	External Marks:	60

Prerequisites: Reinforced concrete structures, Auto cad

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Evaluate cross sectional and reinforcement requirements of various structural elements by using STAAD.Pro
CO2	Evaluate quantities and prepare rate analysis for various works in construction of a building using Spread Sheets

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	-	-	3	-	3	3	-	-	3
CO2	3	3	3	-	-	3	-	3	3	-	-	3

List of Experiments

PART-A

Analysis of the following concrete & steel structural elements using STAAD. ProSoftware.

- 1. Design of continuous beam.**
- 2. Design of plane frame**
- 3. Design of space frame.**
- 4. Design of G+4 Residential building: Creating model from the given drawing, Assigning Loads and Load Combinations**
- 5. Design of G+4 Residential building: Creating model from the given drawing, Assigning Lateral Loads**
- 6. Design of G+4 Residential building: Preparation of detail drawing, Preparation of Design Documents**
- 7. Design of Roof Truss**

PART – B

- 1. Estimate & Working out rates using spread sheets for the different items in a singleStory building.**
- 2. Demonstration of software’s ETABS**

18A4101492- ENVIRONMENTAL ENGINEERING LAB

Practical	3 Hours	Internal Marks:	40									
Credits:	1.5	External Marks:	60									
Prerequisites: Environmental Engineering												
Course Objectives:												
<ul style="list-style-type: none"> ➤ Estimation some important characteristics of water and wastewater in the laboratory ➤ It also gives the significance of the characteristics of the water and wastewater 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Determine some important characteristics of water and wastewater in the laboratory											
CO2	Outline some conclusion and decide whether the water is potable or not.											
CO3	Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments											
CO4	Determine strength of the sewage in terms of BOD and COD											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	3	-	2	3	-	-	3
CO2	3	3	-	-	-	3	-	2	3	-	-	3
CO3	3	3	-	-	-	3	-	2	3	-	-	3
CO4	3	3	-	-	-	3	-	2	3	-	-	3
List of Experiments												
<ul style="list-style-type: none"> ➤ Determination of pH and Electrical Conductivity (Salinity) of Water and Soil. ➤ Determination and estimation of Total Hardness–Calcium & Magnesium. ➤ Determination of Alkalinity/Acidity ➤ Determination of Chlorides in water and soil ➤ Determination and Estimation of total solids, organic solids and inorganic solids and settleable solids by Imhoff Cone. ➤ Determination of Iron. ➤ Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method and B.O.D. ➤ Determination of N, P, K values in solid waste ➤ Physical parameters – Temperature, Colour, Odour, Turbidity, Taste. ➤ Determination of C.O.D. ➤ Determination of Optimum coagulant dose. ➤ Determination of Chlorine demand. ➤ Presumptive Coliform test. 												

TEXT BOOKS:

Standard Methods for Analysis of Water and Waste Water – APHA Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi

REFERENCE BOOKS:

1. Relevant IS Codes.
2. Chemistry for Environmental Engineering by Sawyer and Mc. Carty.

18A4101791- PROJECT WORK-I

Practical	6 Hours	Internal Marks:	40									
Credits:	1.5	External Marks:	60									
Prerequisites:												
Course Objectives:												
➤ To enable the student apply engineering knowledge that has been taught all through the programme for solving practical engineering problem												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Apply all levels of engineering knowledge in solving the Engineering problems											
C02	Work together with team spirit											
C03	Document the project											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 - Low, 2- Medium, 3 - High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	3	3	3	3	3	-	3	3	-	3	3
C02	3	3	3	3	3	3	-	3	3	-	3	3
C03	3	3	3	3	3	3	-	3	3	-	3	3
Evaluation of Project work-I												
Project work-I shall be evaluated for a total of 100 marks.												
➤ Of 100 marks, 40 marks shall be awarded by the project supervisor based on student's involvement in carrying out the project and the remaining 60 marks are based on presentation and viva-voce before a committee consisting of two supervisors and a senior faculty of the department.												
➤ There will be no external assessment for Project work-I.												

18A4101792- SUMMER INTERNSHIP/ DESIGN PROJECT

Practical	3 Hours	Internal Marks:	40
Credits:	1.5	External Marks:	60
Prerequisites:			
Evaluation of Summer Internship/ Design Project			
Summer Internship/ Design Project shall be evaluated for a total of 100 marks. Of 100 marks, 40 marks shall be awarded by an internal committee consisting of two faculty members based on the presentation given and work carried out by a student and the remaining 60 marks are for final Viva-Voce examination conducted by the committee consisting of two Internal Examiner and the Head of the Department at the end of IV B.Tech I semester.			

18A4100801- ENTREPRENEURSHIP

Lecture – Tutorial:	2-0 Hours	Internal Marks:	40
Credits:	0	External Marks:	60

Prerequisites:

Course Objectives:

1. To understand entrepreneurial process and its significance in economic development of a nation.
2. To provide awareness about entrepreneurship.
3. To develop idea generation, creative and innovative skills.
4. To design business plan

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Analyse the business environment
CO2	Analyse and identify business opportunities.
CO3	Identify the elements of success of entrepreneurial ventures.
CO4	Statutory legal and financial regulations to start a business.
CO5	Evaluate effectiveness of different entrepreneurial strategies.
CO6	Specify performance indicators of entrepreneurship

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	2	-	-	-	-	-	-	2	-	2	-
CO2	1	2	-	-	-	-	-	-	2	-	2	-
CO3	1	-	-	-	-	-	-	-	2	-	2	-
CO4	1	-	-	-	-	-	-	-	2	-	2	-
CO5	1	2	-	-	-	-	-	-	2	-	2	-
CO6	1	-	-	-	-	-	-	-	2	-	2	-

UNIT I

Entrepreneurship

Entrepreneur – Characteristics and qualities, Entrepreneurs vs. Intrapreneurs and Managers – Classification of Entrepreneurs. Opportunities for Entrepreneurs in India and Abroad.

UNIT II

Micro, Small and Medium Enterprises

Small Enterprises – Definition, Classification – Characteristics, – Project Formulation – Steps involved in setting up of a Small Business – Identifying, Selecting a Business. Forms of Business; Women Entrepreneurship; Rural Entrepreneurship.

UNIT III

Idea Generation and Feasibility Analysis

Sources of Ideas - Methods of idea generation - - Product Identification - Opportunity Selection - What is a Business Plan - Significance - Formulation of Business Plan - Business Opportunities in Various Sectors

UNIT IV

Institutional support for Entrepreneurship

Role of Central and State Government in promoting Entrepreneurship – Introduction to various incentives, subsidies and grants.

Resources for Start-up

Need – Sources of Finance, Banking sources; Non-banking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business

TEXT BOOKS:

1. Entrepreneurial Development, S.S.Khanka, S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Entrepreneurship – Theory, Process and Practice, Donald F Kuratko, 9th edition, Cengage Learning 2014.

REFERENCE BOOKS:

1. Entrepreneurship, Hisrich Robert D, Peters M P, 8th Edition, Tata McGrawHill, 2013.
2. Entrepreneurship, Rajeev Roy, 2nd edition, Oxford University Press, 2011.
3. The Dynamics of Entrepreneurial Development and Management, Vasanth Desai, Himalaya Publishing House, 2011

E-RESOURCES:

- <https://lecturenotes.in/subject/35/entrepreneurship-development-ed>

IV-II CE
SYLLABUS

PROFESSIONAL ELECTIVE-V

18A4201511- CIVIL INFRASTRUCTURE FOR SMART CITY DEVELOPMENT (SWAYAM)

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites:												
Course Objectives:												
1. To understand and explain Green building concepts, Smart urban transport systems, E-Governance and IOT.												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Explore and understand the fundamental concepts of smart and sustainable cities.											
CO2	Explain the component of smart cities and dwell into their technological advancement.											
CO3	Explain the involvement of stake holders in the design and implementation of responsive smart cities.											
CO4	Develop work break down structure, scheduling of smart cities											
CO5	Explain the importance of different linkages and their roles including government, urban planners, universities, city developers and communities.											
CO6	Identify and recognize the role of ICT and data analytics in addressing the urban challenges and key issues											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	2	-	-	-	-	-	-
CO2	3	-	-	-	-	2	-	-	-	-	-	-
CO3	3	-	2	-	-	2	-	-	-	-	-	-
CO4	3	-	2	-	-	2	-	-	-	-	-	-
CO5	3	-	-	-	-	2	-	-	-	-	-	-
CO6	3	-	2	-	-	2	-	-	-	-	-	-
-UNIT I												
Smart city development												
Understanding – Dimensions – Global experience, Global standards and performance bench marks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, Financing smart cities development, Governance of smart cities												
Green building concepts and sustainable development												
Green projects in smart cities, sustainability – green building – Rating system – Energy efficient building – energy saving systems.												
UNIT II												
Smart urban transport systems												
Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport												

problems and mobility issues. Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process –Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management.

UNIT III

Project management in Smart Cities

Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM, Project cost analysis, resource allocation & levelling, Line of balancing technique, Project monitoring and control, Project risk management

UNIT IV

E- governance and IOT

The concept of management, concept of e-management & e-business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT fundamentals, protocols, design and development, data analytics and supporting services, case studies.

TEXT BOOKS:

1. 'Regional Development and Planning for the 21st Century: New Priorities and New Philosophies', Allen G.Noble, (Eds), Aldershot, USA, 1988.
2. Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers, John Wiley & Sons, Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP, 2008

REFERENCE BOOKS:

1. 'Handbook of Local and Regional Development', Andy Pike, Andres Rodriguez-Pose, John Tomaney, Taylor & Francis, 2010
2. 'Fifty years of Dutch National Physical Planning, Andreas Faludi and Sheryl Goldberg, Alexandrine Press, Oxford, 1991.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/106/105106115/>

PROFESSIONAL ELECTIVE-V

18A4201512-GEO-TECHNIQUES FOR DESIGN OF UNDERGROUND STRUCTURES

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Soil Mechanics, Foundation Engineering												
Course Objectives:												
<ol style="list-style-type: none"> 1. To teach excavation methods and design of supporting systems 2. To train analysis of deep excavation techniques 3. Explain the design procedure of excavation supporting systems. 4. To demonstrate excavation and protection procedure to be adopted during constructions carrying out below the ground level. 5. To teach the elements and construction process of tunnel 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Compute the safe bearing capacity of footings subjected to vertical and inclined loads.											
C02	Explain the advanced methods of settlement computations and proportion foundation footings.											
C03	Identifying the methods of computing the pull-out capacity and negative skin friction of piles and compute the settlements of pile groups in clays.											
C04	Evaluate the problems posed by expansive soils and the different foundation practices devised.											
C05	Differentiate between isolated footings and combined footings and mat foundations.											
C06	Design of piles and pile caps in different soils											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	2	1	-	-	-	-	-	-	-	-	-
C02	3	-	-	-	-	2	-	-	-	-	-	-
C03	3	-	-	-	-	2	-	-	-	-	-	-
C04	3	2	1	-	-	-	-	-	-	-	-	-
C05	3	-	-	-	-	-	-	-	-	-	-	-
C06	3	3	3	-	-	2	-	-	-	-	-	-
UNIT I												
Excavation Methods and Lateral Supporting System												
Introduction - excavation methods and lateral supporting systems – retaining walls – strutting systems – factors influencing on the selection of the retaining strut system – case history. Lateral earth pressure for design of supporting systems - Rankine’s and Coulomb’s earth pressure theory – earth pressure for design of excavation.												
LO: 1. Understand excavation process												
2. Identify appropriate lateral supporting systems.												
UNIT II												
Settlement analysis: Immediate settlement of footings resting on granular soils – Schmertmann & Hartman method – De Beer and Martens method - Immediate												

settlement in clays – Janbu’s method – correction for consolidation settlement using Skempton and Bjerrum’s method – Correction for construction period.

LO: 1. Understand settlement analysis by various methods.

2. Study corrections for construction period

UNIT III

Analysis of Deep Excavation

Introduction - free and fixed earth support method – shear failure of strutted walls – push in – basal heave - upheaval – sand boiling - Stress and deformation analysis of excavation: simplified method – beam on elastic foundation method – finite element method.

LO: 1. Learn procedures in deep excavation.

2. Understand concept of beams on elastic foundations

Design of Excavation Supporting Systems

Introduction – design methods and factor of safety – retaining wall – structural components in braced excavations – strut systems – anchor systems – tests of anchors

UNIT IV

Pile foundations

Single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays – laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms’ analysis.

LO: 1. Explain conditions for adopting pile foundations

2. Design piles and pile caps in different soils.

TEXT BOOKS:

1. J. E. Bowles Foundation Analysis and Design, John Wiley
2. Soil Mechanics and Foundation Engineering, V. N. S. Murthy, CBS Publishers

REFERENCE BOOKS:

1. Foundation Design, W.C. Teng, Prentice Hall Publishers
2. Analysis and Design of Substructures, Saran S., Taylor & Francis Publishers, 2006
3. Design of Foundation Systems: Principles and Practices, Kurien, N.P., Narosa Publishing House, New Delhi, 1999
4. Pile Foundation Analysis and Design, Poulos, H. G., and Davis, E. H., John Wiley, 1980.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/108/105108075/>
- <https://nptel.ac.in/content/storage2/courses/105101083/download/lec1.pdf>

PROFESSIONAL ELECTIVE-V
18A4201513-REMOTE SENSING AND GIS

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites:												
Course Objectives:												
<ol style="list-style-type: none"> 1. Introduce the basic principles of Remote Sensing and GIS techniques. 2. Teach various types of satellite sensors and platforms 3. Impart concepts of visual and digital image analyses 4. Teach concepts of principles of spatial analysis 5. Teach application of RS and GIS to Civil engineering 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Comparing with ground, air and satellite based sensor platforms.											
C02	Interpret the aerial photographs and satellite imageries.											
C03	Create and input spatial data for GIS application.											
C04	Explain RS concepts in water resources engineering.											
C05	Explain GIS concepts in water resources engineering.											
C06	Applications of various satellite data.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	2	-	-	-	-	-	-	-	-	-	-	-
C02	2	-	-	-	2	-	-	-	-	-	-	-
C03	2	-	-	-	2	-	-	-	-	-	-	-
C04	2	-	-	-	2	-	-	-	-	-	-	-
C05	2	-	-	-	2	-	-	-	-	-	-	-
C06	2	-	-	-	2	-	-	-	-	-	-	-
UNIT I												
Introduction to photogrammetry:												
Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.												
LO: 1. Understand concepts of photogrammetry												
2. Estimate heights and distances.												
UNIT II												
Remote sensing:												
Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.												
LO: 1. Understand advantages of remote sensing												
2. Demonstrate concepts of remote sensing.												

UNIT III

Geographic information system:

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

LO: 1. Understand concepts of GIS.

2. Explain data collection and data interpretation

3. Develop terrain characteristics using Mapping

UNIT IV

GIS spatial analysis:

Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

LO: 1 Applications of GIS and data interpretation.

Water resources applications:

Land use/Land cover in water resources, Surface water mapping and inventory - Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

LO: 1. Applications of RS & GIS in water resources applications.

2. Study technological problems like reservoir sedimentation ground water identification

TEXT BOOKS:

1. Remote Sensing and GIS by Oxford University Press, B. Bhatta, New Delhi.
2. Advanced surveying: Total station GIS and remote sensing, Satheesh Gopi, Pearson publication.

REFERENCE BOOKS:

1. Fundamentals of remote sensing, Universities press, George Joseph, Hyderabad.
2. Concepts & Techniques of GIS, C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
3. Remote sensing and GIS, B. S. Publications, M. Anji Reddy, New Delhi.
4. Remote Sensing and its applications, L. R. A. Narayana, University Press 1999.

E-RESOURCES:

- [https://www.iare.ac.in/sites/default/files/lecture notes/IARE CE RS%20and%20GIS Lecture%20notes.pdf](https://www.iare.ac.in/sites/default/files/lecture%20notes/IARE%20CE%20RS%20and%20GIS%20Lecture%20notes.pdf)
- <https://nptel.ac.in/content/storage2/courses/105108077/module1/lecture1.pdf>
- [https://kanchiuniv.ac.in/coursematerials/Dr K Anitha Course%20Material Remote%20Sensing%20and%20GIS.pdf](https://kanchiuniv.ac.in/coursematerials/Dr%20K%20Anitha%20Course%20Material%20Remote%20Sensing%20and%20GIS.pdf)

PROFESSIONAL ELECTIVE-V**18A4201514-ROAD SAFETY ENGINEERING**

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Highway Engineering, Traffic Engineering												
Course Objectives:												
1. Understand the road accidents and road safety improvement strategies												
2. Analyze the crash data using statistical methods & conduct road safety audits												
3. Understand the mechanism needed for crash reconstruction based on case studies												
4. Apply accident mitigation measures in view of safety of user on a highway												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Explain the road accidents and road safety improvement strategies											
CO2	Analyze the crash data using statistical methods											
CO3	Conduct road safety audits											
CO4	Explain the mechanism needed for crash reconstruction based on case studies											
CO5	Apply accident mitigation measures in view of safety of user on a highway											
CO6	Explain the traffic management measures and its influence											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	-	-	-	-	-	-
CO2	3	2	-	3	-	3	-	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	-	-	-
CO5	3	-	-	-	-	3	-	-	-	-	-	-
CO6	3	-	-	-	-	3	-	-	-	-	-	-
UNIT I												
TRAFFIC SAFETY												
Road accidents, trends, causes, collision and condition diagrams, highway safety, human factors, vehicle factors.												
SAFETY MANAGEMENT SYSTEMS AND STRATEGIES												
Road safety management system, road safety improvement strategies, elements of a road safety plan, safety data needs.												
UNIT II												
STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH DATA												
Before-after methods in crash analysis, statistical methods for traffic safety analysis: Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons., Black Spot Identification & Investigations, Case Studies.												
ROAD SAFETY AUDITS												
Key elements of a road safety audit, Road Safety Audits and Investigations, Crash investigation and analysis, Describe methods for identifying hazardous road locations, Case Studies												
UNIT III												
CRASH RECONSTRUCTION												
Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction. CASE STUDIES FOR												

CRASHES AND ACCIDENTS

Speed for various skid, friction, and drag, and acceleration scenarios, crash vs accident, Case Studies

UNIT IV**ACCIDENT MITIGATION MEASURES**

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Traffic calming.

TRAFFIC MANAGEMENT EDUCATION AND ENFORCEMENT

Traffic management measures and their influence in accident prevention, legislation, enforcement, education and propaganda. Salient features of Motor vehicle act, 2019: registration and licensing authorities in India: Their powers and duties, legal requirements to be met for driving various classes of vehicles. Classification of traffic offences. Penalties and appeals

TEXT BOOKS:

1. Traffic Engineering and Transport Planning, Kadiyali, L.R. Khanna, NDLS, 2017.
2. Highway Engineering. Khanna, S.K. and Justo, C E G., Nem Chand, RR, 2001

REFERENCE BOOKS:

1. Observational Before-After Studies in Road Safety, Hauer, E., Pergamon, Turkey, 1997
2. Traffic Accident Investigation Manual, Stannard Baker. J, The traffic Institute North-western University, IL, US, 2019.
3. Traffic safety and human behaviour, Shinar, D., Emerald, WY, UK, 2017

E-RESOURCES:

- https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_42.pdf
- https://nptel.ac.in/courses/105101008/downloads/cete_42.pdf
- <https://roadsafety.piarc.org/en/road-safety-management>

PROFESSIONAL ELECTIVE-V

18A4201515 -RIVER BASIN MANAGEMENT

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites:												
Course Objectives:												
<ol style="list-style-type: none"> 1. Teach the basic concepts of river basin management 2. Demonstrate the various types flows and catchment process 3. Explain various monitoring systems and regulations in river basin management 4. Teach river basin management techniques 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Summarise the concepts of river basin management.											
C02	Implement the techniques in river basin management.											
C03	Compare methods and tools in river basin management											
C04	Check the river basin to obtain most possible benefits.											
C05	Planning of river basin.											
C06	Management of river basin.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	1	-	-	-	-	-	2	-	-	-	-	-
C02	1	-	-	-	-	-	2	-	-	-	-	-
C03	1	-	-	-	-	-	2	-	-	-	-	-
C04	1	-	-	-	-	-	2	-	-	-	-	-
C05	1	2	-	-	-	-	2	-	-	-	2	-
C06	1	-	-	-	-	-	2	-	-	-	2	-
UNIT I												
Basic Concepts of River Basin Management (RBM)												
Integrated River Basin Management (IRBM) - River Basin Organizations (RBOs) - Types. Theories and Principles of IRBM - Need for RBM & Need for Irrigation- Objectives and Benefits of IRBM - Key Activities and Challenges in IRBM - Various Guiding Principles of IRBM - Scenarios in Developed and Developing Countries.												
LO: 1. Learn basic concepts of river basin management.												
2. Identify key activities and challenges of IRB												
UNIT II												
River Systems:												
Recapitulation of Basic Principles of Hydrology - River Basins and Catchments - Hydrologic, Geomorphological, Physical & Chemical Processes. Stream Corridors, Stream Order Model- Functions of River Systems - Provisioning, Regulating, Cultural and Supporting Services - Low Base Flows - Ecological Stresses to Rivers - Human Interventions and Impacts - Man’s Attitude towards Nature and Development. Engineered River Systems.												
LO: 1. Understand river basin systems.												
Explain functions of river system												
Identify ecological stress on rivers and necessity of engineering river systems												
UNIT III												

Tools and Methods of IRBM:

Monitoring and Water Resources Information System - Monitoring, Acquisition and Processing of Water Resources Data - Statistical Tools - Decision Support Systems. Governance Issues - Water Governance - Its Importance - Fundamental Requirements for Good TBM - Rules, Regulations and Laws - Various Acts Enforced by Government of India for River Basin Management and Development.

LO: 1. Learn tools and methods of river basin management.

UNIT IV**River Basin Planning And Management (Strategies)**

Water Resources Planning and Management of - Need, Various Aspects and Approaches of Planning and Management - Planning Process - Operational Management - Instruments of Operational Management - Water Quality Management - Water Charges and Cost Recovery - Issues related to Water Right and Water Allocation.

LO: 1. Understand river basin planning and strategic management.

TEXT BOOKS:

1. A Handbook for Integrated Water Resources Management in Basins Published by Global Water Partnership and International Network of Basin Organizations (INBO)
2. Modern Water Resources Engineering Edited, Lawrence K. Wang and Chih Ted Yang, Humana Press

REFERENCE BOOKS:

1. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg Khanna Publishers.
2. Applied hydrology, Chow V. T., D. R Maidment and L. W. Mays, Tata McGraw Hill Education Pvt. Ltd, (2011), New Delhi.
3. Water Resources Engineering Wiley India Pvt. Ltd, Mays L.W., (2013).
4. Integrated River Basin Management -
www.universitywaterspectrumpartnership.org.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/106/105106145/>

PROFESSIONAL ELECTIVE-VI
18A4201521-ADVANCED STRUCTURAL DESIGN

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40									
Credits:	3	External Marks:	60									
Prerequisites: Structural Analysis, Reinforced concrete structures												
Course Objectives:												
1. Familiarize Students with Raft Foundations and Retaining walls.												
2. Equip student with concepts of design of different types of RCC water tanks.												
3. Understand Concepts of flat slabs												
4. Familiarize different types of Bunkers, Silos and Chimneys.												
5. Understand different types of transmission towers.												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
C01	Design of raft foundations											
C02	Design different types of RCC retaining walls											
C03	Carryout analysis and design of different types of RCC water tanks											
C04	Analyze and design Flat slabs											
C05	Solve the problems design of RCC Bunkers, Silos											
C06	Explain various types of transmission towers and loading on them.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	3	3	-	-	3	-	3	-	-	-	-
C02	3	3	3	-	-	3	-	3	-	-	-	-
C03	3	3	3	-	-	3	-	3	-	-	-	-
C04	3	3	3	-	-	3	-	3	-	-	-	-
C05	3	3	3	-	-	3	-	3	-	-	-	-
C06	3	3	3	-	-	2	-	3	-	-	-	-
UNIT I												
Analysis and Design of Raft Foundations, Design of RCC Retaining walls: Cantilever and Counter fort												
UNIT II												
Analysis and Design of RCC Water Tanks, Circular and Rectangular types- Intze tank including staging.												
UNIT III												
Analysis and Design of Flat Slabs- Direct Design and Equivalent Frame Methods- Check for Punching shear.												
UNIT IV												
Analysis and Design of Bunkers and Silos- Concepts of Loading. Introduction to Transmission Towers- Principles and procedures												
TEXT BOOKS:												
1. Reinforced Concrete Structures’ Vol-2 by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi												
2. ‘Reinforced Concrete Structures’ by N. Subrahmanian, Oxford Publishers												
3. ‘Design Drawing of Concrete and Steel Structures’ by N. Krishna Raju University Press 2005.												

REFERENCE BOOKS:

1. 'Essentials of Bridge Engineering' by D. Johnson Victor, Oxford and IBM publication Co., Pvt. Ltd.
2. 'Reinforced concrete design' by S. U, Pillai and D. Menon, Tata Mc.Grawhill Publishing Company

E-RESOURCES:

- <https://books.askvenkat.org/advanced-structural-design-asd-textbook-download/>
- <https://lecturenotes.in/subject/179/design-of-advanced-concrete-structures-dacs>

INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in three components as follows:

1. Descriptive (subjective type) examination: 35 marks
2. Assignment: 05 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

PROFESSIONAL ELECTIVE-VI

18A4201522-GEOSYNTHETICS

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

1. To familiarize with geosynthetics.
2. To impart knowledge on designing the geosynthetics material for various functions.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

C01	Explain geosynthetics.
C02	Interpret the test methods of different materials of geosynthetics.
C03	Interpret the test methods of Geotextiles & Geo-grids
C04	Interpret the test methods of Geo-membranes
C05	Explain the manufacturing and materials required
C06	Explain the applications of geosynthetics in construction

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	-	-	-	-	2	-	-	-	-	-	-
C02	3	-	-	-	-	2	-	-	-	-	-	-
C03	3	-	-	-	-	2	-	-	-	-	-	-
C04	3	-	-	-	-	2	2	-	-	-	-	-
C05	3	-	-	-	-	2	-	-	-	-	-	-
C06	3	-	-	-	-	2	-	-	-	-	-	-

UNIT I

Overview of Geosynthetics

Types – geotextiles, geo-grids, geo-nets, geo-membranes, geo-synthetic clay liners and geo-composites – their manufacturing

Geotextiles

Properties and test methods – functions – designing for separation, reinforcement, stabilization, filtration, drainage.

UNIT II

Geo-grids

Properties and test methods – design for geo-grid reinforcement for roads, reinforced wall, foundation, slopes and embankments.

Geo-membranes

Properties and test methods – design considerations of geo-membrane in pond, canal, reservoirs and solid liners

UNIT III

Manufacturing : Materials and Process

Raw materials : polyamide , polyester , polyethylene , polypropylene , poly vinyl chloride, Different type of geosynthetics based on manufacturing woven , monofilament , multifilament , slit filament , non-woven

Different bonding process : Mechanically bonded, Chemically bonded ,Thermally bonded

UNIT IV

Applications of Geosynthetics

Use of geosynthetics in roads , Use of reinforced soil in Retaining walls - Improvement of bearing capacity -Geosynthetics in environmental control and landfills - Ground Improvement by geodrains -Use of Geosynthetics in lining of canals

TEXT BOOKS:

1. Designing with Geosynthetics, Koerner, R.M, Prentice Hall, New Jersey, USA, 4th edition, 1999.
2. An Introduction to Soil Reinforcement & Geosynthetics, G L Siva Kumar Babu, 1st edition, University press

REFERENCE BOOKS:

1. Soil Reinforcement with Geotextiles, Jewell, R.A., Special Publication No. 123, CIRIA, Thomas Telford. London, UK, 1996.
2. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.

E-RESOURCES:

- <https://nptel.ac.in/courses/105/101/105101143/>

PROFESSIONAL ELECTIVE-VI
18A4201523-ENVIRONMENTAL ECONOMICS

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

This course aims to provide a comprehensive introduction to the economic analysis of issues arising from the interactions between the natural environment and the human economy. It underscores the role of entropy laws in this process of interaction. It focusses on the ecosystem-services and discusses comprehensively the challenges arising due to externalities, public-good character and non-tradability of such services. In particular, it highlights the resulting nature of market failure along with issues for social welfare and distributive implications in determining human well-being.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Examine the environmental issues in relation to the theory of externalities
CO2	Examine the environmental issues in relation to the public goods, and welfare
CO3	Illustrate and examine economic principles concerning the choice of instruments for controlling pollution and the relative strength and weaknesses of environmental policies
CO4	Examine various approaches developed for valuing environmental goods and services.
CO5	Examine various methods developed for valuing environmental goods and services.
CO6	Examine issues in the contemporary environmental discourse from an economists' point of view.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	-	-	-	-	2	-	-	-	-	-
CO2	2	2	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	-	-	2	-	-	-	-	-
CO5	2	-	-	-	-	-	2	-	-	-	-	-
CO6	2	-	-	-	-	-	2	-	-	-	-	-

UNIT I

Economy and the natural environment

The human economy – natural environment interaction. Biophysical Foundations of production and consumption of human economy Sources and Sink functions of the ecosystem. Material Balance approach: the concept and conditions of sustainability of the human economy.

Property Rights, Market, Spatial-temporal dimensions of externality.

UNIT II

Theory of Environmental Regulation and Policy

The socially optimal level of pollution and Pareto optimal allocation of resources.
How to ensure the attainment of optimal pollution :

Assignment of Property Rights: Coase Theorem and its limitations

Government interventions - Command and Control: standard setting, Market based instruments: Pigouvian taxes - emission charges, ambient charges, product charges, subsidies, noncompliance fees, Tradable pollution permits.

Uncertainty and choice of regulatory instrument

UNIT III**Sustainable Economic Development**

Capital theoretic basis of the notion of sustainable development: Sustainable Development as non-declining intertemporal utility or that of the value of the wealth. Concepts of Genuine investment or savings and Green National Income. Natural capital stock and sustainable resource accounting. Strong and weak Sustainability, Environmental Adjustment of National Income.

UNIT IV**Economic Development and Environment**

The relation between Development Environmental Quality: Environmental Kuznets Curve Development vs conservation of environmental resources: Ecosystem flips and irreversibility: Krutilla-Fisher equation

Environmental Cost-Benefit Analysis under strong and weak conditions of sustainability: Choice of time discount rate for evaluation. Sustainability premium

TEXT BOOKS:

1. Intermediate Environmental Economics, Charles D Kolstad, 2012, Indian Edition, Oxford University Press, New Delhi
2. Environmental Economics and Management: Theory, Ecott J. Callan and Janet M. Thomas, 2013, Policy and Applications, Cengage Learning, Delhi.

REFERENCE BOOKS:

1. 'The Problem of Social Cost', R H Coase, 1960, The Journal of Law and Economics, III: 1-44
2. 'Economic Growth and the Environment', the Quarterly Journal of Economics, R H Coase, 1960, CX (2): 353-377.
3. 'Environmental Accounting: An Operational Perspective', Peter Bartelmus, Ernst Lutz and Jan Van Tongeren, 2001, in UlanganathanSankar (ed.) Environmental Economics, Oxford University Press, New Delhi.
4. Ecological Limits and Economic Development, RamprasadSengupta, 2013, Oxford University Press, New Delhi

E-RESOURCES:

- <https://ocw.mit.edu/courses/economics/14-42-environmental-policy-and-economics-spring-2011/lecture-notes/>
- http://econdse.org/wp-content/uploads/2016/08/chapter_3.pdf

PROFESSIONAL ELECTIVE-VI
18A4201524-URBAN TRANSPORTATION PLANNING

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites: Highway Engineering, Traffic Engineering

Course Objectives:

1. To learn various procedures for travel demand estimation.
2. To various data collection techniques for OD data.
3. To know various models and techniques for trip generation, trip distribution, mode choice and traffic assignment.
4. To develop alternative urban transport network plans.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

C01	Estimate travel demand for an urban area.
C02	Plan the transportation network for a city.
C03	Explain about collection of data and types of sources of data
C04	Explain trip generation and distribution
C05	Identify the corridor and plan for providing good transportation facilities.
C06	Evaluate various alternative transportation proposals.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
C01	3	-	-	-	-	-	-	-	-	-	-	-
C02	3	2	1	-	-	-	-	-	-	-	-	-
C03	3	-	-	2	-	-	-	-	-	-	-	-
C04	3	-	-	-	-	-	-	-	-	-	-	-
C05	3	-	-	-	-	-	-	-	-	-	-	-
C06	3	2	3	-	-	-	-	-	-	-	-	-

UNIT I

Urban Transportation Problems & Travel Demand:

Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT II

Data Collection And Inventories:

Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT III

Trip Generation & Distribution:

UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution:

Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT IV

Mode Choice Analysis:

Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation

Traffic Assignment:

Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

TEXT BOOKS:

1. 'Introduction to Urban System Planning' by Hutchinson, B.G., McGraw Hill.
2. 'Transportation Engineering – An Introduction' by Khisty C.J., Prentice Hall.
3. 'Fundamentals of Transportation Planning' by Papacostas, Tata McGraw Hill.

REFERENCE BOOKS:

1. 'Urban Transportation Planning: A decision oriented Approach' by Mayer M and Miller E, McGraw Hill.
2. 'Introduction to Transportation Planning' by Bruton M.J., Hutchinson of London.
3. 'Metropolitan Transportation Planning' by Dicky, J.W., Tata McGraw Hill.
4. 'Traffic Engineering and Transportation Planning' by Kadiyali.L.R., Khanna Publishers, New Delhi.

E-RESOURCES:

- <https://lecturenotes.in/subject/1222>
- <https://nptel.ac.in/courses/105/107/105107067/>

PROFESSIONAL ELECTIVE-VI
18A4201525-WATER SHED MANAGEMENT

Lecture – Tutorial:	2-1 Hours	Internal Marks:	40
Credits:	3	External Marks:	60

Prerequisites:

Course Objectives:

1. Introduce the concept of watershed management
2. Understand the watershed characteristics
3. Learn the principles of soil erosion and measures to control erosion
4. Appreciate various water harvesting techniques.
5. Learn land management practices for various land use/land cover.
6. Introduce concepts of watershed modelling.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Determine watershed parameters and analyse watershed characteristics to take appropriate management action.
CO2	Quantify soil erosion and design control measures.
CO3	Apply land grading techniques for proper land management.
CO4	Suggest suitable harvesting techniques for better watershed management.
CO5	Explain appropriate models for watershed management.
CO6	Explain concepts of watershed modelling.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	-	-	-	2	-	-	-	-	-
CO2	3	2	1	-	-	-	2	-	-	-	-	-
CO3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	3	-	-	-	-	-	2	-	-	-	-	-
CO5	3	-	-	-	-	-	2	-	-	-	-	-
CO6	3	-	-	-	-	-	2	-	-	-	-	-

UNIT I

Introduction

Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

Characteristics of Watersheds

Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT II

Principles of Erosion:

Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT III

Water Harvesting:

Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT IV

Land Management:

Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

Watershed Modelling

Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models.

TEXT BOOKS:

1. 'Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2. 'Land and Water Management' by Murthy.VVN, Kalyani Publications, 2007.

REFERENCE BOOKS:

1. 'Water Resource Engineering by Wurbs R A and James R A, Prentice Hall Publishers, 2002.
2. 'Watershed Hydrology' by Black P E, Prentice Hall, 1996.
3. 'Watershed Management' by Murthy J V S, New Age International Publishers, 2006

E-RESOURCES:

- <https://nptel.ac.in/courses/105/101/105101010/>
- <https://www.slideshare.net/GhassanHadi/watershed-1-42316353>

18A4201791-PROJECT-II

Practical	16 Hours	Internal Marks:	40									
Credits:	14	External Marks:	60									
Prerequisites:												
Course Objectives:												
<ul style="list-style-type: none"> ➤ To enable the student apply engineering knowledge that has been taught all through the programme for solving practical engineering problem. ➤ To enable the student capable for problem solving / problem shooting. ➤ To install and inculcate team spirit/ team work in to the minds of the students. ➤ To enable/ train the students report making/ documentation. ➤ To provide students an opportunity to use any civil engineering software for their Project work. 												
Course Outcomes:												
Upon successful completion of the course, the student will be able to:												
CO1	Apply all levels of engineering knowledge in solving the Engineering											
CO2	Use Civil Engineering software at least one.											
CO3	Work together with team spirit											
CO4	Document the project											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	3	3	3	-	-	3	-	3	3
CO2	3	3	3	3	3	3	-	-	3	-	3	3
CO3	3	3	3	3	3	3	-	-	3	-	3	3
CO4	3	3	3	3	3	3	-	-	3	-	3	3
Evaluation of Main Project												
<p>Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.</p>												
<p>Final Project Total marks – 200 Marks Internal Evaluation – 60 marks End Semester Examination (Viva – Voce) – 140 Marks</p>												
Internal Evaluation:												
The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.												
End Semester Examination (Viva – Voce):												
140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of												

project work shall be conducted at the end of the IV year