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SRIVASAVI ENGINEERING COLLEGE (AUTONOMOUS)

(Sponsored by Sri Vasavi Educational Society)

Approved by AICTE, New Delhi and Permanently Affiliated to JNTUK,
Kakinada Pedatadepalli, **TADEPALLIGUDEM-534101**, W.G. Dist, (A.P.)

Department of Civil Engineering

Dtd: 30.06.2020

Minutes of the BOS Meeting

Third BOS Meeting of Civil Engineering Department was held in online mode on 29.6.2020 at 11.30 A.M. Following members have attended the meeting.

SL.No.	Name	Position
1	Dr.G.RadhaKrishnan	Chairman
2	Dr.GVRPrasadaRaju	Member
3	Dr.C.B.Kameswar Rao	Member
4	Dr.M. Kumar	Member
5	Er.DSR Sekhar	Member
6	Mr.T.YeswanthSai	Faculty of CE
7	Mr.VLDPrasad Reddy	Faculty of CE
8	Mr.T.NagaSeshuBabu	Faculty of CE
9	Mr.A.Sudheer	Faculty of CE

Minutes of the BOS Meeting:

- **Item No.1: Chairman, BOS has welcomed all the members and given the Opening Remarks.**
- **Item No.2: Review & approval of the V& VI Sem Course Structure of B. Tech CE of V18 Reg. The Chairman and the members reviewed the course structure of B. Tech CE and suggested modifications in the structure. Approved course structure given in **Annexure- CE-I****

- **Item No.2: Review & approval of the syllabus V & VI Sem Courses of B. Tech CE of V18 Reg.** The Chairman and the members reviewed the syllabus of all courses of V and VI semester B. Tech CE and suggested modifications in the few courses. Approved syllabus given in **Annexure-CE-II**

- **Item No.3: Review & Approval the List of Open Elective Courses offered by Civil Engineering Dept to all other departments.**
List of courses approved by BOS are mentioned below to be offered under Open Elective-I for B.Tech VI semester, under V18 regulation for all other branches.
 - a) Repair and Rehabilitation of Structures (V18 CEOE1)
 - b) Remote Sensing & Geographical Information Systems (V18 CEOE2)Approved syllabus given in **Annexure-CE-III**

- **Item No. 04: Approval for offering Minor degree in DATA SCIENCE offered by Department of Computer Science and Engineering for B.Tech Civil Engineering students under V18 Regulation** BOS Members approved our students to opt for the Minor degree in data science offered by the Department of Computer Science and Engineering with the rules and regulations which will be approved by Academic Council.

Finally, the chairman thanked all the BOS members and faculty. The meeting was ended at 12.30 P.M

Dr.G.RadhaKrishnan
CHAIRMAN, BOS

ANNEXURE-CE-I

COURSE STRUCTURE APPROVED IN 3rd BOS MEETING

V SEMESTER

S.No	CourseCode	CourseTitle	Hours per week			Credits
			L	T	P	C
1	V18CET15	Structural Analysis-I	3	0	0	3
2	V18CET16	Geotechnical Engineering-I	3	0	0	3
3	V18CET17	Hydrology & Water Resources Engineering	3	0	0	3
4	V18CET18	Design of Reinforced Concrete Structures	3	0	0	3
5	V18CET19	Transportation Engineering-I	3	0	0	3
6	V18CET33	RS&GIS	2	0	0	2
7	V18CEL07	Transportation Engineering Lab	0	0	3	1.5
8	V18CEL08	Geotechnical Engineering Lab	0	0	3	1.5
9	V18ENT11	Constitution of India	2	-	-	0
10	V18ENT05	Professional Communication Skills-III	4	0	0	0
Total			23	0	6	20

Total Contact Hours: 29 Total

Credits : 20

Certification Course—Enrolment of Certification Course will be initiated during V Semester

VI SEMESTER

S.No	CourseCode	CourseTitle	Hours per week			Credits
			L	T	P	C
1	V18CET20	Structural Analysis-II	3	0	0	3
2	V18CET21	Geotechnical Engineering-II	3	0	0	3
3	V18CET22	Design of Steel Structures	3	0	0	3
4	V18CET23	Transportation Engineering-II	3	0	0	3
5	V18CET24	Environmental Engineering-I	3	0	0	3
6		Open Elective Course-1	3	0	0	3
7	V18CEL09	Environmental Engineering Lab	0	0	3	1.5
8	V18CEL10	CAD & GIS Lab	0	0	3	1.5
9	V18ENT06	Professional Communication Skills-IV	4	0	0	0
Total			22	0	6	21

Total Contact Hours: 28 Total

Credits : 21

ANNEXURE-CE-II

SYLLABIOFV&VISEMESTEROFB.TECHCOURSES

VSEMESTER-SYLLABUS

Year/Sem	VSem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET15
Name of the Course	STRUCTURAL ANALYSIS – I					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Illustrate Shear Force, Bending Moment and Deflection of Propped Cantilevers for different fixity conditions (K3)
- Calculate Shear Force, Bending Moment and Deflection of fixed beams for different fixity conditions (K3)
- Calculate Shear Force, Bending Moment and Deflections of Continuous beams for different fixity conditions (K3)
- Apply Slope Deflection Equation to Continuous beams (K3)
- Understand the concepts of Energy Theorems (K2)
- Assess Maximum Shear Force, Bending Moment and Deflections at a given section when loads of varying spans are passing over truss (K3)

SYLLABUS

UNIT – I

Propped Cantilevers: Analysis of propped cantilevers-shear force and bending moment diagrams-Deflection of propped cantilevers.

UNIT– II

Fixed Beams: Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams-Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

UNIT – III

Continuous Beams: Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed continuous beams with overhang, continuous beams with different moment of inertia for different spans- Effects of sinking of supports-shear force and bending moment diagrams.

UNIT-IV

Slope-Deflection Method: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

UNIT-V

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem- Deflections of simple beams and pin jointed trusses.

UNIT –VI

Moving Loads And Influence Lines: Introduction, influence line diagrams, influence line diagrams for simply supported beams, cantilever beams, overhanging beams, double overhanging beams, balanced cantilever beams, girder supporting floor beams, use of influence line diagrams, maximum SF and BM values for moving loads, Train of concentrated loads

Text Books:

1. Basic Structural Analysis, C.S.Reddy Tata Mc.Graw-Hill, New Delhi.
2. Analysis of Structures by T.S.Thandavamoorthy, Oxford University Press, New Delhi.
3. Analysis of Structures-Vol.I and II, V.N.Vazirani and M.M.Ratwani, Khanna Publishers, New Delhi.
4. Structural Analysis-Vol.I and II, S.S.Bhavikatti, Vikas Publishing House, New Delhi.

References:

1. Theory of Structures, B.C.Punmia, A.K.Jain & Arun K.Jain, Lakshmi Publications.
2. Theory of Structures, R.S.Khurmi, S.Chand Publishers.
3. Structural Analysis by R.C.Hibbeler, Pearson, New Delhi.
4. Structural Analysis-I, Hemanth Patel, Yogesh Patel, Synergy Knowledgeware, Mumbai
5. Structural Analysis I Analysis of Statically Determinate Structures, P.N.Chandramouli. Yesdee Publishing Pvt Limited, Chennai

Year/Sem	VSem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET16
Name of the Course	GEOTECHNICAL ENGINEERING-I					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Show the inter-relationship of various parameters related to soil mechanics (K1)
- Describe various index properties of soils and classify them (K2)
- Assess the permeability of different soils having different properties (K3)
- Employ different methods to know the stress distribution in soils (K3)
- Interpret different parameters related to consolidation of soil (K3)
- Examine the stress-strain behavior of different soils under various drainage conditions (K3)

SYLLABUS

UNIT I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density, Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

UNIT II

Index Properties of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT III

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy’s law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems. Total, neutral and effective stresses – quick sand condition – 2-D flow and Laplace’s equation - Seepage through soils – Flow nets: Characteristics and Uses.

UNIT IV

Stress Distribution in Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes - Newmark's influence chart - 2:1 stress distribution method.

UNIT V

Consolidation: Compressibility of soils - $e-p$ and $e-\log p$ curves - Stress history - Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation - Time rate of consolidation and degree of consolidation - Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT VI

Shear Strength of Soils: Basic mechanism of shear strength - Mohr - Coulomb Failure theories - Stress-Strain behavior of Sands - Critical Void Ratio - Stress-Strain behavior of clays - Shear Strength determination - various drainage conditions.

TEXTBOOKS:

1. "Basic and Applied Soil Mechanics", Gopal Ranjan and A. S. R. Rao, New Age International Publishers.
2. "Soil Mechanics and Foundation Engineering", V.N.S. Murthy, CBS publishers.
3. "Soil Mechanics and Foundations", B.C. Punmia, Laxmi Publications.

REFERENCE BOOKS:

1. "Fundamentals of Soil Mechanics", D.W. Taylor, Wiley.
2. "An Introduction to Geotechnical Engineering", Holtz and Kovacs; Prentice Hall.
3. "Fundamentals of Geotechnical Engineering", B.M. Das, Cengage Learning, New Delhi.

Year/Sem	VSem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET17
Name of the Course	HYDROLOGY & WATER RESOURCE ENGINEERING					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Identify the physical processes in hydrology and components of the hydrologic cycle. (K2)
- Estimate the different components of the hydrologic cycle. (K2)
- Compute the runoff of a catchment using Hydrographs. (K3)
- Compute the flood frequency, design flood, flood routing. (K3)
- Discuss the concepts of groundwater movement and well hydraulics. (K2)
- Describe the advanced concepts of Runoff modeling. (K2)

SYLLABUS

UNIT I

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT II

Abstractions from Precipitation: Initial abstractions. Evaporation: factors affecting, measurement, reduction Evapotranspiration: factors affecting, measurement, control Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT III

Runoff: Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations,

principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

UNIT IV

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.

UNIT V

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

UNIT VI

Advanced Topics in Hydrology: Rainfall-runoff Modelling, instantaneous unit hydrograph (IUH) – conceptual models – Clark and Nash models, general hydrological models- Chow – Kulandaiswamy model.

TEXTBOOKS:

1. "Engineering Hydrology", Subramanya K., Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2013.
2. "Engineering Hydrology", Jayarami Reddy P., Laxmi Publications Pvt. Ltd., New Delhi, (2013)
3. "Applied hydrology", Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

REFERENCE BOOKS:

1. "Water Resources Engineering", Mays L.W, Wiley India Pvt. Ltd, 2013.
2. "Hydrology", Raghunath H.M., New Age International Publishers, 2010.
3. "Engineering Hydrology- Principles and Practice" Ponce V.M., Prentice Hall International, 1994.
4. "Hydrology and Water Resources Engineering", Patra K.C., Narosa Publications, 2011.
5. "Engineering Hydrology", Ojha C.S., Berndtsson P. and Bhunya P., Oxford University Press,

2010.

Year/Sem	VSem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET18
Name of the Course	DESIGN OF REINFORCED CONCRETE STRUCTURES					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Understand the concepts and methods for elements design (K2)
- Solve the elements of structure like flexural members (K3)
- Illustrate the design concepts of structures subjected to shear, bond and torsion (K3)
- Apply design principles in the design of slabs (K3)
- Choose suitable design principle in the design of columns (K3)
- Apply suitable design procedure in the design of foundations (K3)

SYLLABUS

UNIT I

Introduction of Reinforced concrete: Structural elements- Loads on structures- Strength and serviceability - Methods of design - Working stress method- design constants - neutral axis - moment of resistance for different sections- Design of singly and doubly reinforced beams- Concepts of limit state design - Partial load and safety factors - stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance. Codes of practice.

UNIT II

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T and L) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement- Maximum Flexural Steel- Design of Flanged Sections (T&L)- Effective width of flange – Behavior- Analysis and Design.

UNIT III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions.

Design examples in simply supported and continuous beams, detailing. Limit state design for serviceability: Deflection, cracking and code provision.

UNIT IV

Slabs: Classification of slabs, design of one - way slabs, one way continuous slab using IS Coefficients (Conventional) – Design of two - way slabs - simply supported and various edge conditions using IS Coefficients, Design of Stair Case.

UNIT V

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – IS Code provisions.

UNIT VI

Footings: Different types of footings – Design of isolated footings – pedestal, square, rectangular and circular footings subjected to axial loads, uni-axial and bi-axial bending moments.

NOTE:

All units i.e. from unit I to unit VI are to be taught in Limit State Design.

Following sheets should be prepared by the students.

- Sheets-1 Reinforcement detailing of T-beams, L-beams and continuous beams.
- Sheets-2 Reinforcement detailing of beam with all details.
- Sheets-3 Detailing of one-way, two-way and continuous slabs.
- Sheets-4 Reinforcement detailing of columns.
- Sheets-5 Reinforcement detailing of isolated footings.

EXAMINATION PATTERN:

Internal Examination Pattern:

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

Descriptive (subjective type) examination	: 15 marks
Detailing sheets (For above)	: 10 marks
Assignment	: 05 marks

TEXTBOOKS:

1. "Limit State Design", A.K. Jain
2. "Design of Reinforced Concrete Structures", N. Subrahmanyam.
3. "Reinforced Concrete", Vol. 1., H.J. Shah, Charotar Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. "RCC Design", B. C. Punmia, A. K. Jain and A. K. Jain. Lakshmi Publications
2. "Reinforced Concrete Structures", N. Krishna Raju and R. N. Pranesh, New Age Publications.
3. "Reinforced Concrete Structures", S. Unnikrishna Pillai and Devdas Menon, Tata Mc. Graw Hill, New Delhi.
4. IS 456-2000, Code of Practice for Reinforced Concrete Structures.
5. IS 875, Code of Practice for Design Loads.
6. SP-16, Design Aids for Reinforced Concrete.

Year/Sem	V Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET19
Name of the Course	TRANSPORTATION ENGINEERING-I					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Identify engineering surveys and can decide the alignment (K2)
- Analyze and design highway geometric elements. (K3)
- Analyze and design of traffic infrastructure (K3)
- Analyze and design of flexible, rigid pavements (K3)

- Examine pavement construction activities and also conduct quality control at site (K3)
- Evaluate pavement condition and can identify and suggest remedial measures (K3)

SYLLABUS

UNIT I

Highway Planning and Alignment: Highway development in India; Classification of Roads; Necessity for Highway Planning; Different Road Development Plans

– First, second, third road development plans, road development vision 2021;
Highway Alignment - Factors affecting Alignment - Engineering Surveys.

UNIT II

Highway Geometric Design: Importance of Geometric Design - Design controls and Criteria - Highway Cross Section Elements - Sight Distance Elements - Design of Horizontal Alignment - Design of Transition Curves - Design of Vertical alignment.

UNIT III

Traffic Engineering: Basic Parameters of Traffic - Volume, Speed and Density Traffic Volume Studies; Speed studies – spot speed and speed & delay studies; Parking

Studies; Road Accidents - Causes and Preventive measures - Condition Diagram and Collision

Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Traffic Signals – Webster Method .

UNIT IV

Design of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements: Design factors – Flexible Pavement Design Methods Mechanistic method.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses –

Frictional stresses – Combination of stresses – Design of slabs – IRC method – Rigid pavements **UNIT V**

Highway Construction

Types of Highway Construction, Earthwork, Construction of Embankments, subgrade stabilization, Construction of Bituminous Pavements and Construction of Cement Concrete Pavements

UNIT VI

Highway Maintenance: Pavement Failures, Pavement condition survey, Maintenance of Highways, Pavement evaluation, strengthening of existing pavements

TEXTBOOKS:

1. "Highway Engineering", Khanna S.K., Justo C.E. and Veeraragavan A, Nem Chand Bros., Roorkee.
2. "Traffic Engineering and Transportation Planning", Kadiyali L.R, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. "Principles of Transportation Engineering", Partha Chakraborty and Animesh Das, PHI Learning Private Limited, Delhi.
2. "Principles of Highway Engineering", Kadiyali L.R, Khanna Publishers, New Delhi
3. "Transportation Engineering - An Introduction", Jotin Khisty C, Prentice Hall, Englewood Cliffs, New Jersey.
4. "Transportation Engineering and Planning", Papacostas C.S. and Prevedouros, P.D., Prentice Hall of India Pvt. Ltd; New Delhi.
5. IRC 37-2018: Guidelines for the Design of Flexible Pavements, Indian Road Congress Publications, New Delhi.
6. IRC 58-2015: Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Road Congress Publications, New Delhi.
7. MORTH-Specifications for Road and Bridge works, Indian Road Congress Publication, New Delhi, Latest Edition
8. IRC 67-2012: Code of Practice for Road Signs, Indian Road Congress Publication, New Delhi
9. IRC 35-2015: Code of Practice for Road Markings, Indian Road Congress Publication, New Delhi

Year/Sem	VSem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	2	0	0	2	V18CET33
Name of the Course	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Define the basic principles of Remote Sensing and GIS, including ground, air and satellite based sensor platforms (K1)
- Interpret the aerial photographs and satellite imageries (K2)
- Relate the process of input spatial data entry and its types (K3)
- Examine the Spatial Data for a variety of applications (K3)
- Employ RS and GIS for diverse applications (K3)
- Apply RS and GIS concepts in water resources engineering (K3)

SYLLABUS

UNIT I

Introduction to Remote Sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, Characteristics of remote sensing systems.

Sensors and platforms: Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT, MODIS, ASTER, RISAT and CARTOSAT.

UNIT II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image preprocessing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT III

Geographic Information System: Introduction, key components, application areas of GIS, map projections.

Data entry and preparation: spatial data input, raster data models, vector data models.

UNIT IV

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing and buffer analysis.

UNIT V

RS and GIS Applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications.

UNIT VI

Applications of Hydrology, Water Resources and Disaster Management: Food zoning and mapping, groundwater prospects and potential recharge zones, watershed management and disaster management with case studies.

TEXTBOOKS:

1. "Remote Sensing and GIS", Bhatta, B., Oxford University Press, 2008.
2. "Remote Sensing and Geographical Information Systems", Anji Reddy, M., BSPublications, 2008.
3. "Basic of Remote Sensing and GIS" Kumar. S., Laxmi Publications,

REFERENCE BOOKS:

1. "Fundamentals of Remote Sensing", George Joseph, Universities Press, 2013.
2. "Concepts and Techniques of Geographical Information System", Chor Pang Lo and Yeung, A.K.W., Prentice Hall, India, 2006.
3. "Remote Sensing and its Applications", Narayan L.R.A, Universities Press, 2012.
4. "Introduction to Geographic Information Systems", Kand Tsung Chang, McGraw Hill Higher Education, 2009.
5. "Basic of Remote Sensing & GIS", Kumar, S., Laxmi Publications, New Delhi, 2005.

6. "Principals of Geographical Information Systems", Burrough, P. A. and McDonnell, R. A.
Oxford University Press, 1998.
7. "Remote Sensing", Schowenger, R. A., Elsevier publishers, 2006.
8. "Remote Sensing and Image Interpretation", Lillesand, T. M., Kiefer, R. W. and
Chipman, J. W., Wiley India Pvt. Ltd., New Delhi, 2013.
9. "Fundamentals of Geographic Information Systems", Demers, M. N., Wiley India Pvt. Ltd,
2013.

Year/Sem	VSem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	0	0	3	1.5	V18CEL07
Name of the Course	TRANSPORTATION ENGINEERING LAB					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Assess the suitability of different materials for the road construction (K3)
- Examine the given bitumen samples and judge their suitability for road construction (K3)
- Find the optimum bitumen content for the bituminous mix (K3)
- Develop the gradation of bituminous mix for stability and flow properties (K3)

LIST OF EXPERIMENTS

I. ROAD AGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test.
5. Shape tests

II. BITUMINOUS MATERIALS:

6. Penetration Test.
7. Ductility Test.
8. Softening Point Test.
9. Flash and fire point tests.
10. Viscosity Test.

III. BITUMINOUS MIX:

11. Marshall Stability test.

LIST OF EQUIPMENT

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers.
4. Los Angeles Abrasion test machine
5. Length and elongation gauges
6. Bitumen penetration test setup.

7. Bitumen Ductility test setup.
8. Ring and ball apparatus
9. Flash and Fire Apparatus
10. Viscometer.
11. Marshall Stability apparatus.

REFERENCES:

1. "Highway Material Testing Manual", S.K. Khanna, C.E. G. Justo and A. Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. IRCCodesofPractice
3. Asphalt Institute of American Manuals
4. Code of Practice of B.I.S.

Year/Sem	VSem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	0	0	3	1.5	V18CEL08
Name of the Course	GEOTECHNICAL ENGINEERING LAB					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Employ index properties required for classification of soils (K3)
- Find the permeability of different soils using different tests (K3)
- Predict the compaction, consolidation and swelling characteristics of the soils (K3)
- Compute the strength properties of soils (K3)

LIST OF EXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density - Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Hydrometer Analysis Test
6. Permeability of soil - Constant and Variable head tests
7. Compaction test
8. Consolidation test (to be demonstrated)
9. Direct Shear test
10. Triaxial Compression test (UU Test)
11. Unconfined Compression test
12. Vane Shear test
13. Differential free swell (DFS)
14. CBR Test

LIST OF EQUIPMENTS

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for

- a) Core cutter method
- b) Sand replacement method
4. Set of sieves: 4.75 mm, 2 mm, 1 mm, 0.6 mm, 0.42 mm, 0.3 mm, 0.15 mm, and 0.075 mm.
5. Hydrometer
6. Permeability apparatus for
 - a) Constant head test
 - b) Variable head test
7. Universal auto compactor for light and heavy compaction tests.
8. Shaking table, funnel for sand draining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolidation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm diameter specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature 500-1500°C)

REFERENCES

1. Determination of Soil Properties, J.E. Bowles.
2. IS: 2720—Relevant Parts of Bureau of Indian Standards, New Delhi.

VI SEMESTER – SYLLABUS

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET20
Name of the Course	STRUCTURAL ANALYSIS – II					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Illustrate the concepts of Arches (K3)
- Solve the structure for lateral loads using approximate methods (K3)
- Illustrate the concepts of Cables and Suspension bridges (K3)
- Employ Moment distribution method for analyzing beams/frames (K3)
- Employ Kani's method for analyzing beams/frames (K3)
- Compute the moments/forces using matrix methods (K3)

SYLLABUS

UNIT I

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question).

UNIT-II

Lateral Load Analysis Using Approximate Methods: application to building frames.

(i) Portal Method (ii) Cantilever Method.

UNIT – III

Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT– IV

Moment Distribution Method: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports – Portal frames – including Sway-Substitute frame analysis by two cycle.

UNIT–V

Kani's Method: Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway.

UNIT –VI

Introduction to Matrix Methods: Flexibility methods: Introduction, application to continuous beams (maximum of two unknowns) including support settlements. Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

Text Books:

Structural Analysis, T.S. Thandavamoorthy, Oxford University Press, India.

1. Structural Analysis, R.C. Hibbeler, Pearson Education, India
2. Theory of Structures – II, B.C. Punmia, Jain & Jain, Laxmi Publications, India.
3. Structural Analysis, C.S. Reddy, Tata Mc-Grawhill, New Delhi.
4. Structural Analysis - Vol. I and II, S.S. Bhavikatti, Vikas Publishing House, New Delhi.

References:

1. Intermediate Structural Analysis, C.K. Wang, Tata McGraw Hill, India
2. Theory of structures, Ramamuratham, Dhanpatrai Publications.
3. Analysis of structures, Vazrani & Ratwani – Khanna Publications.
4. Comprehensive Structural Analysis - Vol. I & 2, R. Vaidyanathan & P. Perumal - Laxmi Publications Pvt. Ltd., New Delhi
5. Structural Analysis I, P.N. Chandramouli. Yesdee Publishing Pvt Limited
6. Structural Analysis, Aslam Kassimali, Cengage Learning
7. Matrix Methods of Structural Analysis, P.N. Godbole, R.S. Sonaparote, PHI Learning Pvt Limited

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET21
Name of the Course	GEOTECHNICAL ENGINEERING-II					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Use the field test data and arrive at the bearing capacity (K3)
- Examine the stability of slope and find earth pressures in layered soils (K3)
- Determine the bearing capacity of shallow foundations using analytical methods (K3)
- Compute the magnitude of foundation settlement and decide on the size of the foundation accordingly (K3)
- Apply the principles of bearing capacity of piles and design them accordingly (K3)
- Demonstration of the well foundations and their construction (K3)

SYLLABUS

UNIT I

Soil Exploration: Need, Methods of soil exploration – Boring and Sampling methods, Field tests, Penetration Tests, Pressure meter, planning of programme and preparation of soil investigation report.

UNIT II

Slope Stability: Infinite and finite earth slopes in sand and clay, types of failures, factor of safety of infinite slopes, stability analysis by Swedish arc method, standard method of slices, Taylor's Stability Number, Stability of slopes of dams and embankments – different conditions.

Earth-Pressure theories: Rankine's & Coulomb's theory of earth pressure, Culmann's graphical method, earth pressures in layered soils.

UNIT III

Shallow Foundations – Bearing Capacity Criteria: Types of foundations and factors to be considered in their location, Bearing capacity – criteria for determination of bearing capacity – factors influencing bearing capacity, analytical methods to determine bearing capacity – Terzaghi's theory, IS Methods.

UNIT IV

Shallow Foundations – Settlement Criteria: Safe bearing pressure based on N- value, allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

UNIT V

Pile Foundation: Types of piles, Load carrying capacity of piles based on static pile formulae , Dynamic pile formulae, Pile load tests , Load carrying capacity of pile groups in sands and clays.

UNIT VI

Well Foundations: Types, Different shapes of well, Components of well – functions, forces acting on well foundations, Design Criteria – Determination of staining thickness and plug - construction and Sinking of wells, Tilt and shift.

TEXTBOOKS:

1. Principles of Foundation Engineering, Das, B.M., (2011), 6th edition Cengage Learning.
2. Basic and Applied Soil Mechanics, Gopal Ranjan & A.S.R. Rao, New Age International Pvt. Ltd, (2004).
3. Soil Mechanics and Foundations, B.C. Punmia, Laxmi Publications.

REFERENCE BOOKS:

1. Foundation Analysis and Design, Bowles, J.E., McGraw-Hill Publishing Company, New York.
2. Theory and Practice of Foundation Design, N.N. SOM & S.C. DASPHI Learning Private Limited.

Year/Sem	VI Sem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET22
Name of the Course	DESIGN OF STEEL STRUCTURES					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Estimate the strength of the riveted and welded joints (K3)
- Select suitable flexural member by using concept of design (K3)
- Understand the design concept of tension and compression members in roof trusses (K3)
- Apply design principles in the design of columns and built up columns (K3)
- Choose suitable design principle in the design of column bases (K3)
- Apply suitable design procedure in the design of plate and gantry girder (K3)

SYLLABUS

UNIT I

Connections: Introduction - Properties of structural steel - IS Rolled sections - I.S Specifications - Lap and Butt connections (Riveted and Bolted connections) - Eccentric connections.

Welded connections: Introduction - Advantages and disadvantages of welding - Strength of welds - Butt and fillet welds - Permissible stresses - IS Code requirements - Design of Butt and fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT II

Beams: Allowable stresses - Design requirements as per IS Code - Design of simple and compound beams - Curtailment of flange plates - Beam to beam connection - check for deflection, shear, buckling, and bearing - Design of laterally unsupported beams.

UNIT III

Tension Members: Introduction to different modes of failures - gross section yielding - Net Section rupture and block shear failure - Determine the design strength due to yielding of gross section - rupture of critical section and block shear - Design of tension members.

Compression Members: Effective length of columns - Slenderness ratio - permissible stresses - Design of compression members, Design of Struts.

Roof Trusses: Different types of trusses – Design loads – Load combinations as per IS Code recommendations, structural details – Design of simpler roof trusses involving the design of purlins, members and joints.

UNIT IV

Built up compression members – Design of lacings and battens. Design Splicing of columns.

UNIT V

Design of Column Foundations: Introduction - Design of slab base - Design of gusset base - Column bases subjected to moment.

UNIT VI

Design of Plate Girder: Introduction - Design consideration - IS Code recommendations - Design of plate girder - Welded - curtailment of flange plates and stiffeners - splicing and connections.

Design of Gantry Girder: Introduction - Impact factors - longitudinal forces - Design of Gantry girders.

NOTE:

All units i.e. from unit II to unit - VI to be taught in Limit State method only. Welding

Connections should be used from Unit II – Unit V.

The students should prepare the following sheets.

Sheets-1 Detailing of steel members Connection.

Sheets-2 Detailing of beams including curtailment of flange plates.

Sheets-3 Detailing of Column including lacing and battens.

Sheets-4 Detailing of Column bases, slab base and gusseted base.

Sheets-5 Detailing of Plate girder including curtailment, splicing and stiffeners.

EXAMINATION PATTERN:

Internal Examination Pattern:

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

Descriptive (subjective type) examination	:15marks
Detailingsheets(Forabove)	:10marks
Assignment	:05marks

TEXT BOOKS:

1. Design of steel structures, S.K. Duggal, Tata McGraw Hill, and New Delhi.
2. Design of steel structures, S.S. Bavakatti, I.K. International Publishing House Pvt. Ltd.
3. Steel Structures Design and Practice, N. Subramanian, Oxford University Press.
4. Design of Steel Structures, Ramachandra, Scientific Publishers Journals Dept.

REFERENCE BOOKS:

1. Structural Design in Steel, Sarwar Alam Raz, New Age International Publishers, New Delhi.
2. Design of Steel Structures, P. Dayaratnam, S. Chand Publishers.
3. Design of Steel Structures, M. Raghupathi, Tata Mc. Graw-Hill.
4. Structural Design and Drawing, N. Krishna Raju, University Press.
5. IS:800-2007, General construction in steel-Code of practice.
6. IS:875-1987, Code of Practice for Design Loads.
7. Steel Tables

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET23
Name of the Course	TRANSPORTATION ENGINEERING – II					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Understand the Historical development of Railways in India (K2)
- Analyze and Design the Railway Track Geometric Elements (K3)
- Apply turnouts and controllers on Railway Track (K3)
- Analyze and design geometric elements of Airport Runway and Taxiway (K3)
- Analyze design of flexible and Rigid Highway pavements (K3)
- Classify the various components of Dock & Harbors (K2)

SYLLABUS

UNIT I

Components of Railway Engineering: Historical development of railways in India – Advantages of Railways – Classification of Indian Railways – Permanent way – Components and their functions – Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings.

UNIT II

Geometric Design of Railway Track: Track Geometric design – Points & Crossings – Track drainage – Layout of Railway stations and yards – Signals – Interlocking – Track circuiting – Track Maintenance.

UNIT III

Turnouts & Controllers: Track layouts – Switches – Crossings – Turnouts – Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems – Mechanical signaling system – Electrical signaling system.

UNIT IV

Airport Planning: Airport Masterplan – Airport site selection – Aircraft characteristics – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway – Terminal area.

UNIT V

Runway Design Methods: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures

UNIT – VI

Docks & Harbors: Layout of Port components – Functions – Classification of Ports – Site selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational aids.

TEXTBOOKS:

1. Railway Engineering, Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi.
2. Airport Engineering, Khanna & Arora, Nemchand Bros, New Delhi.
3. Docks and Harbor Engineering, Bindra S.P., Dhanpathi Rai & Sons, New Delhi.

REFERENCE BOOKS:

1. Railway Engineering, Saxena & Arora, Dhanpat Rai, New Delhi.

2. Airport Engineering, Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
3. Airport Engineering Planning & Design, Subhash C. Saxena, CB Publishers, New Delhi.
4. Transportation Engineering Planning Design, Wright P. H. & Ashfort N. J., John Wiley & Sons.
5. Transportation Engineering Volume II, Venkatramaiah, C., Universities Press, Hyderabad.
6. Transportation Engineering, Railways, Airports, Docks & Harbors, Srinivasa Kumar R, University Press, Hyderabad.
7. Highway, Railway, Airport and Harbor Engineering, Subramanian K. P, Scitech Publications (India) Pvt. Limited, Chennai.

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CET24
Name of the Course	ENVIRONMENTAL ENGINEERING-I					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Describe the importance of protected water supply (K1)
- Identify the water source and select proper intake structure (K2)
- Examine the Characteristics of water (K3)
- apply a suitable process to treat raw water collected from source (K3)
- Select a suitable disinfection method to treat water from primary treatment units (K3)
- Demonstrate various appurtenances used in the water supply (K3)

UNIT I

Protected Water Supply systems: Importance and Necessity, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer, Agency activities. Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variations- factors affecting water demand, Design Period, Factors affecting the Design period, Population Forecasting

UNIT II

Sources of Water: Lakes, Rivers, Impounding Reservoirs, comparison of sources with reference to quality, quantity and other considerations- Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries. Collection and Conveyance of Water: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits.

UNIT III

Quality and Analysis of Water: Characteristics of water—Physical, Chemical and Biological- Analysis of Water – Physical, Chemical and Biological characteristics. Comparison of sources with reference to quality-I.S. Drinking water quality standards and WHO guidelines for drinking water

UNIT IV

Primary Treatment of Water: Flowchart of water treatment plant, Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration.

UNIT V

Secondary Treatment (Disinfection): Theory of disinfection—Chlorination and other Disinfection methods, Softening of Water, Removal of color and odours - Iron and Manganese removal – Adsorption-fluoridation and defluoridation—aeration— Reverse Osmosis-Iron exchange—Ultra filtration.

UNIT VI

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods -Components of Distribution system: valves such as sluice valves, air valves, scour valves and check valves, hydrants, water meters and Pipes –Laying and testing of pipe lines- selection of pipe materials, pipe joints.

TEXTBOOKS:

1. Elements of Environmental Engineering by K.N. Duggal, S. Chand Company Ltd., New Delhi, 2012.
2. Water Supply Engineering by Dr. P.N. Modi, Standard Book House, 4th edition (2015)
3. Water Supply Engineering by B.C. Punmia, Laxmi Publications, volume-1
4. Water Supply and Sanitary Engineering by S.C. Rangwala, Charotar Publishing House, 29th edition (2016)

REFERENCE BOOKS:

1. Water supply engineering by S.K. Garg, Khanna Publishers, 33rd edition (2010)
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe (2017) Mc-Graw-Hill Book Company, New Delhi, 1985.
3. IS 10500:2012, Drinking Water Specification.
4. IS: 3052 (Part-08), Methods of Sampling and Test (Physical and Chemical) for Water and Waste Water.

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	0	0	3	1.5	V18CEL09
Name of the Course	ENVIRONMENTAL ENGINEERING LAB					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Find some important characteristics of water and wastewater in the laboratory (K3)
- Prepare some conclusion and decide whether the water is potable or not (K3)
- Examine whether the water body is polluted or not with reference to the state parameters in the list of experiments (K3)
- Find the strength of these sewage in terms of BOD and COD (K3)

LIST OF EXPERIMENTS

1. Sampling of water for testing (Demonstration)

2. Determination of alkalinity or acidity
3. Determination of chlorides in water and soil
4. Determination and estimation of total solids, organic and inorganic solids, settleable solids
5. Determination of Iron
6. Determination of pH and Electrical Conductivity of water and soil
7. Determination of Optimum coagulant dose
8. Determination of Chlorine demand
9. Determination and estimation of total hardness – calcium and magnesium
10. Determination of N, P, K values in solid waste
11. Physical parameters – Temperature, colour, odour, turbidity, taste.
12. Presumptive Coliform test
13. Determination of Dissolved Oxygen and BOD
14. Determination of COD

LIST OF EQUIPMENTS

1. pH Meter
2. Turbidity Meter
3. Conductivity Meter
4. Hot Air Oven
5. Muffle Furnace
6. Dissolved Oxygen Meter
7. UV-Visible Spectrophotometer
8. COD Reflux Apparatus
9. Jar Test Apparatus
10. BOD Incubator
11. Autoclave
12. Hazens Apparatus

13. Imhoff Cone

REFERENCES

1. "Standard methods for analysis of water and wastewater", APHA.
2. "Chemical analysis of water and soil", Murali Krishna, KVSG., Reempublications, New Delhi.

Year/Sem	VI Sem	L	T	P	C	COURSE CODE
Regulation/Year	V18/2020-2021	0	0	3	1.5	V18CEL10
Name of the Course	CAD & GIS LAB					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Employ structural analysis software to analyze and design 2D and 3D frames (K3)
- Prepare design and analyze retaining wall and simple towers using CADD software (K3)
- Demonstrate to digitize and create thematic map and extract important features (K3)
- Develop digital elevation models using GIS software (K3)

COMPUTER AIDED DESIGN AND DRAWING SOFTWARE:

- STAADPRO

- STRAAP
- STUDDS

LIST OF EXPERIMENTS

- 2-D Frame Analysis and Design
- Steel Tabular Truss Analysis and Design
- 3-D Frame Analysis and Design
- Retaining Wall Analysis and Design
- Simple Tower Analysis and Design.

GEOGRAPHICAL INFORMATION SYSTEM SOFTWARE:

- ArcGIS 9.0
- ERDAS 8.7
- Mapinfo 6.5

LIST OF EXPERIMENTS

- Digitization of Map/Toposheet
- Creation of thematic maps.
- Estimation of features and interpretation
- Estimation of features and interpretation
- Simple applications of GIS in water Resources Engineering & Transportation Engineering.

REFERENCES

1. Concept and Techniques of GIS' by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers.

ANNEXURE-CE-III

**COURSES OFFERED UNDER OPEN ELECTIVE – IN VISEMESTER TO ALL OTHER
BRANCHES**

Sl.No.	Course Code	Name of the Course
1	V18CEOE1	Repair and Rehabilitation of Structures
2	V18CEOE2	Remote Sensing and GIS

Year/Sem	VI Sem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CETOE1
Name of the Course	REPAIR AND REHABILITATION OF STRUCTURES					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Describe the deterioration of concrete in structures (K1)
- Estimate the degree of deterioration using Non Destructive Test methods (K2)
- Assess the failures and causes of failures in structures (K3)
- Related different materials used for repair and rehabilitation of structures (K3)
- Employ and suggest suitable retrofitting techniques (K3)
- Organize the case studies and report the condition of structures (K3)

UNIT I

Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting.

Chemical processes of deterioration like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack, Acid attack, temperature and their causes, Mechanism, Effect, preventive measures.

Cracks: Cracks in concrete, types, pattern, quantification, measurement and preventive measures.

UNIT II

Non Destructive Testing: Non destructive test methods for concrete like Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance and Pull out tests. Methods for corrosion measurement and assessment, including half-cell potential and resistivity, mapping of data.

UNIT III

Failure of buildings: Definition of building failure, types of failures, Causes of Failures, Faulty Design, Accidental over Loading, Poor quality of material, Poor Construction practices and Fire damage. Investigation of failures, diagnostic testing methods and equipments required. Repair of cracks in concrete.

UNIT IV

Materials for repair and rehabilitation: Admixtures, types of admixtures, purposes of using admixtures, chemical composition, Natural admixtures, Fibres, wraps, Glass and Carbon fibre wraps, Steel Plates. Concrete behavior under corrosion, disintegrated mechanisms, moisture effects and thermal effects. Visual investigation, Acoustical emission methods, Corrosion activity measurement, chloride content, Depth of carbonation, Impact echo methods, Ultrasound pulse velocity methods, Pull out tests.

UNIT V

Repair Techniques: Grouting, Jacketing, Shotcreting, Externally bonded plates, Nailing, Underpinning and under water repair. Materials, Equipments, Precautions and Processes.

UNIT VI

Investigation of structures: Distress, observation and preliminary test methods. Case studies related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.

TEXT BOOKS:

1. "Maintenance & Repair of Civil Structures", Gupta, B.I., and Amit Gupta, Standard Publishers and Distributors, 2015.
2. "Rehabilitation of Concrete Structures", Vidivelli, B., Standard Publishers and Distributors, 2007.
3. "Concrete Bridge Practice, Construction, Maintenance & Rehabilitation", Raina, V.K., Shroff Publishers and Distributors, 2010.

REFERENCES:

1. "Concrete Structures - protection, Repair and Rehabilitation", Doodge, R. Woodson., BH Publishers.
2. "Concrete technology", Neville, A. and Brooks, J.J. Prentice Hall, 2010.
3. "Special Structural concrete", Rafat Siddique, Galgotia Publications, 2000.
4. "Concrete repair and maintenance illustrated", Peter H. Emmons, R.S. Means Publishers, 1993.
5. "Concrete technology", Shetty, M.S., S. Chand publishers, 1982.
6. "Repair and protection of concrete structures", Noel P. Mailvaganam, CRC press, London, 1992.

Year/Sem	VSem	L	T	P	C	COURSECODE
Regulation/Year	V18/2020-2021	3	0	0	3	V18CEOE2
Name of the Course	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion of this course the student will be able to

- Define the basic principles of Remote Sensing and GIS, including ground, air and satellite based sensor platforms (K1)
- Interpret the aerial photographs and satellite imageries (K2)
- Relate the process of input spatial data entry and its types (K3)
- Examine the Spatial Data for a variety of applications (K3)
- Employ RS and GIS for diverse applications (K3)
- Apply RS and GIS concepts in water resources engineering (K3)

SYLLABUS

UNIT I

Introduction to Remote Sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, Characteristics of remote sensing systems.

Sensors and platforms: Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT, MODIS, ASTER, RISAT and CARTOSAT.

UNIT II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image preprocessing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT III

Geographic Information System: Introduction, key components, application areas of GIS, map projections.

Data entry and preparation: spatial data input, raster data models, vector data models.

UNIT IV

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing and buffer analysis.

UNIT V

RS and GIS Applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications.

UNIT VI

Applications of Hydrology, Water Resources and Disaster Management: Food zoning and mapping, groundwater prospects and potential recharge zones, watershed management and disaster management with case studies.

TEXTBOOKS:

1. "RemotesensingandGIS", Bhatta, B., Oxford University Press, 2008.
2. "RemoteSensingandGeographicalInformationSystems", Anji Reddy, M., BS Publications, 2008.
3. "BasicsofRemoteSensingandGIS" Kumar, S., Laxmi Publications,

REFERENCE BOOKS:

1. "Fundamentals of Remote Sensing", George Joseph, Universities Press, 2013.
2. "Concepts and Techniques of Geographical Information System", Chor Pang Lo and Yeung, A.K.W., Prentice Hall, India, 2006.
3. "Remote Sensing and its Applications", Narayan L.R.A, Universities Press, 2012.
4. "Introduction to Geographic Information Systems", Kand Tsung Chang, McGraw Hill Higher Education, 2009.
5. "BasicsofRemotesensing&GIS", Kumar, S., Laxmi Publications, New Delhi, 2005.
6. "Principals of Geographical Information Systems", Burrough, P.A and McDonnell, R.A. Oxford University Press, 1998.
7. "Remote Sensing", Schowenger, R.A., Elsevier publishers, 2006.

8. "Remote Sensing and Image Interpretation", Lillesand, T.M, Kiefer, R.W. and Chipman, J.W., Wiley India Pvt. Ltd., New Delhi, 2013.

9. "Fundamentals of Geographic Information Systems", Demers, M.N, Wiley India Pvt. Ltd, 2013.

