Annexure-III Back

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SRI VASAVI ENGINEERING COLLEGE (AUTONOMOUS)
(Sponsored by Sri Vasavi Educational Society)
Approved by AICTE, New Delhi and Permanently Affiliated to JNTUK, Kakinada
Pedatadepalli, **TADEPALLIGUDEM – 534 101,** W.G. Dist, (A.P.)
Department of Civil Engineering

Dt: 30.08.2021

Minutes of the BOS Meeting

Fourth BOS Meeting of Civil Engineering Department is held in online mode on 28.08.2021 at 10:30 AM with the following members were present.

Sl.No	Name	Position
1	Dr.G.Radhakrishnan	Chairperson
2	Dr.G.V.R.Prasada Raju	Member
3	Dr.C.B.Kameswara Rao	Member
4	Dr.M.Kumar	Member
5	Mr.T.Raj kumar	Member
6	Mr.T Naga Seshu Babu	Faculty of CE
7	Mr.A Sudheer	Faculty of CE
8	Mr.B Hema Sundar	Faculty of CE
9	Mr.J Pavan Kumar	Faculty of CE

Minutes of the BOS Meeting:

The following points have been suggested/discussed by the committee in BOS meeting and the same has been approved.

1. The proposed course structure and syllabus of VII & VIII semesters V18 Regulation is approved given in **Annexure - CE - I**
2. The list of courses mentioned below have to be offer under open elective in VII & VIII semesters of B.Tech under V18 Regulation for other branches

Open Elective - II	VII Sem	1. Environmental Pollution and Control 2. Disaster Management
Open Elective - III	VIII Sem	1. Solid Waste Management 2. Water Quality and Conservation

The detailed syllabus of above courses is given in the **Annexure - CE - II**

3. The proposed course structure and syllabus of III & IV semesters V20 Regulation is approved is given in **Annexure - CE - III**

4. The comment made by Dr.C.B.Kameswara Rao in the course structure of III & IV semester under Skill Oriented Course which includes Parent Institution in addition to Industries/Professional bodies/APSSDC and other accredited bodies.

5. Approval of course structure and syllabus for I to IV semester of M.Tech CIVIL (Structural Engineering) under V 21 regulations.

The approved course structure and syllabus is given in **Annexure - CE - IV**

6. Approval of syllabus for Audit Course (Diaster Management V21STEAC1) offered in I& II semester M.Tech .

The approved course structure and syllabus is given in **Annexure - CE - V**

7. Few comments made by Dr.C.B.Kameswara Rao in the course structure and syllabus of I to IV semesters of V21 Regulation M.Tech Structural Engineering were acknowledged, approved and suitable modification have to be made.

8. Comments

a) Advanced Reinforced Concrete Design course in I semester is elective it could be made mandatory.

b) The course **Theory of Plates and Shells** & **Stability of Structures** could be interchanged from Elective to mandatory.

c) Computer Aided Design Laboratory & **Structural Design Laboratory** courses are similar and both could be joined as one laboratory only.

Modifications have to be made by making **Advanced Reinforced Concrete Design** as mandatory in II semester. New course **Structural Optimization** is included in I Semester II Elective.

Theory of Plates and Shells have to be made elective and **Stability of Structures** have to be made as mandatory course. **Computer Aided Design Laboratory & Structural Design Laboratory** have to be joined as one Laboratory only.

CHAIRPERSON OF BOS

ANNEXURE – CE- I

COURSE STRUCTURE APPROVED IN PREVIOURS BOS MEETINGS

(For 2018 - 2019 Admitted Batch) - V18 Regulation

I SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V18ENT01	English – I	2	-	-	MNC
2	V18MAT01	Engineering Mathematics – I	3	1	-	4
3	V18CHT01	Engineering Chemistry	3	1	-	4
4	V18CST01	Programming in C for problem solving	3	-	-	3
5	V18MET01	Engineering Graphics	1	-	3	2.5
6	V18ENL01	English Communication Skills Lab – I	-	-	2	MNC
7	V18CSL01	Programming lab in C for problem solving	-	-	3	1.5
8	V18CHL01	Engineering Chemistry Lab	-	-	3	1.5
Total			12	2	11	16.5

Total Contact Hours : 25

Total Credits : 16.5

II SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V18ENT02	English – II	2	-	-	2
2	V18MAT02	Engineering Mathematics – II	3	1	-	4
3	V18PHT01	Optics and Waves	3	1	-	4
4	VI8MET03	Engineering Mechanics	3	1	-	4
5	V18ENL02	English Communication Skills Lab – II	-	-	2	1
6	V18CEL01	Computer aided Civil Engineering Drawing Lab	-	-	3	1.5
7	V18PHL01	Optics and Waves Lab	-	-	3	1.5
8	VI8MELO1	Engineering and IT Workshop	-	-	3	1.5
Total			11	3	11	19.5

Total Contact Hours: 25

Total Credits: 19.5

III **SEMESTER**

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET04	Strength of Materials-I	3	1	0	4
2	V18CET36	Building Materials Planning & Construction	3	1	0	4
3	V18CET10	Introduction to Fluid Mechanics	3	1	0	4
4	V18CET35	Principles of Environmental Science & Engineering	2	0	0	2
5	V18MAT04	Probability & Statistics	3	1	0	4
6	VI8EET01	Basic Electrical and Electronics Engineering	3	1	0	4
7	V18CEL02	Material Testing Lab	0	0	3	1.5
8	VI8EEL01	Basic Electrical and Electronics Engineering Lab	0	0	2	1
9	V18ENT03	Professional Communication Skills -I	3	0	0	0
Total			20	3	6	24.5

Total Contact Hours: 29

Total Credits: 24.5

IV **SEMESTER**

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET13	Strength of Materials-II	3	0	0	3
2	V18CET08	Engineering Geology	2	0	0	2
3	V18CET09	Concrete Technology	3	1	0	4
4	V18CET14	Hydraulic Engineering	3	1	0	4
5	V18CET11	Surveying and Geomatics	2	1	0	3

6	V18MBT51	Managerial Economics & Financial Analysis	3	0	0	3
7	V18CEL03	Concrete Technology Lab	0	0	3	1.5
8	V18CEL04	Surveying Lab	0	0	3	1.5
9	V18CEL05	Fluid Mechanics And Hydraulic Machinery Lab	0	0	3	1.5
10	V18CEL06	Engineering Geology Lab	0	0	2	1
11	V18ENT04	Professional Communication Skills -II	3	0	0	0
Total			17	4	11	24.5

Total Contact Hours: 32

Total Credits: 24.5

V SEMESTER

S.No	Course Code	Course Title	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	Remote Sensing And Geographical Information System	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

VI SEMESTER

S.No	Course Code	Course Title	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 I	3	0	0	3
7	V18CEL09	Environmental Engineering Lab	0	0	3	1.5
	V18CEL10	CAD & GIS Lab	0	0	3	1.5
8	V18ENT06	Professional Communication Skills – IV	4	0	0	0
Total			22	0	6	21

Total Contact Hours: 28

Total Credits: 21

VII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET26	Elective-II	3	0	0	3
2	V18CET27	Elective-III	3	0	0	3
3	V18CET28	Open Elective-II Suggested (Metro Systems & Engineering) See Annexure-I	3	0	0	3
4	V18CEL10	Project work part - A (Project work, seminar and internship in industry or at appropriate work place)	0	0	12	6
Total			9	0	12	15

Total Contact Hours: 21

VIII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET29	Elective-IV	3	0	0	3
2	V18CET30	Elective-V	2	0	0	2
3	V18CET31	Prestressed Concrete	3	0	0	3
4	V18CET32	Applications of Remote Sensing and GIS in Civil Engineering	2	0	0	2
5	V18CEL11	Project work part - B (Continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place	0	0	13	6.5
Total			10	0	13	16.5

Total Contact Hours: 23

Total Credits - 160

COURSE STRUCTURE PROPOSED FOR APPROVAL IN 4th BOS MEETING

VII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET25	Estimation, Specification and Contracts	3	0	0	3
2	V18CET26	Environmental Engineering - II	3	0	0	3
3	V18CET27 V18CET28 V18CET29 V18CET30 V18CET31	Professional Elective Course – 1 1. Pavement Analysis and Design 2. Air Pollution and Control 3. Irrigation Engineering 4. Bridge Engineering 5. Advanced Foundation Engineering	3	0	0	3
3	V18CET32 V18CET34 V18CET37 V18CET38 V18CET39	Professional Elective Course – 2 1. Traffic Engineering & Management 2. Construction Project Planning & Systems 3. Solid Waste Management 4. Ground Water Development 5. Earthquake Engineering	3	0	0	3
4		Open Elective Course – 2	3	0	0	3
6	V18CEPWA	Project Work Part - A	0	0	6	3
Total			15	0	6	18

Total Contact Hours: 21

Total Credits: 18

VIII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	V18CET40 V18CET41 V18CET42 V18CET43 V18CET44	Professional Elective Course – 3 1. Highway Construction and Management 2. Repair and Rehabilitation of Structures 3. Rural Water Supply and onsite sanitation Systems. 4. Pre stressed Concrete 5. Engineering with Geo-synthetics	3	0	0	3
2	V18CET45 V18CET46 V18CET47 V18CET48 V18CET49	Professional Elective Course – 4 1. Urban Hydrology and Hydraulics 2. Environmental Impact Assessment and Management 3. Advanced Concrete Technology 4. Finite Element Methods 5. Ground Improvement Techniques	3	0	0	3
3		Open Elective Course – 3	3	0	0	3
4	V18CEPWB	Project Work Part - B	0	0	14	7
Total			9	0	14	16

Total Contact Hours: 23

Total Credits: 16

SYLLABI OF VII & VIII SEMESTER OF B.TECH COURSES FOR THE

ACADEMIC YEAR 2021-2022

VII SEMESTER – SYLLABUS

Year/Sem	VII Sem	L	T	P	C	COURSE CODE
Regulation	V18	3	0	0	3	V18CET25
Name of the Course	**ESTIMATION, SPECIFICATION & CONTRACTS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Explain to student for understanding different construction works and can estimate approximate cost required for a building (K2)
- Develop the student to a position for finding the cost of various building components (K3)
- Illustrate the calculation of quantities for earthwork of roads and canals to students (K3)
- Discuss to students about contracts and their types ,value a property(K2)
- Describe the students in calculating the approximate costs of building using various techniques(K2)
- Demonstrate the students in determining the quantities of different components of buildings(K3)

SYLLABUS

UNIT I

Introduction: General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates.

UNIT II

Rate Analysis: Working out data for various items of work over head and contigent charges.

UNIT III

Earthwork: Introduction to earthwork, Lead and lift, Earthwork volume calculation by mid-sectional area method, Mean sectional area method, Trapezoidal rule, Prismoidal rule estimation of quantities for canals

UNIT IV

Contracts: Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings- Standard specifications for different items of building construction.

UNIT V

Approximate estimation of building: Introduction to approximate estimation of building, Advantages of estimating building by approximate estimation- Types of approximate estimation –problems on approximate estimation

UNIT VI

Detailed Estimation of Buildings: Estimation of quantities for one roomed building, two roomed building.

Text Books:

1. Estimating and Costing‘ by B.N. Dutta, UBS publishers, 2000.

2. Civil Engineering Contracts and Estimates‘ by B. S. Patil, Universities Press (India) Pvt.Ltd. Hyd.

3. Construction Planning and Technology‘ by Rajiv Gupta, CBS Publishers & Distributors Pvt.Ltd. New Delhi.

4 Estimating and Costing‘ by G.S. Birdie.

References:

1. 1_Standard Schedule of rates and standard data book‘ by public works department.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works – B.I.S.)
3. _Estimation, Costing and Specifications‘ by M. Chakraborthi; Laxmi publications.
4. National Building Code

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET26
Name of the Course	**ENVIRONMENTAL ENGINEERING-II**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Estimate the sewage and storm water flow and design the sewerage system (K3)
- Relate the appropriate pumps in the sewerage systems (K3)
- Analyze sewage quality and design suitable primary treatment units (K3)
- Employ the secondary treatment units (K3)
- Employ miscellaneous treatment units (K3)
- Identify suitable disposable method with respect to effluent standards.(K2)

SYLLABUS

UNIT I

Introduction: Sanitation – Systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers – appurtenances in sewerage – cleaning and ventilation of sewers

UNIT II

Pumping of Wastewater: Pumping stations – location – components– types of pumps and their suitability with regard to wastewaters – Problems in sewage pumping.

House Plumbing: Systems of plumbing-sanitary fittings and other accessories–one pipe and two pipe systems – Design of building drainage

UNIT III

Characteristics and Treatment of sewage: Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD - BOD equations

Primary treatment of sewage - Screens-grit chambers-grease traps–floatation–sedimentation – design of preliminary and primary treatment units.

UNIT IV

Secondary Treatment: Aerobic and anaerobic treatment process-comparison. Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons, Fluidized bed reactors.

Attached Growth Process: Trickling Filters–mechanism of impurities removal- classification–design-operation and maintenance problems, Rotating Biological Contactors.

UNIT V

Miscellaneous Treatment Methods: Nitrification and Denitrification – Removal of Phosphates –UASB–Membrane reactors-Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design–Reuse and disposal of septic tank effluent.

UNIT VI

Sludge Management: Characteristics-SVI, handling and treatment of sludge-thickening – anaerobic digestion of sludge, Sludge Drying Beds. Centrifuge.

Disposal of sewage: Methods of disposal – disposal into water bodies-Oxygen Sag Curve-Disposal into sea, disposal on land- sewage sickness.

Text Books:

1. Wastewater Engineering Treatment and Reuse, Metcalf & Eddy, Tata McGraw-Hill edition.
2. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna.
3. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.

References:

1. Environmental Engineering, Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
2. Wastewater Treatment for Pollution Control and Reuse, Soli. J Arceivala, Sham R Asolekar, Mc-GrawHill, NewDelhi; 3rd Edition
3. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, Garg, S. K., Khanna Publishers
4. Sewage treatment and disposal, P. N. Modi & Sethi.
5. Environmental Engineering, Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003

6. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET27
Name of the Course	**PAVEMENT ANALYSIS AND DESIGN**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand the factors influencing the design methodologies.(K2)
- Analyze stresses and strains in a flexible pavement using multi-layered elastic theory (K3)
- Analyze stresses and strains in a rigid pavement using Westergaard's theory (K3)
- Design a flexible pavement using IRC, Asphalt Institute, and AASHTO methods (K3)
- Design a rigid pavement using IRC, and AASHTO methods (K3)
- Design of joints, Dowel & tie bars.(K3)

SYLLABUS

UNIT I

Factors Affecting Flexible Pavement Design: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT II

Factors Affecting Rigid Pavement Design : Rigid pavement layers**,** Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure,

UNIT III

Stresses in Flexible Pavement: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts;.

UNIT IV

Stresses in Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars

UNIT V

Design of Flexible Pavements: Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index.IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method. Need for Overlays, Overlays design methods for Flexible and Rigid pavements.

UNIT VI

Design of Rigid Pavements: Factors effecting Design – Wheel load & its repetition, subgrade strength & proportion, strength of concrete- modulus of elasticity. Reinforcement in slab. Design of joints. Design of Dowel bars. Design of Tie bars. IRC and AASHTO methods of Rigid Pavement design.

Text Books:

1. Principles of Pavement Design, Yoder.J. &Witzorac Mathew, W. John Wiley & Sons Inc
2. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
3. AASHTO Pavement Design Guide (1993)

References:

1. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
2. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers.
3. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
4. IRC: 37 & 58 Codes for Flexible and Rigid Pavements Design.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET28
Name of the Course	**AIR POLLUTION AND CONTROL**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand the ambient air quality based on the analysis of air pollutants
- employ particulate and gaseous control measures for an industry
- Illustrate the plume behavior in a prevailing environmental condition
- Estimate carbon credits for various day to day activities
- operate air pollution gases methods(K3)
- Classify the air pollution controlling methods(K4)

SYLLABUS

UNIT I

Air Pollution: Sampling and analysis of air pollutants, conversion of ppm into µg/m3. Definition of terms related to air pollution and control - secondary pollutants – Indoor air pollution – Ozone holes and Climate Change and its impact - Carbon Trade.

UNIT II

Thermodynamics and Kinetics of Air-pollution: Applications in the removal of gases like SOx, NOx, CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution. Odour pollution control, Flares.

UNIT III

Meteorology and Air Pollution: Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behaviour and Air Quality - Wind rose diagrams and Isopleths Plume Rise Models

UNIT IV

Ambient Air Quality Management: Monitoring of SPM - RPM SO2; NOx and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring –

Noise Monitoring - Weather Station. Emission Standards- Gaussian Model for Plume Dispersion

UNIT V

Air Pollution Control: Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control Equipments – Settling Chambers, Cyclone separators –Fabric filters– Scrubbers, Electrostatic precipitators

UNIT VI

Air Pollution Control Methods: Control of NOx and SOx emissions – Environmental friendly fuels - In-plant Control Measures, process changes, methods of removal and recycling. Environmental criteria for setting industries and green belts.

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, Laxmi Publications, New Delhi, 2015

2. Air Pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Company.

3. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.

References:

1. An Introduction to Air pollution, R. K. Trivedy and P.K. Goel, B.S. Publications.

2. Air Pollution by Wark and Warner - Harper & Row, New York.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET29
Name of the Course	**IRRIGATION ENGINEERING**					
Branch	CIVIL ENGINEERING					

COURSE OUTCOMES:

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

- Explain the importance, type and quality of Irrigation Water (K2)
- Estimate the Irrigation water requirements (K2)
- Asses different parameters needed for the design of irrigation canal networks (K3)
- Asses different irrigation canal structures (K3)
- Asses different diversion head works (K3)
- Assess the stability of gravity and earth dams (K3)

SYLLABUS

UNIT I

Introduction: Definition – Importance of Irrigation in India – Advantages and Dis advantages – Types of Irrigation – Quality of Irrigation water- Different types techniques used for water distribution in field.

UNIT II

Irrigation and Water Requirement of Crops: Different types of crops and crop seasons- Soil, water and plant relationship- Irrigation efficiencies-Consumptive use –Estimation of consumptive use-Crop water requirement-Duty and Delta-Factors affecting duty-Depth and Frequency of Irrigation-Water logging and Drainage-crop rotation.

UNIT III

Canals: Classification-Alluvial and Non Alluvial canals-Design of non-erodible canals-Different command areas-Methods of economic section and maximum permissible velocity-Design of erodible canals-Kennedy‘s silt theory and Lacey‘s regime theory.

UNIT IV

Canal structures: Falls-Types and location- Design principle of Sarda type wall and straight glacis wall

Regulators: Head and cross regulators –design principles

Cross Drainage works: Design principles of aqueduct- siphon aqueduct-super passage

Outlets: Types-proportionality-sensitivity and flexibility

UNIT V

Diversion Head Works: Types of diversion head works-Weirs and Barrages-Layout of diversion head works-components- causes and failures of weirs on permeable foundations-Bligh's creep theory-Khosla's theory-exit gradient.

UNIT VI

Reservoir planning: Site selection-zones of storage-yield and storage capacity of reservoir and reservoir sedimentation-Types of dams- selection of type of dam-selection of site for a dam.

Gravity Dams: Forces acting on gravity dam-causes of failure of gravity dam-elementary profile and practical profile of gravity dam-limiting height of dam-stability analysis-drainage galleries-grouting.

Earthen Dams: Types of earthen dams-causes of failure-criteria for safedesign-seepage-measures of control of seepage filters.

Text Books:

1. Irrigation Engineering and Hydraulic structures, Santosh Kumar Garg, Khanna Publishers.
2. Irrigation and Water power Engineering, B.C. Punmia, Pande B.B. Lal, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications Ltd.
3. Water resources and Irrigation engineering by Sri Krishna publications.

References:

1. Irrigation and Water Resources Engineering, Asawa G L (2013), New Age International Publishers.
2. Irrigation Water Resources and Water Power Engineering, Modi P N (2011), Standard book House, New Delhi.
3. Irrigation and Drainage Engineering|| by Peter Waller and Muluneh Yitayew

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET30
Name of the Course	**BRIDGE ENGINEERING**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon successful completion the course the student will be able to

- Generalize different types of Bridges with diagrams and Loading standards (K2)
- Asses the moments in the girders (K3)
- Illustrate different sub structural works of bridges (K3)
- Illustrate different parameters of Well Foundations (K3)
- Report the effectiveness of different Bearings of a Bridge (K2)
- Generalize the suspension bridge and cable stayed bridge (K2)

SYLLABUS

UNIT I

Introduction: Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT II

T-Beam Bridge: Pigeaud's method for computation of slab moments; Courbon's method for computation of moments in girders; Design of simply supported T-beam bridge.

UNIT III

Sub Structure for Bridges: Pier and abutment caps; Materials for piers and abutments, Design of pier; Design of abutment; Backfill behind abutment; approach slab.

UNIT IV

Foundations For Bridges: scour at abutments and piers; Grip length; Types of foundations; Design of well foundation.

Box Culverts: Loading – Analysis and Design- Reinforcement detailing

UNIT V

Bearings for Bridges: Importance of bearings; bearings for slab bridge; bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing.

UNIT VI

Cable Supported Bridge: Different types of cable supported bridge, difference between suspension bridge and cable stayed bridge. Different components and factors considered for design of a) suspension bridge, b) cable stayed bridge.

Text Books:

1. Essentials of Bridge Engineering by Dr. Johnson Victor; Oxford & IBH publishing Co. Pvt.Ltd
2. Cable supported bridges, concepts and design by N J Gimsing. John Willey and Sons
3. Design of Bridges, N. Krishna Raju, Tata McGraw Hill

References:

1. Design of Bridge Structures by T. R Jagadeesh, M.A Jayaram, Prentice Hall of India Pvt. Ltd.
2. Design of Concrete Bridges, Aswini, Vazirani, Ratwani
3. Bridge Engineering by S.Ponnuswamy

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET31
Name of the Course	**ADVANCED FOUNDATION ENGINEERING**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Illustrate the safe bearing capacity of footings subjected to different types of loading on varied soil strata using different methods (K3)
- Compute the settlements of foundations using advanced methods (K3)
- Employ different techniques for proportioning of foundations laid on different soils strata (K3)
- Assess the forces acting on Earth Retaining Structures using different Earth Pressure Theories (K3)
- Predict the load carrying capacity, pull-out capacity, negative skin friction of piles and their settlements (K3)
- Interpret different foundation practices in expansive soils (K3)

SYLLABUS

UNIT I
Bearing capacity of Foundation susing 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 at opof slope– Bearing capacity of foundations at theedge of the slope.

UNIT II
Settlement analysis: Immediate settlement of footings resting on granular soils –Schmertmann& Hartman method – De Beer and Martens method - Immediate settlement inclays–Janbu'smethod–correction for consolidation settlement using Skempton and Bjerrum's method – Correction 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.

UNIT IV

Earth-retaining structures – cantilever sheet piles – anchored bulkheads – fixed and free earth support methods – design of anchors – braced excavations – function of different components– forces in ties – stability against bottom heave.

UNIT V

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.

UNIT VI

Foundationsinexpansivesoils–definitionsofswellpotentialandswellingpressure – determination of free swell index – factors affecting swell potential and swelling pressure – foundation practices – sand cushion method – CNS layer - drilled piers and belled piers– under-reamed piles – moisture control methods.

Text Books:

1. Principles of Foundation Engineering, B M Das, CENTAG Learning
2. Soil Mechanics and Foundation Engineering, V N S Murthy, CBS Publishers
3. Basic and applied soil mechanics by Gopal Ranjan and ASR Rao, New Age Publishers

References:

1. Foundation Analysis and Design, J.E.Bowles, JohnWiley
2. Foundation Design, W.C.Teng, PrenticeHallPublishers
3. Analysis and Design of Foundations and Retaining Structures by Prakash S edited by Saritha Prakashan

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V18 / 2021-2022	3	0	0	3	V18CET32
Name of the Course	**TRAFFIC ENGINEERING & MANAGEMENT**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand basics principles of Traffic Engineering(K2)
- Analyze parking data and model accidents(K3)
- Determine capacity and LOS(K3)
- Design of Signalized systems at congested intersections(K3)
- Design of interchanges and Rotary Intersections(K3)
- To provide engineering techniques to achieve Safe and efficient movement of people
  and goods on roadways(K2)

SYLLABUS

UNIT I

Traffic Studies (Part- I) : Basic principles of Traffic, Volume, Speed and Density; Definitions and their interrelationships; Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data; Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Head ways and Gap Studies - Headway and Gap acceptance, Origin and Destination Studies.

UNIT II

Traffic Studies (Part-II) : Parking Studies: parameters of parking, definitions, Parking
inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data;
Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modeling;, Road Safety Auditing, Measures to increase Road safety.

UNIT III

Capacity and LOS Analysis: Introduction to Traffic capacity, Analysis concepts, Level of Service, Basic definitions, Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments -

Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

UNIT IV

Signal Designing: Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

UNIT V

Design of Intersections: **Rotary Design, Weaving angles, Entry width, Exit Radius, Capacity of Rotary, Types of interchanges, Implementation.**

UNIT VI

Transportation System Management: Measures for Improving vehicular flow – one way Streets, Signal Improvement, Transit Stop Relocation, Parking Management, Reversible lanes- Reducing Peak Period Traffic - Strategies for working hours, Congestion Pricing, Differential Toll Policies.

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.
3. Transportation Engineering - An Introduction - C. Jotin Khisty, Prentice Hall Publication.

References:

1. Fundamentals of Transportation Engineering - C. S. Papacostas, Prentice Hall India.
2. Traffic Engineering - Theory & Practice - Louis J. Pignataro, Prentice Hall Publication.
3. Traffic Engineering by Roger P. Roess, William R. Mc. Shane, Elena S. Prassas , Prentice Hall, 1977.
4. Relevant IRC Codes

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET33
Name of the Course	**CONSTRUCTION PROJECT PLANNING & SYSTEMS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Identify the importance of Project Manager, Project Planning & scheduling and different charts (K3)
- Solve the networks by using different network analysis methods such as PERT & CPM (K2)
- Discuss the functioning of various Construction equipment & Earthwork equipment (K2)
- Discuss the functioning of various Hoisting equipment (K2)
- Discuss the methods of production of Aggregate products and concreting (K2)
- Describe the Quality control, Safety Engineering and construction techniques (K2)

SYLLABUS

UNIT I

Introduction: Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts

UNIT II

PERT & CPM: Project Evaluation and Review Technique – Critical Path Method – Applications- cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

UNIT III

Construction & Earthwork 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.

UNIT IV

Hoisting Equipment: Hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

UNIT V

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 VI

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

Text Books:

1. Construction Engineering and Management by Dr. S. Seetharaman, Umesh Publications.
2. Project planning and control with PERT and CPM by Dr. B. C. Punmia and K.K. Khandelwal, Laxmi Publications (P) Ltd.
3. Construction planning, Equipment and Methods by Peurifoy and Schexnayder, Shapira,TataMc.Grawhill.

References:

1. Construction project management theory and practice by Kumar NeerajJha, Pearson.
2. Construction Technology by Subir K. Sarkar and SubhajitSaraswati, Oxford University press.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET34
Name of the Course	**SOLID WASTE MANAGEMENT**					
Branch	CIVIL ENGINEERING					

Course Outcomes:
Upon successful completion of this course, the students will be able to

- Generalize Solid Waste and its management (K2)
- Assess different elements for managing Solid Waste (K3)
- Employ different methods for transfer and transport of solid waste (K3)
- Employ different methods for Separation and Transformation of Solid waste (K3)
- Organize different methods for processing and treatment of municipal solid waste (K3)
- Identify suitable disposal methods with respect to solid waste (K2)

SYLLABUS

UNIT I

Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste – sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT II

Basic Elements In Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Types and methods of waste collection systems, analysis of collection system – optimization of collection routes.

UNIT III

Transfer and Transport: Need for transfer operation, compaction of solid waste – transport means and methods, transfer station types and design requirements.

UNIT IV

Separation and Transformation of Solid Waste: Unit operations used for separation and transformation: shredding – materials separation and recovery, source reduction and waste minimization.

UNIT V

Processing and Treatment: Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT VI

Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text Books:

1. George Techobanoglous —Integrated Solid Waste Management||, McGraw Hill Publication, 1993
2. Gerard Kiely — Environmental Engineering||, McGraw Hill Publication, 2007
3. J Glynn Henry,. Gary W.Heinke —Environmental Science and Engineering||, Prentice-Hall of India Pvt Ltd, 1996

References:

1. Vesilind, P.A., Worrell, W., Reinhart, D. —Solid Waste Engineering||, Cenage learning, New Delhi, 2004
2. Charles A. Wentz; —Hazardous Waste Management||, McGraw Hill Publication, 1995.
3. Mackenzie L Davis, David A.Cornwell :Introduction to Environmental Engineering|| McGraw Hill Publication, 2017

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET35
Name of the Course	**GROUND WATER DEVELOPMENT**					
Branch	CIVIL ENGINEERING					

Course Outcomes

At the end of the course the student will be able to

- Analyse radial flow towards wells in confined and unconfined aquifers (K3)
- Design wells and understand the construction practices (K5)
- Construct the wells and development of ground water (K2)
- Determine the process of artificial recharge for increasing groundwater potential (K4)
- Employ different geo physical methods to explore ground water (K3)
- Apply appropriate measures for groundwater management (K3)

SYLLABUS

UNIT I

Introduction: Groundwater in the hydrologic cycle, groundwater occurrence, aquifer parameters and their determination, general groundwater flow equation.

Well Hydraulics Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

UNIT II

Well Design: Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery.

UNIT III

Well Construction and Development: Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting

of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT IV

Artificial Recharge: Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben-Herzberg relation, Shape of interface, control of saline water intrusion.

UNIT V

Geophysics: Surface methods of exploration of groundwater – Electrical resistivity and Seismic refraction methods, Sub-surface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications.

UNIT VI

Groundwater Modeling and Management: Basic principles of groundwater modelling- Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models, Concepts of groundwater management, basin management by conjunctive use-case studies.

Text Books:

1. Groundwater, Raghunath H M, New Age International Publishers, 2005.
2. Groundwater Hydrology, Todd D. K., Wiley India Pvt Ltd., 2014.
3. Groundwater Hydrology, Todd D K and L W Mays, CBS Publications, 2005.

References:

1. Groundwater Assessment and Management, Karanth K R, Tata McGraw Hill Publishing Co., 1987.
2. Groundwater Hydrology, Bouwer H, McGraw Hill Book Company, 1978.
3. Groundwater Systems Planning and Management, Willis R and W.W.G. Yeh, Prentice Hall Inc., 1986.
4. Groundwater Resources Evaluation, Walton W C, McGraw Hill Book Company,1978.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET36
Name of the Course	**EARTHQUAKE ENGINEERING**					
Branch	CIVIL ENGINEERING					

Course Outcomes

At the end of the course the student will be able to

- Differentiate types of lodes and it's characteristic(K2)
- Recognize foundations of many basic engineering concepts related earthquake engineering(K2)
- Examine the strong ground motion and seismic hazard(K3)
- Assess the frequency of wave propagation in different mediums(K3)
- Find the behavior of structures during earthquake and earthquake resistant Features of structure(K3)
- Relate the properties of liquefaction and soil improvement for remediation of seismic hazards(K3)

SYLLABUS

UNIT I

Introduction to Dynamic Loads: Static Load v/s Dynamic Load, Types of Dynamic forces, Force Control and Displacement Control.

UNIT II

Seismology and Earthquakes: Introduction, Seismic Hazards, seismic waves, internal structure of earth, Continental drift and plate tectonics, faults, elastics rebound theory, geometric notations, location of earthquakes, size of earthquakes.

UNIT III

Strong Ground Motion: Strong ground motion measurement, ground motion parameters, estimation of ground motion parameters.

Seismic Hazard Analysis: Identification and Evaluation of Earthquake Sources, deterministic seismic hazard analysis, probabilistic seismic hazard analysis.

UNIT IV

Wave Propagation: Waves in unbounded media, waves in a semi – infinite body, waves in a layered media, attenuation of stress waves.

Artificial Ground Motion Generation: Modification of actual ground motion records, time –domain generation, frequency domain generation.

UNIT V

Behavior of Structures: During Earthquake and Earthquake Resistant Features of Structure Inertia forces in structures, Behavior of Masonry Structures, Behavior of RC Structures

UNIT VI

Liquefaction: Flow liquefaction, cyclic mobility, evaluation of liquefaction hazards, liquefaction susceptibility, initiation of liquefaction, effects of liquefaction.

Soil Improvement for Remediation of Seismic Hazards: Densification techniques, Reinforcement Techniques, Grouting and Mixing techniques, Drainage techniques.

Text Books:

1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications
2. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi.
3. K. Chopra; Dynamics of Structures, Pearson, New Delhi
4. Park & Pauly; Behavior of R.C Structures
5. Geotechnical Earthquake Engineering by Steven L. Kramer, prentice Hall

Reference Books:

1. IS: 1893 (Part-I) 2002, Criteria for Earthquake Resistant Design General Provision to Building.
2. S: 13920 (1993), Code of Practice for Ductile Detailing of RC Structures
3. IS: 4326 (1993), Code of Practice for Earthquake Resistant Design and Construction of Buildings
4. IS: 13827 (1993), Improving Earthquake Resistance of Earthen Buildings
5. IS: 13828 (1993), Guide lines for Improving Earthquake Resistance of low Strength Masonry Buildings.
6. S S Rao; Mechanical Vibration; Pearson, New Delhi.

VIII SEMESTER – SYLLABUS

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V18 / 2021-2022	3	0	0	3	V18CET37
Name of the Course	**HIGHWAY CONSTRUCTION & MANAGEMENT**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon the successful completion of course students will be able to

- Understand the concepts of PMS and evaluate strategies for pavement maintenance (K2)
- Evaluate the pavements based on the functional and structural characteristics(K3)
- Understand constructions of Construction methods of Base, Subbase, Shoulders and drains(K2)
- Understand constructions of bituminous pavements(K2)
- Understand the concepts of construction of cement concrete pavements(K2)
- Evaluate the concepts of maintenance of cement concrete pavements(K3)

SYLLABUS

UNIT I

Pavement management system: Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance; Rehabilitation and Feedback systems; Examples of HDM and RTIM packages; Highway financing; Fund generation; Evaluating alternate strategies and Decision criteria ; Pavement Maintenance Management Components of Maintenance Management and Related Activities – Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies.

UNIT II

Pavement Inventories, Quality Control and Evaluation: Serviceability Concepts; Visual Rating; Pavement Serviceability Index; Roughness

Measurements; Distress Modes – Cracking Rutting Etc; Pavement Deflection – Different Methods and BBD, Skid Resistance, Roughness, Safety – Aspects; Inventory System. Causes of Deterioration, Traffic and Environmental Factors, Pavement Performance Modeling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction.

UNIT III

Construction of Base, Subbase, Shoulders and Drain: Roadway and Drain Excavation, Excavation and Blasting, Embankment Construction, Construction of Gravel Base, Cement Stabilised Sub- Bases, WBM Bases, Wet Mix Construction; Crushed Cement Bases, Shoulder Construction; Drainage Surface, Turfing Sand Drains; Sand Wicks; Rope Drains, Geo- Textile Drainage; Preloading Techniques.

UNIT IV Bituminous Construction: Preparation and Laying of Tack Coat; Bituminous Macadam, Penetration Macadam, Built up Spray Grout, Open Graded Premix, Mix Seal, Semi-Dense Asphalt Concrete-Interface Treatments and Overlay Construction, IRC Specifications.

UNIT V Cement Concrete pavement Construction: Cement Concrete Pavement Analysis - Construction of Cement Roads, Manual, and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction.

UNIT VI Bituminous and Cement Concrete pavement Maintenance: Repair of surface layer, Base layer, sub base layer, Sub grade. Maintenance of Concrete slab, Dry Lean concrete sub base layer and Subgrade in concrete pavement.

Text Books :

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.
2. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi.
3. MORTH - Specifications.

References:

1. Principles of Transportation Engineering, Partha Chakroborthy and Animesh Das PHI Learning Private Limited, Delhi.
2. Transportation Engineering - An Introduction, JotinKhisty C, Prentice Hall, Englewood Cliffs, New Jersey.
3. Transportation Engineering and Planning, Papacostas C.S. and P.D. Prevedouros,Prentice Hall of India Pvt.Ltd; New Delhi.

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET38
Name of the Course	**REPAIR AND REHABILITATION OF STRUCTURES**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon the successful completion of course students will be able to

- Develop various maintenance and repair strategies(K2)
- Evaluate the existing buildings through field investigations(K2)
- Understand and use the different techniques for structural rehabilitation(K2)
- To assess damage to structures and various repair techniques(K2)
- To understand the importance of maintenance of structures(K2)
- Understand the importance of advanced concretes mixes(K2)

SYLLABUS

UNIT I

Introduction: Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage.

UNIT II

Non Destructive Testing: Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Inspection and Testing – Symptoms and Diagnosis of Distress – Damage assessment

UNIT III

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

UNIT IV

Strengthening and stabilization: Techniques- design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction

techniques- Column strengthening-flexural strengthening- Connection stabilization and strengthening, Crack stabilization

UNIT V

Fibre reinforced concrete: Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash-properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state-Durability of flyash concretes.

UNIT VI

High performance concretes: Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete-properties-qualifications.

Text Books:

1. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard

Publications.

2. Concrete Technology by A.R. Santa Kumar, Oxford University press

3. Concrete technology by Neville and J J Brooks, Pearson publications, 2nd edition

References:

1. Concrete technology by M S Shetty, S. Chand publications (2006).

2. Defects and Deterioration in Buildings, EF & N Spon, London

3. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press

4. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H.Ranso, (1981)

5. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B.A. Richardson, (1991)

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET39
Name of the Course	**RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon the successful completion of course students will be able to

- Relate various approaches for planning the water supply systems in rural areas (K3)
- Apply suitable methods of water treatment for rural areas(K3)
- Develop distribution system in rural areas (K3)
- Apply the sanitary engineering concept and principals(K3)
- Apply the different public sanitation methods in rural areas(K3)
- Apply different solid waste methods in rural areas(K3)

SYLLABUS

UNIT I

Concept of environmental and scope of sanitation in rural areas: Magnitude of problem of water supply and sanitation – population to be covered and difficulties National policy. Various approaches for planning of water supply systems in rural areas. Selection and development of preferred sources of water, springs, wells and infiltration galleries, collection of raw water from surface source.

UNIT II

Specific problems: Specific problems in rural water supply and treatment iron, manganese, fluorides etc. Low cost treatment, appropriate technology for water supply and sanitation. Improvised method and compact system of treatment of surface and ground waters such as MB settlers, slowand sand filter, chlorine diffusion cartridge etc. Water supply through spot sources, hand pumps, open dug –well.

UNIT III

Planning of distribution system in rural areas: Water supply during fairs, festivals and emergencies. Treatment and disposal of wastewater/sewage. Various method of collection and disposal of night soil.

UNIT IV

On site sanitation system and community latrines: Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits etc.

UNIT V

Industrial Hygiene And Sanitation: Occupational Hazards- Schools- Public Buildings- Hospitals- Eating establishments- Swimming pools – leanliness and maintenance and comfort- Industrial plant sanitation

UNIT VI

Solids Waste: Collection, Transfer, Transport and deposit of solid waste management, composting, land filling.

Text Books:

1. Low cost on site sanitation option, Hoffman & Heijno Occasional Nov.1981 paper no.

2. 21, P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices, J.C. Mokeniaan, 5

3. Rijswijk (the Haque). Wagner, E.G. and Lanoik, J.N. water supply for rural areas and Small Communities, Geneva: W.H.O.1959.

References:

1. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.
2. Vesilind, P.A., Worrell, W., Reinhart, D. —Solid Waste Engineering||, Cenage learning, New Delhi, 2004

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET40
Name of the Course	**PRESTRESSED CONCRETE**					
Branch	CIVIL ENGINEERING					

COURSE OUTCOMES:

Upon the successful completion of course students will be able to

- Generalize the basic concepts of prestressed concrete (K2)
- Compute prestress and bending stresses (K3)
- Estimate effective prestress including the short- and long-term losses (K2)
- Analyze and design prestressed concrete beams under flexure (K4)
- Analyze and design prestressed concrete beams under Shear and torsion (K4)
- Generalize the end zone of prestressed concrete members (K2)

SYLLABUS

UNIT I

Introduction: Basic concepts of prestressing; Need for High strength steel and High strength concrete. Terminology; Advantages and Applications of Prestressed Concretes. Materials For Prestressed Concrete: High strength concrete; High tensile steel.

UNIT II

Prestressing Systems: Prestressing Systems- Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems

Analysis of Prestress and Bending Stresses: Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure (Thrust) line and internal resisting couple; Concept of Load balancing.

UNIT III

Losses of Prestress: Nature of losses of prestress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

UNIT IV

Deflections of Prestressed Concrete Members: Importance of control of deflections; Factors influencing deflections; Short term deflections of un-cracked members; Effect of tendon profile on deflections.

Limit State of Collapse: Flexural Strength of Prestressed Concrete Sections: Ultimate flexural strength of rectangular sections and T-sections using simplified IS code recommendations.

UNIT V

Limit State of Collapse: Shear Resistance of Prestressed Concrete Members: Shear and principal stresses; Shear- IS Code recommendations: Ultimate shear resistance of prestressed concrete members; Design of shear reinforcement.

Torsional Resistance of Prestressed Concrete Members: Design of reinforcements for torsion, shear and bending.

UNIT VI

Design of End Blocks: Transmission of prestress in pretensioned members; Transmission length; Anchorage stress in post tensioned members; Bearing stress and bursting tensile force stresses in end blocks-Methods. IS Code provision for the design of end block reinforcement.

Text Books: (supplemented with IS: 1343)

1. Prestressed Concrete by N. Krishna Raju; Tata Mc.Graw - Hill Publishing Company Limited, New Delhi.
2. Pre-stressed Concrete- P. Dayarathnam: Oxford and IBH Publishing Co.
3. Prestressed Concrete, S. Ramamrutham

References:

1. Prestressed concrete by N. Rajagopalan; Narosa Publishing House.
2. Design of pre-stressed concrete structures- T.Y. Lin and Ned H. Burns - John Wiley & Sons, New York.
3. Fundamental of pre-stressed concrete- N.C. Sinha & S.K. Roy
4. Prestressed Concrete, T. Y. Lin & Burns, Wiley Publications

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET41
Name of the Course	**ENGINEERING WITH GEO-SYNTHETICS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Relate the need and demand of geo-synthetic materials in the field of geotechnical construction works (K3)
- Employ various parameters related to the use and application of geotextiles, geogrids (K3)
- Examine the use and field testing of geo-synthetics in road construction (K3)
- Design reinforced earth retaining walls with strip, sheet and gird reinforcement (K5)
- Distinguish survivability requirements of geo-composites and could design geowebs, geocells, and moisture barriers and natural geotextiles etc. (K4)
- Employ other methods to use the natural geotextiles like jute fibres, coir, bamboo and their combination (K3)

SYLLABUS

UNIT I

Geosynthetics: Introduction to Geosynthetics – Basic description – Polymeric materials– Uses and Applications. Properties of Geotextiles – Geogrids – Geomembranes – Geocomposites.

UNIT-II

Geotextiles: Design criteria for Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers.

Geogrids: Designing for Reinforcement – Stabilization – Designing Gabions – Construction methods.

UNIT-III

Use of Geosynthetics in Roads: Geosynthetics in road ways- applications role of subgrade conditions-design criteria-survivability-application in paved roads.

UNIT-IV

Reinforced Earth Retaining Walls: Components - External stability – Internal stability-Design of reinforced earth walls with strip, sheet and grid reinforcement.

UNIT-V

Geomembranes: Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and closures, moisture barriers.

Geocomposites: An added advantage – Geocomposites in Separation – Reinforcement – Filtration – Geocomposites as Geowebs and Geocells.

UNIT-VI

Natural Geotextiles: Natural fibres as geotextiles- factors governing the use jute fibres-coir geotextiles-bamboo/timber-combination of geotextiles.

Text Books:

1. Designing with Geosynthetics by Robert M. Koerner, Prantice Hall, Eaglewood Cliffs, NJ.

2. An Introduction to Soil Reinforcement and Geosynthetics‘ by G.L.Sivakumar Babu

(2009), Universities Press (India) Pvt. Ltd.

3. Engineering with Geosynthetics‘, by G. Venkatappa Rao and GVS Suryanarayana Raju –

Tata McGraw Hill Publishing Company Limited – New Delhi.

References:

1. _Construction and Geotechnical Engineering using Synthetic Fabries‘ by Robert M.

Koerner and Josoph P. Welsh. John Willey and Sons, New York.

2. _Foundation Analysis and Design‘ by J.E. Bowles McGraw Hill Publications.

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET42
Name of the Course	**URBAN HYDROLOGY & HYDRAULICS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Generalize the effect of urbanization on hydrological cycle (K2)
- Develop intensity duration frequency curves for urban drainage systems (K3)
- Calculate runoff parameters in urban drainage system (K3)
- Develop design storms to size the various components of drainage systems (K3)
- Apply best management practices to manage urban flooding (K3)
- Prepare master drainage plan for an urbanized area (K3)

SYLLABUS

UNIT I

Introduction: Urbanization and its effect on water cycle – urban hydrologic cycle – Trends in urbanization – Effect of urbanization on hydrology

UNIT II

Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

UNIT III

Approaches to urban drainage: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems.

UNIT IV

Elements of drainage systems: Open channel, underground drains, appurtenances, pumping, source control.

UNIT V

Analysis and Management: Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.

UNIT VI

Master drainage plans: Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, use of models in planning.

Text Books:

1. Manual on Drainage in Urbanised area, Geiger W. F., J Marsalek, W. J. Rawls and F.C. Zuidema, (1987 - 2 volumes), UNESCO,

2. Urban Hydrology, Hall M J (1984), Elsevier Applied Science Publisher.

3. Hydrology – Quantity and Quality Analysis, Wanielista M P and Eaglin (1997), Wiley and Sons

4. Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling, Akan A.O and R.L. Houghtalen (2006), Wiley International.

References:

1. Storm water Detention for Drainage, Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.

2. Urban water cycle processes and interactions, Marsalek et.al. (2006), Publication No. 78, UNESCO, Paris (http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)

3. Frontiers in Urban Water Management – Deadlock or Hope, by Maksimovic C and J A Tejada-Guibert (2001), IWA Publishing

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET43
Name of the Course	**ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Prepare EMP, EIS, and EIA report (K3)
- Select the an appropriate EIA methodologies (K2)
- Assess the Impact of development activities and land use (K3)
- Employ in procuring the natural resources for assessing the environment (K3)
- Assess the ecosystem (K3)
- Develop the EIA notifications and reports (K3)

SYLLABUS

UNIT I

Basic concept of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base map-Classification of environmental parameters role of stakeholders in the EIA preparation stages in EIA

UNIT II

E I A Methodologies: introduction, 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, cost/benefit Analysis – EIS and EMP

UNIT III

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- application of remote sensing and GIS for EIA.

UNIT IV

Procurement of natural resources: Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT V

Assessment of ecosystem: Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment advantages of Environmental Risk Assessment

UNIT VI

EIA notification: EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, procedure for environmental clearance, and 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. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)

2. Environmental Impact Assessment Methodologies, Y.Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

3. Environmental Impact Assessment and Management, B B Hosetti, A.Kumar, Daya Publishing House (2014)

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke PrenticeHall Publishers

2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. ,Katania & Sons Publication., New Delhi.

3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET44
Name of the Course	**ADVANCED CONCRETE TECHNOLOGY**					
Branch	CIVIL ENGINEERING					

Course Outcomes

Upon successful completion of course the students will be able to

- Relate material characteristics and their influence on microstructure of concrete(K3)
- Predict concrete behavior based on its durability properties(K3)
- Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes(K3)
- Select a suitable type of concrete based on specific application(K3)
- Employ suitable concreting methods to place the concrete based on requirement(K3)
- Illustrate different types of concrete tests for hardened properties(K3)

SYLLABUS

UNIT I

Ingredients of Concrete: Cement –chemical composition and their importance, hydration of cement, types of cement. Testing of cement.
Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing.
Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water.
Chemical admixtures: Plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

UNIT II

Durability of Concrete: Durability, Transport mechanism of fluids and gases in concrete, cracking in concrete - corrosion and carbonation induced cracking, Alkali Aggregate Reaction, degradation by freeze and thaw, chloride attack, sulphate and sea water attack (marine conditions). Hot and cold weather concreting.

UNIT III

Concrete Mix Design: Design of concrete mixes by IS code method - ACI method Design of high strength concrete mixes, design of fly-ash cement concrete mixes, design of high density concrete mixes.

UNIT IV

Special Concrete: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, refractory concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, mortars, renders, recycled concrete, Ferro Cement, Self Compacting Concrete.

UNIT V

Special processes and technology for particular types of structure: Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete, concrete for liquid retaining structures, vacuum process

UNIT VI

Testing of Concrete: Test methods: Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structure

Text Books:

1. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.
2. Concrete Technology, Gambhir M.L, Tata McGraw Hill
3. Concrete Technology, M.S.Shetty, S.Chand& Company New Delhi
4. Concrete microstructure, properties & materials, P.KumarMehata, Paulo & J.M. Monteiro,
5. Light Weight Concrete, Short &Kenniburg, Asia Publishing House, Bombay

References:

1. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
2. Job Thomas, —Concrete Technology||, CENGAGE Learning,2015.
3. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete BMTPC.
4. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET45
Name of the Course	**FINITE ELEMENT METHOD**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Apprise the students about the basics of the Finite Element Technique(K2)
- Describe the finite element method, identify different types of finite elements and apply to respective engineering problems(K3)
- Analyze one dimensional solid elements of various engineering problems(K3)
- Illustrate frame structures of various engineering problems (K3).
- Analyze 2-D and 3-D engineering problems using finite element method(K3)
- Examine finite element for elastic stability, fluid mechanics and dynamic analysis (K3)

SYLLABUS

UNIT I

Introduction to Finite Element Analysis: Basic Concepts of Finite Element Analysis - Introduction to Elasticity -Steps in Finite Element Analysis

UNIT II

Finite Element Formulation Techniques: Virtual Work and Variational Principle -Galerkin Method- Finite Element Method: Displacement Approach - Stiffness Matrix and Boundary Conditions

UNIT III

Element Properties: Natural Coordinates -Triangular Elements - Rectangular Elements - Lagrange and Serendipity Elements -Solid Elements - Isoparametric Formulation -Stiffness Matrix of Isoparametric Elements - Numerical Integration: One Dimensional - Numerical Integration: Two and Three Dimensional- Worked out Examples

UNIT IV

Analysis of Frame Structures: Stiffness of Truss Members -Analysis of Truss -Stiffness of Beam Members - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Analysis of Grid and Space Frame

UNIT V

FEM for Two and Three Dimensional Solids: Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements - Numerical Evaluation of Element Stiffness - Computation of Stresses, Geometric Nonlinearity and Static Condensation - Axisymmetric Element - Finite Element Formulation of Axisymmetric Element - Finite Element Formulation for 3 Dimensional-Elements Worked out Examples

UNIT VI

Additional Applications of FEM: Finite Elements for Elastic Stability - Finite Elements in Fluid Mechanics - Dynamic Analysis

Text Books:

1. Introduction to Finite Elements in Engineering, Tirupati R. Chandrupatla, Ashok D. Belgundu, PHI publications.

2. A first course in the Finite Element Method, Dary L. Logan, Thomson Publications.

3. The Finite Element Method- Zinkiewicz, O.C. and Taylor, R.L , Oxford .

4. Finite Element Analysis Theory and Programming- Krishnamoorthy, C.S, Tata McGraw-Hill Education.

References:

1. Concepts and applications of Finite Element Analysis, Robert D. Cook, Michael E Plesha, John Wiley & sons Publication.

2. Introduction to Finite Element Method, Desai & Abel CBS Publication.

3. Introduction to Finite Element Method- P.N. Godbole, I K International Publishing House Pvt. Ltd.

4. The Finite Element Method in Engineering- S.S. Rao, Butterworth-Heinemann;

5. An Introduction to Finite Element Method- Reddy, J. N., McGraw-Hill Education

Year/Sem	**VIII**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CET46
Name of the Course	**GROUND IMPROVEMENT TECHNIQUES**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remoulded and in-situ soils (K2)
- The student should be in a position to understand the importance of dewatering and different dewatering techniques (K3)
- The student should be in a position to know the importance of stabilization of soils and types of stabilizations (K3)
- To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls (K3)
- To enable the students to know how geotextiles and geosynthetics can be used to improve the engineering performance of soils (K2)
- To make the student learn the concepts, purpose and effects of grouting (K2)

SYLLABUS

UNIT I

In situ densification methods: In situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT II

Dewatering: Sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells– electro osmosis

UNIT III

Stabilization of soils: Methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

UNIT IV

Reinforced earth: Principles – components of reinforced earth –stability checks – soil nailing

UNIT V

Geosynthetics: Geotextiles – types – functions, properties and applications – geogrids , geomembranes and gabions – properties and applications.

UNIT VI

Grouting: Objectives of grouting – grouts and their applications – methods of grouting – stage of grouting.

Text Books:

1. Ground Improvement Techniques, Purushotham Raj, Laxmi Publications, New Delhi.
2. Ground Improvement Techniques, Nihar Ranjan Patro, Vikas Publishing House (p) limited , New Delhi.
3. An introduction to Soil Reinforcement and Geosynthetics, G. L. Siva Kumar Babu, Universities Press.

References:

1. Ground Improvement, M.P.Moseley, Blackie Academic and Professional, USA
2. Designing with Geosynethetics, R. M Koerner, Prentice Hall
3. Engineering Principles of Ground Modification by Manfred R. Hausmann,McGraw-Hill Inc.,

ANNEXURE – CE- II

COURSES OFFERED UNDER OPEN ELECTIVE IN VII & VIII SEMESTER TO OTHER BRANCHES

Open Elective 2	VII Sem	3. Environmental Pollution and Control 4. Disaster Management	V18CEOE03 V18CEOE04
Open Elective 3	VIII Sem	3. Solid Waste Management 4. Water Quality and Conservation	V18CEOE05 V18CEOE06

Year/Sem	**VII**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CEOE03
Name of the Course	**ENVIRONMENTAL POLLUTION AND CONTROL**					
Branch	Common to all except Civil Engineering					

Course Outcomes:

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

- Describe about air pollution and its control methods to students(K2)
- Develop the student to understand about industrial wastewater and ways to control it (K3)
- Describe student to understand about solid waste and methods to control it(K2)
- Express to student about importance of Environmental sanitation(K2)
- Prepare student to understand about Hazardous waste and ways to control it(K3)
- Illustrate the importance of Sustainable development to student(K3)

SYLLABUS

UNIT I

Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards.Noise Pollution: Noise standards, Measurement and control methods –Reducing residential and industrial noise – ISO14000.

UNIT II

Industrial wastewater Management: – Strategies for pollution control - Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants - Recirculation of industrial wastes – Effluent standards.

UNIT III

Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration Composting-Solid waste disposal methods – fundamentals of Land filling.

UNIT IV

Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT V

Hazardous Waste: Characterization - Nuclear waste – Biomedical wastes – Electronic wastes - Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT VI

Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

Text Books:

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

References:

1. Air Pollution and Control by M.N. Rao & H.N. Rao
2. Solid Waste Management by K. Sasi Kumar, S.A. Gopi Krishna. PHI New Delhi.
3. Environmental Engineering by Gerard Kiley, Tata McGraw Hill.
4. Environmental Sanitation by KVSG Murali Krishna, Reem Publications, New Delhi.
5. Industrial Water Pollution Control by Nemerow Jr., McGraw Hill Publishing.
6. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard – Cengage Learning.
7. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
8. Environmental Engineering – Howard S. Peavy, Donald R. Rowe,Teorge George Tchobanoglus – Mc-Graw-Hill Book Company,New Delhi, 1985.

Year/Sem	**VII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CEOE04
Name of the Course	**DISASTER MANAGEMENT**					
Branch	Common to all except Civil Engineering					

Course Outcomes:

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

- Describe to student to have a idea on different natural hazards and disaster management (K2)
- Develop the student to understand manmade disaster and their management (K3)
- Prepare the student in such a way inorder to understand building codes and vulnerability of disaster (K3)
- Illustrate to student about role of technology in disaster management (K2)
- Assess the importance of education and community preparedness in disaster management to student (K3)
- Classify the multi-sectional issues caused by disaster to student (K2)

SYLLABUS

UNIT I

Natural Hazards and Disaster Management: Introduction of DM Disaster Management cycle – Five priorities for action- Case study methods of the following: floods, droughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

UNIT II

Man Made Disastar And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - rail and air craft‘s accidents-Management of these disasters

UNIT III

Risk And Vulnerability: - Building codes and land use planning – social vulnerability – environmental vulnerability -Financial management of disaster.

UNIT IV

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure - mitigation programme for earth quakes –geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.

UNIT V

Education And Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building.

UNIT VI

Multi-sectional Issues: Impact of disaster on poverty and deprivation-Climate change adaptation and human health -Exposure , health hazards and environmental risk-Forest management and disaster risk reduction - The Red cross and red crescent movement.

Text Books:

1. Disaster Management – Global Challenges and Local Solutions‘ by Rajib shah & R R Krishnamurthy(2009),Universities press.
2. Disaster Science & Management‘ by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Disaster Management – Future Challenges and Opportunities‘ by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

Reference Books:

1. _Disaster Management‘ edited by H K Gupta (2003), Universities press.
2. Natural Hazards and Disaster Management, Vulnerability and Mitigation by RB Singh
3. Disaster Management by Harish K.Gupta

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V18	3	0	0	3	V18CEOE05
Name of the Course	**SOLID WASTE MANAGEMENT**					
Branch	Common to all except Civil Engineering					

Course Outcomes:
Upon successful completion of this course, the students will be able to

- Generalize Solid Waste and its management(K2)
- Assess different elements for managing Solid Waste(K3)
- Employ different methods for transfer and transport of solid waste(K3)
- Employ different methods for Separation and Transformation of Solid waste(K3)
- Organize different methods for processing and treatment of municipal solid waste(K3)
- Identify suitable disposal methods with respect to solid waste(K2)

SYLLABUS

UNIT I

Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste – sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT II

Basic Elements In Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Types and methods of waste collection systems, analysis of collection system – optimization of collection routes.

UNIT III

Transfer and Transport: Need for transfer operation, compaction of solid waste – transport means and methods, transfer station types and design requirements.

UNIT IV

Separation and Transformation of Solid Waste: Unit operations used for separation and transformation: shredding – materials separation and recovery, source reduction and waste minimization.

UNIT V

Processing and Treatment: Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT VI

Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text Books:

1. George Techobanoglous —Integrated Solid Waste Management||, McGraw Hill Publication, 1993
2. Gerard Kiely — Environmental Engineering||, McGraw Hill Publication, 2007
3. J Glynn Henry,. Gary W.Heinke —Environmental Science and Engineering||, Prentice-Hall of India Pvt Ltd, 1996

References:

1. Vesilind, P.A., Worrell, W., Reinhart, D. -Solid Waste Engineering||, Cenage learning, New Delhi, 2004
2. Charles A. Wentz; —Hazardous Waste Management||, McGraw Hill Publication, 1995.
3. Mackenzie L Davis, David A.Cornwell :Introduction to Environmental Engineering|| McGraw Hill Publication, 2017

Year/Sem	**VIII Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation Year	V18 / 2021-2022	3	0	0	3	V18CEOE06
Name of the Course	**WATER QUALITY AND CONSERVATION SYSTEMS**					
Branch	Common to all except Civil Engineering					

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

- Describe the Engineering Hydrology and application (K2)
- Assess the importance and necessity of water supply systems (K3)
- Relate different sources of surface and ground water (K3)
- Predict the quality of water in reference to IS and WHO standards (K3)
- Design of plumbing and sanitary fittings (K3)
- Employ different conservation techniques (K3)

SYLLABUS

UNIT I
Introduction to Hydrology: Engineering hydrology, applications, Hydrologic cycle, evaporation, evapotranspiration, precipitation, run off, infiltration, hydrological data-sources

UNIT II

Sources of Water: Surface water, Lakes, Rivers, Reservoirs, comparison of sources with reference to quality, quantity and other considerations.

Groundwater, types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries.

UNIT III

Importance and Necessity: Protected Water Supply systems, Flow chart of public water supply system, Water borne diseases. Estimation of water usages in different purpose.

UNIT IV

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 V

Plumbing Systems: Systems of plumbing-types of pipes and sanitary fittings and other accessories–one pipe andtwo pipe systems – Design parameters and factors.

UNIT VI

Water conservation: importance and necessity, objectives, systems-rainwater harvesting, recharge pits, watershed.

Text Books:

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
2. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.
3. Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie

References:

1. Water Supply Engineering – P. N. Modi.
2. Water Supply Engineering – B. C. Punmia
3. Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie

ANNEXURE – CE-III

COURSE STRUCTURE APPROVED IN 2nd JOINT BOS MEETING

(For 2020 - 2021 Admitted Batch) - V20 Regulation

I SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	V20MAT01	Linear Algebra and Differential Equations	3	0	0	3
2	V20PHT01	Engineering Physics	3	0	0	3
3	V20ENT01	English for Professional Enhancement	3	0	0	3
4	V20MEL01	Engineering Graphics	1	0	4	3
5	V20CST01	Programming in C for problem solving	3	0	0	3
6	V20ENL01	Hone Your Communications Skills Lab-I	0	0	3	1.5
7	V20PHL01	Engineering Physics Lab	0	0	3	1.5
8	V20CSL01	Programming lab in C for problem solving	0	0	3	1.5
9	V20CHT02	Environmental Studies	2	0	0	-
		Total	15	0	13	19.5

Total Contact Hours : 28 Total Credits : 19.5

II SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	V20MAT02	Numerical Methods and Vector Calculus	3	0	0	3
2	V20CHT01	Engineering Chemistry	3	0	0	3
3	V20MET01	Engineering Mechanics	3	0	0	3
4	V20EET02	Basic Electrical and Electronics Engineering	3	0	0	3
5	V20MEL02	Engineering Workshop	1	0	4	3
6	V20EEL02	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
7	V20CHL01	Engineering Chemistry Lab	0	0	3	1.5
8	V20ENL02	Hone Your Communications Skills Lab-II	0	0	3	1.5
		Total	13	0	13	19.5

Total Contact Hours : 26 Total Credits : 19.5

COURSE STRUCTURE PROPOSED FOR APPROVAL IN 4th BOS MEETING

III SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	V20MAT04	Probability & Statistics (BOS of Maths)	3	0	0	3
2	V20CET01	Strength of Materials	3	0	0	3
3	V20CET02	Fluid Mechanics & Hydraulics	3	0	0	3
4	V20CET03	Surveying and Geomatics	3	0	0	3
5	V20CET04	Building Materials & Concrete Technology	3	0	0	3
6	V20CEL01	Strength of Materials Lab	0	0	3	1.5
7	V20CEL02	Surveying Lab	0	0	3	1.5
8	V20CEL03	Concrete Technology Lab	0	0	3	1.5
9	V20CESOC1	Skill Oriented Course (Certificate course offered by Parent Institution / Industries / Professional Bodies/APSSDC or any other accredited bodies)	1	0	2	2
10	V20ENT02	Professional Communication Skills-I (MNC) (BOS of Eng)	2	0	0	0
		Total	18	0	11	21.5

Total Contact Hours : 29

Total Credits : 21.5

IV SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	V20CET05	Engineering Geology	3	0	0	3
2	V20CET06	Structural Analysis - I	3	0	0	3
3	V20CET07	Water Resources Engineering	3	0	0	3
4	V20CET08	Transportation Engineering	3	0	0	3
5	V20MBT51	Managerial Economics Financial Analysis (BOS of MBA)	3	0	0	3
6	V20CEL04	Engineering Geology Lab	0	0	3	1.5
7	V20CEL05	FM & Hydraulic Machinery Lab	0	0	3	1.5
8	V20CEL06	Transportation Engineering Lab	0	0	3	1.5
9	V20CESOC2	Skill Oriented Course (Certificate course offered by Parent Institution/ Industries/ Professional Bodies/APSSDC or any other accredited bodies)	1	0	2	2
10	V20ENT03	Professional Communication Skills-II (MNC) (BOS of Eng)	2	0	0	0
		Total	18	0	11	21.5

Total Contact Hours : 29

Total Credits : 21.5

Internship for 2 months/Mini Project is mandatory during summer vacation and is evaluated in V semester.

V SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Structural Analysis - II	3	0	0	3
2		Geotechnical Engineering	3	0	0	3
3		Design of Reinforced Concrete Structures	3	0	0	3

4		Professional Elective Course I	3	0	0	3
5		Open Elective Course I	2	0	2	3
6		Geotechnical Engineering Lab	0	0	3	1.5
7		Building Planning & Drawing Lab	0	0	3	1.5
8		Skill Advanced Course	1	0	2	2
9		Mandatory Course	2	0	0	0
10		Summer Internship	0	0	0	1.5
		Total	17	0	10	21.5

Total Contact Hours: 27 Total Credits: 21.5

VI SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Design of Steel Structures	3	0	0	3
2		Foundation Engineering	3	0	0	3
3		Environmental Engineering	3	0	0	3
4		Professional Elective Course - II	3	0	0	3
5		Open Elective Course - II	2	0	2	3
6		Environmental Engineering Lab	0	0	3	1.5
7		CAD & GIS Lab	0	0	3	1.5
8		Professional Core Courses Lab	0	0	3	1.5
9		Skill Advanced Course / Soft skill course	1	0	2	2
10		Mandatory Course	2	0	0	0
		Total	17	0	13	21.5

Total Contact Hours: 30

Total Credits: 21.5

Internship 2 months/Mini Project is mandatory during summer vacation and is evaluated in VII semester.

VII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Professional Elective Course III	3	0	0	3
2		Professional Elective Course IV	3	0	0	3
3		Professional Elective Course V	3	0	0	3
4		Open Elective Course III	2	0	2	3
5		Open Elective Course IV	2	0	2	3
6		Humanities and Social Science Elective	3	0	0	3
7		Skill Advanced Course	1	0	2	2
8		Summer Internship	0	0	0	3
		Total	17	0	6	23

Total Contact Hours: 23

Total Credits: 23

VIII SEMESTER

S.No	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Project	0	0	0	12
		Total	0	0	0	12

Total Contact Hours: 0

Total Credits: 12

SYLLABI OF III & IV SEMESTERS OF B.TECH V20 REGULATION

ACADEMIC YEAR 2021-2022

III SEMESTER – SYLLABUS

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET01
Name of the Course	**STRENGTH OF MATERIALS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand the basic materials behavior under the influence of different external loading conditions and the support conditions (K2)
- Draw the diagrams indicating the variation of the key performance features like bending moment and shear forces (K3)
- Understand bending concepts and calculation of section modulus and for determination of stresses developed in the beams and torsion (K3)
- Understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections (K2)
- Asses stresses in different engineering applications like columns and struts subjected to different loading conditions (K3)

SYLLABUS

UNIT I

Simple Stresses ,Strains and Strain Energy: Elasticity and plasticity –Types of stresses and strains – Hooke_s law – stress – strain diagram for mild steel – Workingstress – Factor of safety – Lateral strain, Poisson_s ratio and volumetric strain – Elasticmoduli and the relationship between them – Bars of varying section – composite bars –Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam

Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay_s methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. Uniformly varying load. Mohr_s theorems – Moment area method – application to simple cases.

UNIT III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, built up beams, shear centre Torsion- Derivation of torsion equation and its assumptions.

UNIT-IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr‘s circle of stresses – Principal stresses and strains – Analytical and graphical solutions. Theories of failures: Various Theories of failures such as Maximum Principal stress theory –Maximum Principal Strain Theory – Maximum shear stress theory – Maximum strain energy theory –Maximum shear strain energy theory.

UNIT-V

Columns and Struts: Introduction – Types of columns – Short, medium and long columns –Axially loaded compression members – Crushing load – Euler‘s

theorem for long columns –assumptions – derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – Slenderness ratio –Euler' critical stress – Limitations of Euler' theory – Rankine– Gordon formula – Long columns subjected to eccentric loading – Secant formula –Empirical formulae – Straight line formula – Prof. Perry' formula.

Text Books:

1. Mechanics of Materials- R. C. Hibbler, Pearson; 10 edition (January 15, 2016)
2. Strength of materials -S. S. Bhavakatti, Vikas Publishing House; Fourth edition (2013)
3. Strength of Materials -R. K. Rajput, S. Chand Publishing (6th Edition) (2015)
4. Strength of Materials - R.K Bansal,Laxmi Publications; Sixth edition (2018)

References:

1. Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi. (1 December 2009)
2. Introduction to Strength of Material by U.C. Jindal, Pearson Education; Second edition (28 September 2017)
3. Strength of materials by R. Subramanian, Oxford university press, New Delhi, third edition (15 June 2016)

Year/Sem	III Sem	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CET02
Name of the Course	**FLUID MECHANICS & HYDRAULICS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand the physical properties of fluids and their influences on fluid motion (K2)
- Calculate the forces acting on plane and curved surfaces and solve fluid flow problems in kinematics and dynamics (K3)
- Solve various laminar and turbulent flow problems (K2)
- Solve uniform and non uniform open channel flow problems (K2)
- Estimate the impact of jet on plane and curved surfaces using momentum Principle (K2)

SYLLABUS

UNIT I

Introduction and Hydrostatics: Dimensions and units – Physical properties of fluid specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion - pressure at a point, Pascal‗s law, hydrostatic law, atmospheric, gauge and vacuum pressure, measurement of pressure - pressure gauges, Manometers: Differential Manometers- Hydrostatic forces on submerged plane - Horizontal, Vertical, Center of pressure, derivations and problems.

UNIT II

Fluid Kinematics and Dynamics: Description of fluid flow - Stream line, path line and streak lines and stream tube - Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows - Surface and body forces - Euler and Bernoulli‘s equations for flow

UNIT III

Closed Conduit and Measurement of Flow: Laws of Fluid friction-Darcy‘s equation-Minor losses-pipes in series, pipes in parallel, Pipe network problem- variation friction factor with Reynolds‘s number- Pitottube,Venturi meter and Orifice meter - flow over rectangular, triangular and trapezoidal notches.

UNIT IV

Uniform Flow and Non Uniform Flow: Types of flows - Type of channels - Chezy's, manning's and Bazin formulae for uniform flow - Most Economical sections - Critical flow: Specific energy-critical depth computation of critical depth critical, sub-critical and super critical flows - Dynamic equation for G.V.F., Mild, Critical, Steep, horizontal and adverse slopes, surface profiles - direct step method - Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT V

Hydraulic Similitude and Momentum Principles: Dimensional analysis-Buckingham's-Pi theorem - study of hydraulic models-Geometric, Kinematic and Dynamic similarities-dimension less numbers, model laws-Hydrodynamic force of jets on stationary and moving flat-inclined and curved vanes-jet striking centrally and at tip- velocity triangles at inlet and outlet-expressions for work done and efficiency

Textbooks:

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P.N.Modiand Dr.S.N.Seth, Standard Book house, Rajsons Pvt.Ltd.,21stEdition.
2. A text book of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal,Laxmi Publications(P)Ltd.,NewDelhi,10thEdition,2018.
3. A text book of Fluid mechanics and Hydraulic machines by Er. R.K.Rajput, S.Chand&company,6thEdition,2016

References:

1. Introduction to Fluid Mechanics and Fluid Machines by S.K.Som, G.Biswas, Suman Chakraborthy, McGraw Hill Education, 3rd Edition,2017.
2. Fluid Mechanics by A.K.Mohanty, Prentice Hall of India Pvt. Ltd., NewDelhi,2nd Edition,1994.
3. Fluid Mechanics and Hydraulic Machines by K.Subramanya, McGraw Hill Education,1st Edition,2010.

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET03
Name of the Course	**SURVEYING AND GEOMATICS**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Demonstrate the basic surveying skills (K2)
- Computation of bearings by various surveying instruments (K3)
- Perform different methods of leveling (K3)
- Compute various data required for various methods of surveying (K3)
- Compute area and volume quantities by different methods (K3)

SYLLABUS

UNIT I

Introduction: Definition-Uses of surveying- overview of plane surveying (chain, Compass and plane table), Objectives, Principles and classifications – Errors in survey Measurements

UNIT II

Compass survey and traversing: Electronic distance measurements (EDM)-principles of electro optical EDM-Errors and corrections to linear measurements- Compass survey-Meridians, Azimuths and Bearings, declination, computation of angle. Traversing-Purpose-types of traverse-traverse computation-traverse adjustments-Introduction omitted measurements

UNIT III

Leveling, contouring and Curves: Concept and Terminology, Leveling Instrument and their Temporary and permanent adjustments- method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys.Types of curves, design and setting out – simple and compound curves

UNIT IV

Theodolite Surveying: principles-uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Introduction to Trigonometrically leveling,. Tachometric Surveying: Stadia and tangential methods of Tacheometry. Distance and-Elevation formulae for Staff vertical position

UNIT V

Computation of Areas and Volumes: Area from field notes, computation ofareas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

Geomatics: Introduction, Total Station and Global positioning system, Electromagnetic spectrum, Visual image interpretation, Digital image processing

Text Books:

1. Surveying, Vol No.1, 2 &3, B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain –
2. Laxmi Publications Ltd, New Delhi,seventeenth edition (2016)
3. 2 Text book of Surveying, S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing
4. Co. Ltd. New Delhi.Fourth edition (1 July 2017)
5. Text book of Surveying, Arora (Vol No. 1&2), STANDARD BOOK HOUSE SINCE 1960; Edition: Year-2015 edition (2015)
6. Anji Reddy, M., Remote sensing and geographical information system,BS Publications/BSP Books (2012)

References:

1. Text book of Surveying, C. Venkataramaiah, universities Press (India) Pvt. Ltd. (12 January 2011)
2. Surveying and levelling, R. Subramanian, Oxford University Press; 2 edition (30 June 2012)

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET04
Name of the Course	**BUILDING MATERIALS & CONCRETE TECHNOLOGY**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Discuss the basic concepts of building materials (K2)
- Distinguish the basic ingredients of concrete and their role in the production of concrete and its behavior in the field (K2)
- Apply fundamental knowledge in the fresh concrete (K3)
- Apply fundamental knowledge in the hardened properties of concrete and factors (K3)
- Find test on hardened concrete and properties, evaluate the ingredients of concrete through lab test results and design the concrete mix by BIS method (K3)

SYLLABUS

Unit I (Stones, Bricks, Tiles, Wood and Paints)

Stones: Classification of Stones – Properties of stones in structural requirements

Bricks: Composition of good brick earth, Various methods of manufacturing of bricks

Tiles: Characteristics of good tile – Manufacturing methods, Types of tiles

Wood: Structure – Properties – Seasoning of timber – Classification of various types of woods used in buildings – Defects in timber

Paints: White washing and distempering, Constituents of paint – Types of paints – Painting of new and old wood – Varnish

Unit II (Aggregates, Cement and Admixtures)

Aggregates: Classification of aggregate, Bond, Strength and other mechanical properties of aggregate, Physical properties of aggregate, bulking of sand, Deleterious substance in aggregate, Soundness of aggregate, Alkali-Aggregate reaction – Thermal properties, Sieve analysis – Fineness modulus – Grading

curves – Grading of fine and coarse aggregates as per relevant IS code, Maximum aggregate size

Portland Cement: Chemical composition, Hydration, Structure of hydrated cement – Setting of cement, Fineness of cement, Tests for physical properties – Different grades of cements **Supplementary cementitious materials:** Fly ash, GGBS, Silica fume, Rice husk ash, Calcinated ash (Basic properties and their contribution to concrete strength)

Admixtures: Mineral and Chemical admixtures

Unit III (Fresh Concrete)

Manufacture of concrete: Mixing and vibration of concrete, Workability – Segregation and bleeding – Factors affecting workability, Measurement of workability by different tests, Effect of time and temperature on workability – Quality of mixing water, Ready mix concrete, Shotcrete

Unit IV (Hardened Concrete)

Water / Cement ratio: Abram's law, Gel space ratio, Nature of strength of concrete – Maturity concept, Strength in tension and compression – Properties of Hardened Concrete (Elasticity, Creep, Shrinkage, Poisson's ratio, Water absorption, Permeability, etc.), Relating between compression and tensile strength, Curing

Unit V (Testing of Hardened Concrete, Mix Design)

Testing of Hardened Concrete: Factors affecting properties of Hardened concrete, Compression tests, Tension tests, Flexure tests, Non-destructive testing methods – Codal provisions for NDT – Rebound hammer and UPV method.

Mix Design: Factors in the choice of mix proportions – Quality Control of concrete -Acceptance criteria – Concepts Proportioning of concrete mixes by various methods – BIS method of mix design.

Text Books:

1. —Concrete Technology|| by M. S. Shetty - S. Chand & Co., 2004
2. —Engineering Materials|| by Rangwala S C, (36th edition), Anand Charotar Publishing House
3. —Concrete Technology|| by Shantha Kumar – Oxford Publications

Reference Books:

1. —Building Materials|| by S. K. Duggal, New Age International Publications
2. —Building Materials|| by P. C. Verghese, PHI learning (P) Ltd., 2009
3. —Properties of Concrete|| by A. M. Neville – Pearson – 4th edition

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL01
Name of the Course	**STRENGTH OF MATERIALS LAB**					
Branch	CIVIL ENGINEERING					

Course outcomes:

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

- Identify the engineering properties of materials in the laboratory
- Assess torsion test to determine elastic constants
- Assess spring test to determine elastic constants
- Assess flexural test to determine elastic constants
- Determine hardness of metals
- Determine Impact strength of metals

List of Experiments

1. Tension test on Steel bar
2. Bending test on (Steel / Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell_s Reciprocal theorem on beams.
11. Continuous beam – deflection test.

List of Major Equipment:

1. UTM for conducting tension test on rods
2. Steel beam for flexure test
3. Wooden beam for flexure test
4. Torsion testing machine
5. Brinnell_s / Rock well_s hardness testing machine
6. Setup for spring tests
7. Compression testing machine
8. Izod Impact machine
9. Shear testing machine
10. Beam setup for Maxwell_s theorem verification.
11. Continuous beam setup

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL02
Name of the Course	**SURVEYING LAB**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Use different Survey instruments to collect filed data
- Calculate distances, levels and angles from collected data
- Transfer points on ground to drawing sheet
- Interpret survey data to compute areas and volumes by using different methods
- Prepare profile of land from the collected survey data

List of experiments:

1. Survey by chain survey of road profile with offsets in case of road widening.
2. Finding the area of the given boundary using compass (Closed Traverse)
3. Plane table survey; finding the area of a given boundary by the method of Radiation
4. Plane table survey; finding the area of a given boundary by the method of intersection.
5. Fly leveling : Height of the instrument method (differential leveling)
6. Fly leveling: Rise and Fall method.
7. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method.
8. Theodolite Survey: Finding the distance between two inaccessible points.
9. One Exercise on Curve setting.
10. One Exercise on contours.
11. Determination of area using total station
12. Determination distance between two inaccessible points.
13. Introduction to GPS.

References:

1. Surveying Vol No.1, 2 &3 by Dr.B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain –Laxmi Publications, seventeenth edition (2016), New Delhi.
2. Text book of Surveying by S.K. Duggal (Vol No. 1&2), McGraw Hill Education; Fourth edition (1 July 2017), New Delhi.
3. Text book of Surveying,Dr.K.R.Arora (Vol No. 1&2), STANDARD BOOK HOUSE SINCE 1960; Edition: Year-2015 edition (2015), Delhi.

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL03
Name of the Course	**CONCRETE TECHNOLOGY LAB**					
Branch	CIVIL ENGINEERING					

Course outcomes:

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

- Find some properties of cement by consistency, fineness, setting times, specific gravity, soundness and compressive strength.
- Determine the workability of cement concrete by compaction factor, slump and Vee – Bee tests.
- Determine properties of self-compacting concrete by Slump cone, V funnel, L Box
- Determine the specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
- Determine the flakiness and elongation index of coarse aggregates.
- Determine the bulking of sand.
- Understand the non-destructive testing procedures on concrete

I. Tests on Cement

1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity of cement
4. Soundness of cement.
5. Compressive strength of cement.

II. Tests on Aggregate

1. Sieve Analysis and gradation chairs
2. Bulking of sand.
3. Bulk and compact densities of fine and coarse aggregates

III. Tests on Fresh Concrete

1. Slump test
2. Compact factor test
3. Vee-bee Test
4. Flow Table Test

Tests on Self Compacting Concrete

1. Slump cone
2. V funnel
3. L Box

IV. Tests on hardened concrete

1. Compression test on cubes & Cylinders
2. Flexure test
3. Splitting Tensile Test
4. Modulus of Elasticity

V. Non Destructive tests of concrete

1. Rebound hammer
2. Ultrasound pulse Velocity (UPV)

Text Books:

1. Concrete Technology, M. S. Shetty. – S. Chand & Company

References:

1. Concrete Technology, M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi.

Codes for reference:

1. IS: 4031 – chemical analysis and tests on cement.
2. IS 650:1991 –Standards and testing
3. IS 383:1970- Specification for coarse & fine aggregate
4. IS 2386 (Part III) 1963- Methods of test for aggregate for specific gravity, density, voids, absorption & bulking
5. IS 516:1959- Specification for compressive strength, Flexural strength
6. IS 5816:1999-Method of test for splitting tensile strength of concrete.
7. IS 13311(Part 1):1992 Methods of non-destructive testing of concrete: Part 1 Ultrasonic pulse velocity.
8. IS 13311(Part 2):1992 Methods of non-destructive testing of concrete: Part 2 Rebound hammer.
9. IS 6461(Part 7):1973 Glossary of terms relating to cement concrete: Part 7 Mixing, laying, compaction, curing and other construction aspects.

IV SEMESTER – SYLLABUS

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET05
Name of the Course	**ENGINEERING GEOLOGY**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Relate the features of geological agents (K3)
- Employ different techniques to identify different types of minerals and rocks (K3)
- Interpret hazard zonaation with reference to secondary structures (K3)
- Review earthquakes and landslides and their resulting subsidence (K3)
- Examine the engineering geological conditions of the strata and its suitability to major projects like Dams, Tunnels and Reservoirs etc. (K3)

SYLLABUS

UNIT I

Introduction: Branches of geology, Importance of geology in Civil engineering with case studies. Physical Geology: Geological processes, Weathering, Erosion and Civil engineering importance of weathering and Erosion

UNIT II

Mineralogy: Definition of mineral, Importance of study of minerals, Significance of different physical properties in mineral identification, Study of physical properties, Structure and chemical composition of common rock forming and economic minerals viz. Feldspar, Quartz, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Apatite , Kyanite, Garnet, Beryl, Talc, Calcite, Dolomite, Pyrite, Hematite, Magnetite, Galena, Graphite, Magnesite, Bauxite and Clay minerals Petrology: Introduction, Civil Engineering importance of petrology, Definition of Rock, Rock cycle, Geological Classification of rocks Igneous Rocks: Forms, Structures and textures of igneous rocks, Megascopic description and civil engineering uses of Granite, Basalt, Dolerite, Pegmatite and Charnockite Sedimentary Rocks: Formation, Structures and textures of sedimentary rocks, Megascopic description and civil engineering uses of Laterite, Conglomerate, Sand stone, Lime stone and Shale Metamorphic Rocks: Types of metamorphism, Structures and textures of metamorphic rocks, Megascopic Description and Civil engineering uses of Gneiss, Schist, Quartzite, Marble and Slate

UNIT III

Structural Geology: Introduction, Out crop, Strike and dip, Causes for development of secondary structures, Classification of Structures associated with Folds, Faults, Joints, Unconformities and their Civil engineering importance

UNIT IV

Earthquakes: Classification and causes, Intensity and magnitude and their measuring scales, Effects of earthquakes, Seismic belts, Civil Engineering considerations in seismic areas, Seismic zones of India Land Slides: Classification, Causes and effects, Preventive measures of landslides Ground water: Introduction, Classification of rocks based on porosity and permeability, Types of aquifers, Effects of groundwater over draft

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods

UNIT V

Dams & Reservoirs: Types of Dams, Geological considerations for the selection of dam sites, Stages of investigation, Case histories of few dam failures, Geology of few Indian dam sites

Tunnels: Purpose of Tunneling, Geological considerations for tunneling, Effects of tunneling, Over break, Geology of some tunnel sites

Textbooks:

1. A text Book of Engineering Geology by N. Chenna Kesavulu, Macmillan India Ltd., Delhi, second edition, 2009.
2. Principles of Engineering Geology by K M Bangar, Standard Publishers and Distributers, 2009.
3. Principles of Engineering Geology- K Gokhale, B. S. Publication, Revised Edition, 2010.

Reference Books:

1. Fundamentals of Engineering Geology, F.G.Bell, published by Butterworth-Heinemann, 1983.
2. Principles of Engineering Geology and Geotechnics by D P Krynine and W R Judd, CBS Publishers & Distribution, first edition, 2005.
3. Engineering Geology for Civil Engineers by D. Venkata Reddy, Oxford & IBM Publishing Company Pvt. Ltd., New Delhi, second edition, 2017.
4. Engineering and General Geology by Parbin Singh, Published by S. K. Kataria & Sons, New Delhi, 2013.
5. Engineering Geology and Rock Mechanics by Dr B.P.Varma, Khanna Publishers, Delhi, 1998.

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET06
Name of the Course	**STRUCTURAL ANALYSIS-I**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

Upon completion of the 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 Deflections of fixed beams for different fixity conditions (K3)
- Calculate Shear Force, Bending Moment and Deflections of Continuous beams for different fixity conditions (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

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 V

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	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET07
Name of the Course	**WATER RESOURCES ENGINEERING**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Calculate average rainfall and check consistency, continuity of rainfall (K3)
- 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)

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.

Textbooks:

1. —Engineering Hydrology||, Subramanya K., Tata Mc Graw-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.

References:

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.R and Bhunya. P., Oxford University Press,

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	0	0	3	V20CET08
Name of the Course	TRANSPORTATION ENGINEERING					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Design highway geometric elements for the decided alignment through engineering surveys (K3)
- Analyze and design of flexible, rigid pavements and examine pavement construction activities and also conduct quality control at site (K3)
- Analyze and design of traffic infrastructure facilities and evaluate pavement condition to suggest remedial measures (K3)
- Analyze the Railway Track Geometric Elements (K3)
- Analyze and design geometric elements of Airport Runway and Taxiway and classify the various components of Dock & Harbors (K3)

SYLLABUS

UNIT I

Highway Alignment and Geometric Design: Historical development of roads– Highway development in India –Different Road Development Plan– Highway Alignment–Factors affecting Alignment– Engineering Surveys. Highway Geometric Design: Importance of Geometric Design– Factors– Highway Cross Section Elements–Sight Distance Elements–Design of Horizontal Alignment–Design of Vertical alignment.

UNIT II

Design of Pavements and Highway Construction: Types of pavement– Components of pavement–Flexible Pavements – Design factors – Flexible Pavement Design Methods– Mechanistic method, Rigid Pavements– Design Considerations– wheel load stresses– Temperature stresses–Design of slabs– IRC method of rigid pavements–Highway Construction–Types of Highway Construction – Earthwork – Stabilization of soils–Construction of Bituminous Pavements –Construction of Cement Concrete Pavements

UNIT III

Highway Maintenance and Traffic Infrastructure Design: Pavement Failures – Pavement Condition Survey–Maintenance of Highways– Pavement evaluation– Strengthening of existing pavements– Traffic Engineering – Basic Parameters of Traffic– Volume,– Speed– Density- Volume Studies Speed Studies– spot speed– speed & delay studies, Parking Studies, Condition Diagram and Collision Diagrams-–PCU Factors –Capacity and LOS of Highways – Road Traffic Signs –Road markings – Types of Intersections– At-Grade Intersections–Design of Traffic Signals– Webster Method .

UNIT IV

Railway Engineering : Permanent way – Components and their functions – Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings – Geometric Design of Railway Track: Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency –Degree of Curve , Layout of Railway stations and yards – Signals – Interlocking –Track layouts –Turnouts – Layout of Turnout – Crossings –Diamond crossing – Scissors crossing. Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems

UNIT V

Airport Planning and Docks Harbors: Airport Master plan – Airport site selection – Air craft characteristics –Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway – Terminal area. Docks Harbors: Layout of Port components – Functions –Classification of Ports – Site selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational aids.

Textbooks

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros.,Roorkee.
2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi.
3. Railway Engineering, Satish Chandra and Agarwal M. M., Oxford University Press, New Delhi.
4. Airport Engineering, Khanna & Arora, Nemchand Bros, New Delhi.
5. Docks and Harbor Engineering, Bindra S.P., Dhanpathi Rai & Sons, New Delhi.

References

1. Principles of Transportation Engineering, Partha Chakroborthy 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. Railway Engineering, Saxena & Arora, Dhanpat Rai, New Delhi.
5. Airport Engineering Planning & Design, Subhash C. Saxena, CB Publishers, New Delhi.
6. Transportation Engineering, Railways, Airports, Docks & Harbors, Srinivasa Kumar R, University Press, Hyderabad.

IRC CODES

- IRC 37–2018: Guidelines for the Design of Flexible Pavements, Indian Road Congress Publications, New Delhi.
- IRC58–2015: Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Road Congress Publications, New Delhi.

- MORTH - Specifications for Road and Bridge works, Indian Road Congress Publication, New Delhi, Latest Edition.

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL04
Name of the Course	**ENGINEERING GEOLOGY LAB**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Understand the importance of geology in civil engineering
- Identify the geological process of any region to carry civil engineering works
- Evaluate the formation and properties of minerals, rocks and soil
- Develop the ability to prepare geological maps and sections to interpret site conditions

List of Experiments

1. Physical properties of minerals and their megascopic identification
2. Rock forming minerals: Quartz group, Feldspar group, Garnet group, Mica group, Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum etc.
3. Ore forming minerals: Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite etc.
4. Megascopic description and identification of rocks
5. Igneous rocks: Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
6. Sedimentary rocks: Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.
7. Metamorphic rocks: Biotite, Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc.
8. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
9. Simple Structural Geology problems
10. Bore hole data
11. Strength of the rock using laboratory tests
12. Field work to identify Minerals and Rocks, Geomorphology and Structural Geology

References:

1. Applied Engineering Geology Practicals by M T Maruthesha Reddy, New Age International Publishers, Second Edition, 2007.
2. Foundations of Engineering Geology by F G Bell, B S Publications, first edition, 2005.

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL05
Name of the Course	**FLUID MECHANICS & HYDRAULIC MACHINERY LAB**					
Branch	CIVIL ENGINEERING					

Course Outcomes:

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

- Employ the basic principles of Fluid mechanics to assess discharge with different devices and different losses in a pipe line (K3)
- Calculate the performance parameters of Reciprocating and Centrifugal pumps (K3)
- Calculate the performance parameters of different types of turbines (K3)

List of Experiments

1. Determination of friction factor for the given pipe line.
2. Determination of loss of head due to sudden contraction.
3. Determination of force exerted by a jet on a vane.
4. Calibration of Venturimeter.
5. Calibration of Orificemeter.
6. Calibration of Turbine flow meter.
7. Determination of performance parameters of Reciprocating pump.
8. Determination of performance parameters of Single stage Centrifugal pump.
9. Determination of performance parameters of Multi stage Centrifugal pump.
10. Determination of performance parameters of Pelton wheel.
11. Determination of performance parameters of Francis Turbine.
12. Determination of performance parameters of Kaplan Turbine.

Add On Experiments:

1. Determination of loss of head due to sudden expansion.
2. Verification of Bernoulli_s theorem.

References:

1. Fluid Mechanics and Fluid Machines lab – College lab manual.
2. Hydraulics And Fluid Mechanics Including Hydraulics Machines (In Si Units)
   – Modi & Seth,20th edition, Standard publishers, 2015.

Year/Sem	**IV Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	0	0	3	1.5	V20CEL06
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 angles 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. Marshal 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. IRC Codes of Practice
3. Asphalt Institute of American Manuals
4. Code of Practice of B.I.S.

ANNEXURE – CE-IV

COURSE STRUCTURE PROPOSED FOR M.Tech (Structural Engineering)

(For 2021 - 2022 Admitted Batch) - V21 Regulation

I SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V21STET01	Theory of Elasticity	3	0	0	3
2	V21STET02	Structural Dynamics	3	0	0	3
3	V21STET03 V21MAT01 V21STET04	Elective I 1. Matrix Analysis of Structures 2. Analytical & Numerical Methods for Structural Engineering (Bos of Maths) 3. Design of RCC Foundations	3	0	0	3
4	V21STET05 V21STET06 V21STET07	Elective II 1. Bridge Engineering 2. Repair and Rehabilitation of Structures 3. Structural Optimization	3	0	0	3
5	V21STET08	Advanced Concrete Technology	2	0	0	2
6	V21STEL01	Advanced Concrete Technology Laboratory	0	0	4	2
7	V21STEL02	Advanced Structural Engineering Laboratory	0	0	4	2
8		Audit Course -1	2	0	0	0
Total			16	0	8	18

Total Contact Hours : 24

Total Credits : 18

II **SEMESTER**

S.No	Course Code	Course Name	L	T	P	C
1	V21STET09	Finite Element Methods in Structural Engineering	3	0	0	3
2	V21STET10	Stability of Structures	3	0	0	3
3	V21STET11 V21STET12 V21STET13	Elective III 1. Theory of Plates and Shells 2. Advanced Steel Design 3. Analysis of Offshore Structures	3	0	0	3
4	V21STET14 V21STET15 V21STET16	Elective IV 1. Earthquake Resistant Design of Buildings 2. Precast and Prefabricated Structures 3. Earth Retaining Structures	3	0	0	3
5	V21STET17	Advanced Reinforced Concrete Design	2	0	0	2
6	V21STEL03	Structural Design laboratory	0	0	4	2
7	V21STEP01	Mini Project With Seminar	0	0	4	2
8		Audit Course -2	2	0	0	0
Total			16	0	8	18

Total Contact Hours : 24

Total Credits : 18

Audit course 1 & 2

1. English for Research Paper Writing - V21PGENT54(BOS English)
2. Disaster Management (BOS of CIVIL) - V21STEAC1
3. Value Education (BOS English) - V21PGENT55
4. Constitution of India (BOS English) - V21PGENT56
5. Pedagogy Studies (BOS English) - V21PGENT51
6. Personality Development through Life Enlightenment Skills (BOS English)
   - V21PGENT52
7. Stress Management by Yoga - V21PGENT53

III **SEMESTER**

S.No	Course Code	Course Name	L	T	P	C
1	V21STET18 V21STET19 V21STET20	Elective III/ MOOCS*/NPTEL* 1. Design of Prestressed Concrete Structures 2. Structural Health Monitoring 3. Industrial Structures 4. MOOCS-1 through NPTEL/SWAYAM 12 Week Programme related to the programme which is not listed in the course structure	3	0	0	3
2	V21MAT02 V21MBT56	Open Elective / MOOCS*/NPTEL* 1. Operational Research (BOS of Maths) 2. Cost Management of Engineering Projects (BOS of MBA) 3. MOOCS-2 through NPTEL/SWAYAM 12 Week Programme related to the programme which is not listed in the course structure	3	0	0	3
3	V21STEP02	Project Phase I	0	0	20	1 0
Total			6	0	20	16

Total Contact Hours: 26

Total Credits : 16

IV **SEMESTER**

S.No	Course Code	Course Name	L	T	P	C
1	V21STEP03	Project Phase II	0	0	32	16
Total			0	0	32	16

Total Contact Hours: 32

Total Credits : 16

SYLLABI PROPOSED FOR M.Tech

(Structural Engineering)

I SEMESTER – SYLLABUS

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET01
Name of the Course	**THEORY OF ELASTICITY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Relate the stress and deformation and how to determine the components of the stress and strain tensors (K3)
- Apply the conditions of compatibility and equations of equilibrium (K3)
- Employ the mechanical characteristics of materials, constitutive equations and generalized Hook law (K3)
- Use the equilibrium equations stated by the displacements and compatibility conditions stated by stresses (K3)
- Develop index notation of equations, tensor and matrix notation and define state of plane stress, state of plane strain (K3)

SYLLABUS

UNIT I

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations Stress function – Boundary Conditions.

UNIT II

Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading.

UNIT III

Two dimensional problems in polar coordinates - General equations in polar coordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT IV

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

UNIT V

Torsion of Prismatic bars - Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method.

Text Books:

1. 1.Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers
2. Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers
3. Theory of Elasticity By A.I. Lurie

References:

1. Elasticity: Theory, Applications and Numeric Martin H. Sadd, Wiley Publishers
2. Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishers.
3. An Introduction to the Theory of Elasticity
4. By R. J. Atkin, N. Fox · 2005, Dover Publications

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET02

Name of the Course	**STRUCTURAL DYNAMICS**
Branch	STRUCTURAL ENGINEERING

Course Outcomes:

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

- Asses the behavior of structures subjected to dynamic loads Harmonic excitation and earthquake load(K3)
- Demonstrate the behavior and response of SDOF structures with various dynamic loading. (K3)
- Illustrate the response of structural systems to dynamic loads and Realize the behavior and response of linear and nonlinear SDOF and MDOF structures with various dynamic loading. (K3)
- Develop the ability to find out suitable solution for continuous system of various beams with different end conditions. (K3)
- Interpret the analysis of building subject to earthquake by various methods. (K3)

SYLLABUS

UNIT I

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Victorian representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle.

UNIT II

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton‘s law of motion / D‘Alembert‘s Principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems : Formulation and solution of the equation of motion – Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate - SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

Text Books:

1. Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2. Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors
3. Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

References:

1. Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
2. Theory of Vibration -William T Thomson, Springer Science.
3. Mechanical Vibrations- S. S. Rao, 5e, Pearson Publications.
4. Structural Dynamics of Earthquake Engineering - Theory and Application using Mathematica and Matlab- S. Rajasekharan.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET03
Name of the Course	**MATRIX ANALYSIS OF STRUCTURES**					

Branch	STRUCTURAL ENGINEERING

Course Outcomes:

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

- Assess the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods (K3)
- Solve multiple degree of freedom two- and three-dimensional problems involving trusses, beams, frames and plane stress (K3)
- Asses the analysis of grid element by stiffness method (K3)
- Discuss the band width, loads at joints and their support displacement (K2)
- Complete analysis of plane frames with and without side sway by various approaches. (K3)

SYLLABUS

UNIT I

Introduction of matrix methods of analysis - Static and kinematic indeterminacy – Degree of freedom– Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force -displacement equations.

UNIT II

Stiffness method - Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT III

Stiffness method for Grid elements - development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT IV

Additional topics in stiffness methods - discussion of band width – semi band width – static condensation – sub structuring –Loads between joints- Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT V

Analysis of plane frame - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using system approach.

Text Books:

1. Matrix analysis of structures, Robert E Sennet- Prentice Hall-Englewood cliffs,New Jercy.
2. Advanced structural analysis, P. Dayaratnam, Tata McGraw hill publishing company limited.
3. Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hill Education

References:

1. Indeterminate Structural analysis, C.K Wang, Amazon Publications
2. Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E. Bowls, Amazon Publications.
4. Matrix Analysis of Framed Structures -William Weaver, Jr.James M. Gere, Van Nostrand Reinhold, Newyork.
5. Matrix Methods of Structural Analysis Madhu B.Kanchi, Wiley Publications.
6. Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing house.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21MAT01
Name of the Course	**ANALYTICAL& NUMERICAL METHODS FOR STRUCTURAL ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Calculate of Laplace transform methods on heat conduction problems (K3)
- Apply the principles and techniques of Elliptic Equations-Laplace equation (K3)
- Develop the principles and techniques of Integral Equations (K3)
- Adopt the principles and techniques of Finite Difference and their Applications (K3)
- Apply the principles and techniques of Numerical Integration (K3)

SYLLABUS

UNIT I

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT II

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation-Calculus Of Variations-Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods

UNIT III

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT IV

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems - Richardson's extrapolation - Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

UNIT V

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculations of Slopes & Deflections.

Textbooks:

1. Introduction to Partial Differential Equations, Sankar Rao. K, PHI, New Delhi, 1995
2. Numerical Methods For Scientific and Engineering Computations. M. K. Jain- S. R. K. Iyengar – R. K. Jain, New Age International (p) Ltd., Publishers.
3. Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu Macmillan Publishers

References:

1. Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers, Moscow, 1966
2. Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, Sultan Chand & Sons, Reprint 1999.
3. Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4. Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986
5. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers New Delhi

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET04
Name of the Course	**DESIGN OF RCC FOUNDATIONS (Elective-I)**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Attain the perception of site investigation to select suitable type of foundation based on soil category (K3)
- Capable of ensuring design concepts of shallow foundation (K3)
- Can be efficient in selecting suitable type of pile for different soil stratum and in evaluation of group capacity by formulation (K3)
- Design different types of well foundation (K3)
- Explain the properties of soil and mechanism of suitable foundation (K3)

SYLLABUS

UNIT I

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations**.**

Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design of Rectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, Design Calculation for Pedestals.

UNIT II

Wall Footings - Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.

Strip Footings Under Several Columns - Introduction, Design Procedure for Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip

Footing for Unsymmetrical Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT III

Raft Foundations - Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.

Design of Flat Slab Rafts-Mat Foundations - Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailing of Steel, Design of Edge Beam in Flat Slabs.

Beam and Slab Rafts – Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

UNIT IV

Combined Piled Raft Foundations (CPRF) - Introduction, Types and uses of Piled Rafts, , Interaction of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methods of Analysis.

Circular and Annular Rafts - Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT V

Under-reamed Pile Foundations - Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of Free Standing Basement Walls.

Text Books:

1. Design of Reinforced Concrete Foundations by P. C Varghese, PHI Learning Private Limited., New Delhi.
2. Krishnaraju.N — Design of Reinforced Concrete Structurres", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Design of Reinforced Concrete Structures by N. Subramaniam- Oxford University.

References:

1. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill.
2. Ramachandra, —Limit state Design of Concrete Structures— Standard Book House, New Delhi.
3. IS 456 (2000): Plain and Reinforced Concrete - Code of Practice.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET05
Name of the Course	**BRIDGE ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Illustrate the different types of loads and stresses acting on various bridges (K3)
- Asses the various methodologies to analyses the bridges and also interpret the specifications of bridge super structure (K3)
- Demonstrate the box culverts and its design (K3)
- Develop the knowledge on design of plate girder bridges (K3)
- Illustrate the different types of bearings, abutments, piers and various types of foundations for Bridges (K3)

SYLLABUS

UNIT I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces- Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT II

Design of Girders & Slabs: Pigeaud's Method Design of longitudinal girders-Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref: IRC-21), voided slabs.

Super Structure: Slab bridge- Wheel load on slab- effective width method-slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- T-Beam bridges.

UNIT III

Box Culverts: Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT IV

Plate Girder Bridges: Elements of plate girder and their design-web-flange-intermediate stiffener- vertical stiffeners- bearing stiffener-design problem

UNIT V

Sub structure: Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment-culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP-13)

Text Books:

1. 1.Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
3. 3.Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

References:

1. Bridge Deck Behavior- E.C. Hambly 2e- CRC Press
2. Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing Company Limited
3. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4. IRC 112-2011 Code of Practice for Concrete Road Bridges.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET06
Name of the Course	**REPAIR AND REHABILITATION OF STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures. (K2)
- Describe and suggest repair strategies for deteriorated concrete structures including repairing with composites. (K2)
- Develop the methods of strengthening methods for concrete structures. (K3)
- Demonstrate the fiber reinforced concrete and its properties. (K3)
- Examine the structural member's strength by high performance concrete. (K3)

SYLLABUS

UNIT I

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-Non destructive evaluation: Importance- 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 II

Strengthening and stabilization: Techniques- design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT III

Bonded installation techniques: Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding

mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures

UNIT IV

Fibre reinforced concrete: Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Lightweight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Fly ash concrete-Introduction- classification of Fly ash-properties and reaction mechanism of fly ash- Properties of fly ash concrete in fresh state and hardened state- Durability of fly ash concretes

UNIT V

High performance concretes: Introduction- Development of high-performance concretes- Materials of high-performance concretes- Properties of high-performance concretes- Self Consolidating concrete- properties-qualifications.

Textbooks:

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications
3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

References:

1. **Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company**
2. **Concrete Repair and Maintenance illustrated- Peter H Emmons**
3. **Concrete Chemical Theory and Applications- Santa Kumar A.R. Indian Society for Construction Engineering and Technology, Madras**
4. **Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi**

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET07
Name of the Course	**STRUCTURAL OPTIMIZATION**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Study the optimization methodologies applied to structural engineering
- Solve some continuous structural optimization problems using calculus of variations.
- Have sufficient knowledge on various optimization techniques like, non-linear programming, geometric and dynamic
- Describe numerical algorithms and linear programming suitable for structural optimization problems.
- Use and describe quadratic and dynamic programming .

SYLLABUS

UNIT I
Introduction: Need and scope for optimization – statements of optimization problems Objective function and its surface design variables- constraints and constraint surface Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT II
Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms introduction, characteristics of fully stressed design theoretical basis-examples

UNIT III
Non-Liner programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel‘s method, Newton‘s method and Davidon Fletcher Powell‘s method for multivariable optimization- Constrained minimization- Cutting plane method- Zoutendjik‘s method- penalty function methods

UNIT IV
Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame

UNIT V
Introduction to quadratic programming: Geometric programming- and dynamic programming Design of beams and frames using dynamic programming technique

Text books:

1. Iyengar.N.G.R and Gupta.S.K, —Structural Design Optimization||, Affiliated East West Press Ltd, New Delhi, 1997 .
2. Rao,S.S. —Optimization theory and applications||, Wiley Eastern (P) Ltd., 1984
3. Spunt, —Optimization in Structural Design||, Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971.
4. Uri Krish, —Optimum Structural Design||, McGraw Hill Book Co. 1981

References:

1. G. Hadley,"Linear programming", Narosa Publishing House, New Delhi, 1990.
2. H.A. Taha,"Operations Research:An Introduction", 5th Edition, Macmillan, New York, 1992.
3. K. Deb,"Optimization for Engineering DesignAlgorithms and Examples",Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
4. K.Srinivasa Raju and D. Nagesh Kumar, "Multicriterion Analysis in Engineering and Management",PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.28

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	2	0	0	2	V21STET08
Name of the Course	**ADVANCED CONCRETE TECHNOLOGY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Explain the materials of concrete and its chemical proportions (K2)
- Describe the fresh and hardened properties of concrete (K2)
- Explain high strength and high-performance concrete manufacturing process and its properties (K2)
- Develop the special concrete and enhance the durability properties (K3)
- Describe the formwork considerations used in designs (K2)

SYLLABUS

UNIT I

Concrete Making Materials: Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures - Bureau of Indian Standards (BIS) Provisions.

UNIT II

Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.

Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept – Stress strain Behaviour– Creep and Shrinkage – Durability Tests on Concrete – Non-Destructive Testing of Concrete. BIS Provisions**.**

UNIT III

High Strength Concrete - Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.

High Performance Concrete - Requirements and Properties of High-Performance Concrete – Design Considerations. BIS Provisions.

UNIT IV

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method– Light Weight Concrete, Self-Compacting Concrete.

UNIT V

Form work - materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms - shores – reshoring – failure of form work**.**

Text Books:

1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.
2. Concrete Technology by A. R. Santhakumar, 2nd Edition, Oxford University Press.
3. Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

References:

1. **Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J. Monteiro,. Mc. Graw-Hill Publishing Company Ltd. New Delhi**
2. **Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.**
3. **Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.**
4. **IS 10262-2009: Concrete Mix Proportioning - Guidelines.**

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL01
Name of the Course	**ADVANCED CONCRETE TECHNOLOGY LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop relation between Water / Cement Ratios Vs Workability, Water / Cement Ratios Vs Strength in concrete.
- Develop strength and workability relation between fine aggregate, coarse aggregates.
- Calculate Strain measurement in concrete.
- Assess concrete properties by using Non destructive testing methods.
- Find properties of Self compaction concrete by using L Box , J Box , U box and Slump tests

SYLLABUS

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- Impact Hammer test, UPV test
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests

NOTE: **A minimum of five experiments from the above set have to be conducted.**

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL02
Name of the Course	**ADVANCED STRUCTURAL ENGINEERING LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Conduct various laboratory tests on Cement, Aggregates
- Know strain measurement
- Non destructive testing
- Chemical analysis on concrete and Aggregate and Sand

List of Experiments:

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections
2. Study on Performance of RCC Beams designed for Bending and failing in Shear
3. Study on Performance of RCC Beams designed for Shear and failing in Bending
4. Study on Performance of RCC One way slabs
5. Study on Performance of RCC Two way slabs with simply supported edge conditions
6. Study on Performance of RCC Two way slabs with fixed edge conditions
7. Calculation of Young's Modulus of Elasticity of Concrete
8. Extraction and Study of Concrete Core samples from pavements

NOTE : **A minimum of five experiments from the above set have to be conducted as demonstration to entire class..**

II SEMESTER – SYLLABUS

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET09
Name of the Course	**FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute principle of potential energy of an elastic body (K3)
- Calculate the stiffness matrices of truss element (K3)
- Calculate the stiffness matrices of beam elements (K3)
- Interpret displacements, strains and stress resultants (K3)
- Formulate the shape functions for element (K3)

SYLLABUS

UNIT I

Introduction: Review of stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches -weighted residual methods

UNIT II

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin‘s method for 1-D truss – Computation of stress in a truss element.

UNIT III

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading-Galerkin‘s method - 2-D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame examples.

UNIT IV

Finite element formulation: Plane stress, plane strain and axi-symmetric problems- Derivation of CST and LST stiffness matrix and equations- treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems- comparison of CST and LST elements – convergence of solution- interpretation of stresses.

UNIT V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

Text Books:

1. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & Sons Publications
3. Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Bhatti, M.A. Wiley Publications
4. A first course in the Finite Element Method, Dary L. Logan, Thomson Publications.

References:

1. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D.Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited.
3. Introduction to Finite Element Method, Desai & Abel CBS Publication.
4. An Introduction to Finite Element Method- Reddy, J. N., McGraw-Hill Education.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET10
Name of the Course	**STABILITY OF STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop differential equation based on loading and end conditions of beam column (K3)
- Illustrate and work out the elastic buckling using various methodologies (K3)
- Illustrate and work out the in-elastic buckling using various methodologies (K3)
- Assess the torsional buckling behaviour of pure and non uniform torsion of thin walled bars (K3)
- Illustrate and work out the lateral buckling of various cross sections (K3)

SYLLABUS

UNIT I

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT II

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT III

In-elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical

Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix-Applications to simple frames

UNIT IV

Torsional Buckling: Pure torsion of thin walled bars of open cross section – Non uniform torsion of thin walled bars of open cross section - Torsional buckling – Buckling of Torsion and Flexure

UNIT V

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

Text Books:

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere-Mc Graw Hill Publications
3. Theory of Elastic Stability by Manikaselvam

References:

1. Fundamentals of Structural Stability by George J Smith & Dewey H. Hodges, Elsevier Publications
2. Elastic Stability of Structural Elements, N.G.R. Iyengar Macmillan Publications
3. Structural stability of Steel, Theodore v. Galambos & andrea e. Surovek

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET11
Name of the Course	**THEORY OF PLATES AND SHELLS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Analyze Navier's solution, Levy's solution and solve for the rectangular and square plates (K3)
- Analyze circular plates with various boundary conditions (K3)
- Practice on the finite difference method of solving plate problems(K3)
- Develop the potential energy principle and find the solution of rectangular plates for various loadings(K3)
- Identify the behavior of folded plates and shells.(K3)

SYLLABUS

UNIT I

Rectangular Plates: Derivation of governing differential equation for plate– in plane bending and transverse bending effects - Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy's type of solutions for various boundary condition.

UNIT II

Circular plates: Symmetrically loaded, circular plates under various loading conditions, annular plates.

UNIT III

Shells: Introduction to Shells- Single and double curvature- Equations of Equilibrium of shells. Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT IV

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT V

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

Text Books:

1. Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw-Hill book company, INC, New York.
2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications
3. Analysis of Thin Concrete Shells by K. Chandrasekhara, New Age International (P) Ltd

References:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill, New York

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET12
Name of the Course	**ADVANCED STEEL DESIGN**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Examine the simple connection used in various joints and design of connection (K3)
- Assess the plastic analysis to different beams based on their considerations (K3)
- Illustrate the eccentric and moment connection on various structural members (K3)
- Develop and analyse the industrial buildings subjected to transverse and lateral loading (K3)
- Complete the design of steel truss girder bridges and strengthening measures to girders (K3)

SYLLABUS

UNIT I

Simple Connections - Riveted, Bolted Pinned And Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT II

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT III

Eccentric and Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT IV

Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT V

Design af Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

Text Books:

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes Journals Department.

References:

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III - 2015

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Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET13
Name of the Course	**ANALYSIS OF OFFSHORE STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Illustrate different types of offshore structures. (K3)
- Calculation of Conservation mass and momentum. (K3)
- Assess the Wave force estimation on small bodies. (K3)
- Assess the Wave force estimation on long bodies. (K3)
- Compute Static and dynamic analysis of fixed offshore structures. (K3)

SYLLABUS

UNIT I

Introduction: Types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

UNIT II

Dynamics and Kinematics : Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy's theory, dispersion relationship, water particle kinematics, wave energy.

UNIT III

Wave force on small bodies: Estimation - Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

UNIT IV

Wave force on large bodies: Froude-krylov theory, Diffraction theory.

UNIT V

Static and dynamic analysis of fixed offshore structures.

Text Books:

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.

References:

1. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
2. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis, Inc., Plainfield, Illinois, USA.
3. Dynamic Analysis and Design of Offshore Structures 2015th Edition, by Srinivasan Chandrasekaran

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET14
Name of the Course	**EARTHQUAKE RESISTANT DESIGN OF BUILDINGS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Demonstrate the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, magnitude and propagation of ground motion. (K3)
- Assess the seismic design concepts of various moment resisting frames and their ductility behaviour (K3)
- Compute the earthquake load on various building frames and study on ductile behavior of building frames (K3)
- Assess the Cyclic loading behavior of RC, steel and pre- stressed concrete elements (K3)
- Illustrate the methods of Retrofitting and restoration of buildings subjected to damage due to earthquakes (K3)

SYLLABUS

UNIT I

Engineering seismology: Rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects

UNIT II

Seismic design concepts: EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non-structural elements

UNIT III

Calculation of EQ load: 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames

Concept of strong column weak beams, Design and ductile detailing of shear walls.

UNIT IV

Cyclic loading behavior of RC, steel and pre- stressed concrete elements: modern concepts- Base isolation – Adaptive systems – case studies

UNIT V

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

Text Books:

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice Hall of India, 2007, New Delhi.
2. Earthquake Resistant Design of Structures- S.K. Duggal, Oxford Publications.
3. Seismic design of reinforced concrete and masonry buildings by Paulay and Priestley .

References:

1. Earthquake Resistant Design and Risk Reduction- David Dowrick
2. IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings
3. IS 1893 (Part 1 to 5)- 2016: General Provisions and Building
4. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
5. IS 13920-2016: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
6. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET15
Name of the Course	**PRECAST AND PREFABRICATED STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes

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

- Explain impotence of prefabrication and Principles of Prefabrication. (K3)
- Find Prefabricated Load Carrying Members. (K3)
- Assess Joints for different structural connections. (K3)
- Analyze the production technology of prefabrication. (K3)
- Design and detailing of precast UNIT for factories. (K3)

SYLLABUS
UNIT I

Introduction to prefabrication: General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT II

Prefabricated Members: Load Carrying Capacity - Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls..

UNIT III

Joints: Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT IV

Production Technology: Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection,

techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT V

Designing and detailing of precast: For factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Text Books:

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

References:

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET16
Name of the Course	**EARTH RETAINING STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute the lateral earth pressures associated with different earth systems (K3)
- Assess the failure criterion and stability requirements in selecting the most technically appropriate type of retaining wall (K3)
- Employ different techniques to design a sheet pile structure considering both external and internal stability (K3)
- Apply the knowledge of reinforced earth in the designing the earth retaining systems (K3)
- Relate different methods in analyzing the stability of braced cuts and cofferdams (K3)

SYLLABUS

UNIT I

Earth pressures: Different types and their coefficients; Classical Theories of Earth pressure – Rankine‘s and Coulomb‘s Theories for Active and Passive earth pressure; Computation of Lateral Earth Pressure in Homogeneous and Layered soils; Graphical solutions for Coulomb‘s Theory in active and passive conditions.

UNIT II

Retaining walls: Types, Type of Failures of Retaining Walls – Stability requirements –Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT III

Sheet Pile Structures: Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Rowe‘s moment reduction method – Location of anchors and Design of Anchorage system.

UNIT IV

Soil reinforcement: Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.

UNIT V

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – Types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins' methods.

Text Books:

1. Principles of Foundation Engineering by Braja M Das, Cengage Learning
2. Foundation analysis and design by Bowles, J.E., McGraw Hill
3. Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph B. Peck, John Wiley & Sons.

References:

1. Earth Pressure and Earth Retaining Structures by Chris RI Clayton, Rick I woods, Andrew J Bond and Jarbas Milititsky, CRC Press, Taylor and Francis Group, New York.
2. Analysis and Design of Foundations and Retaining Structures, Samsher Prakash
3. Gopal Ranjan and Swami Saran, Saritha Prakashan Publishers, New Delhi.
4. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	2	0	0	2	V21STET17
Name of the Course	**ADVANCED REINFORCED CONCRETE DESIGN**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Explain the limit state method provisions in analysis of structures (K2)
- Apply the yield line method to analyze slab (K3)
- Develop the designs to flat slabs and ribbed slabs (K3)
- Explain the design steps involved in deep beams, corbel design procedure (K2)
- Interpret the Design method of slender and eccentric column (K3)

SYLLABUS

UNIT I

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams.

UNIT II

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple andcontinuous end conditions**.**

UNIT III

Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements**.**

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs. Detailing of reinforcement.

UNIT V

Design of Slender Columns - Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Detailing of reinforcement.

Text Books:

1. Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford UniversityPress.
3. Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc.Graw-Hill Publishing Company Ltd. New Delhi 2010.

References:

1. Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah.Standard Publishers
2. Reinforced concrete structural elements – behavior, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W.Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International,editions, 2nd edition, 1991.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL03
Name of the Course	**STRUCTURAL DESIGN LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop Computer Programs for Analysis and Design of various Structural Elements
- Use different Structural Engineering software's to solve various civil Engineering programs

SYLLABUS

1. Analysis and Design of reinforced concrete multistoried building
2. Analysis of plane and space truss
3. Analysis of plane and space frame
4. Wind analysis on tall structure
5. Analysis of Cylindrical shell
6. Dynamic Analysis of Multistory structure Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

NOTE: A minimum of four from the above set have to be conducted.

References:

1. Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

III SEMESTER – SYLLABUS

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET18
Name of the Course	**DESIGN OF PRESTRESSED CONCRETE STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute the Analysis of prestress , losses in prestress and Anchorage slip (K3)
- Deflections of prestressed concrete members (K3)
- Employ types and advantages and analysis of composite sections (K3)
- Apply the knowledge of prestressed concrete slabs (K3)
- Analyze continuity beams in prestressed concrete structures (K3)

SYLLABUS

UNIT I

Introduction – Prestressing Systems – Pretensioning Systems – Postensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing - Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II

Deflections Of Prestressed Concrete Members: Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012. Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III

Composite Constructions: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate

Flexural and shear strength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV

Prestressed Concrete Slabs: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs. Prestressed Concrete Pipes and Poles : Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes - Prestressed Concrete Poles.

UNIT V

Continuous Beams: Advantage of Continuous Members – Effect of Prestressing Indeterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon's Theorem. Redistribution of moments in a continuous beam. Anchorage Zone Stresses in Beams : Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement.

Text Books:

1. Prestressed Concrete, by N. Krishna Raju, Mc Graw Hill Publishers – fourth edition
2. Prestressed Concrete by K. U.Muthu, PHI Learning Pvt Limited - 18 January 2016
3. Design of Prestressed Concrete by S.S.Bhavikatti - 1 January 2019

References:

1. 1 Prestressed Concrete Analysis and Design, Antone E. Naaman, Techno Press 3000
2. Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns
3. 3 Wiley Publications 3. Design of prestressed Concrete by E.G. Nawy

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET19
Name of the Course	**STRUCTURAL HEALTH MONITORING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Assess the structural health by investigation and regular maintenance (K3)
- Employ various measures for monitoring structural health (K3)
- Employ various Investigations for monitoring structural audit (K3)
- Discover the dynamic field testing (K3)
- Apply the knowledge of Repairing and rehabilitation of structures (K3)

SYLLABUS

UNIT I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration.

UNIT III

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT V

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo– electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Text Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring by Daniel Balageas, Claus-peter fritzen and Alfredo Guemes

References:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.
3. Advances in Condition Monitoring and Structural Health Monitoring: WCCM by Len Gelman .et.al.

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET20
Name of the Course	**INDUSTRIAL STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- functional requirements of structural systems for various industries (K3)
- Get an idea about the materials used and design of industrial structural elements (K3)
- Pre Engineered Buildings (K3)
- Realize the basic concepts and design of power plant structures (K3)
- Design power transmission structures (K3)

SYLLABUS

UNIT I

Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations.

UNIT II

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations

UNIT III

Design of Pre Engineered Buildings

UNIT IV

Power plant structures- Bunkers and silos- chimney and cooling towers- Nuclear containment structures

UNIT V

Power transmission structures- transmission line towers- tower foundations- testing towers

Text books:

1. Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center - 1 July 2017
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company -
3. The Design & Construction of Industrial Buildings by Moritz Kahn

References:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings 3. Design of steel structures by N. Subramanian
3. The Architect's Studio Companion: Rules of Thumb for Preliminary Design by Edward Allen

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21MBT56
Name of the Course	**COST MANAGEMENT OF ENGINEERING PROJECTS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Understand the cost management process and various costs involved in a project (K2)
- Understand various aspects of a project and related processes. (K2)
- Analyze the concepts of Break even and CVP analysis. (K3)
- Demonstrate quality management techniques besides budgeting strategies (K2)
- Apply quantitative techniques for cost management (K4)

SYLLABUS

UNIT I

Introduction and Overview of the Strategic Cost Management Process: Cost concepts in decision-making; relevant cost, Differential cost, Marginal cost, Incremental cost and Opportunity cost. Objectives of Costing System; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project Management: Meaning, Different types of projects.

Various stages of project execution: conception to commissioning, Project execution as a conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution, main clearances and documents.

Project team: Role of each member, Importance of Project site. Project contracts: Types and its contents. CPM & PERT Techniques.

UNIT III

Cost Behavior and Profit Planning: Marginal Costing, Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Standard Costing and Variance Analysis.

UNIT IV

Quality management and Budgeting strategies: Pareto Analysis, Target costing, Life Cycle Costing, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. **Budgetary Control**; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing & decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

ANNEXURE – CE- V

AUDIT COURSES OFFERED IN I & II SEMESTER

Audit course	I & II Sem	Disaster Management	V21STEAC1

Year/Sem		**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation Year	V21 / 2021-2022	3	0	0	3	V21STEAC1
Name of the Course	**DISASTER MANAGEMENT**					
Branch	Common to all					

Course Outcomes:

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

- Describe to student to have a idea on different natural hazards and disaster management (K2)
- Develop the student to understand manmade disaster and their management (K3)
- Prepare the student in such a way inorder to understand building codes and vulnerability of disaster (K3)
- Illustrate to student about role of technology in disaster management (K2)
- Assess the importance of education and community preparedness in disaster management to student (K3)

SYLLABUS

UNIT I

Natural Hazards and Disaster Management: Introduction of DM Disaster Management cycle – Five priorities for action- Case study methods of the following: floods, droughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

UNIT II

Man Made Disastar And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - rail and air craft's accidents-Management of these disasters

UNIT III

Risk And Vulnerability: - Building codes and land use planning – social vulnerability – environmental vulnerability -Financial management of disaster.

UNIT IV

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure - mitigation programme for earth quakes –geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.

UNIT V

Education And Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building.

Text Books:

1. Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy(2009),Universities press.
2. Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

Reference Books:

1. _Disaster Management' edited by H K Gupta (2003), Universities press.
2. Natural Hazards and Disaster Management, Vulnerability and Mitigation by RB Singh
3. Disaster Management by Harish K.Gupta

Annexure-II(b) Back

COURSE STRUCTURE PROPOSED FOR M.Tech (Structural Engineering)

(From 2021 - 2022 Admitted Batch) - V21 Regulation

I SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V21STET01	Theory of Elasticity	3	0	0	3
2	V21STET02	Structural Dynamics	3	0	0	3
3	V21STET03 V21MAT01 V21STET04	Elective I 1. Matrix Analysis of Structures 2. Analytical & Numerical Methods for Structural Engineering (Bos of Maths) 3. Design of RCC Foundations	3	0	0	3
4	V21STET05 V21STET06 V21STET07	Elective II 1. Bridge Engineering 2. Repair and Rehabilitation of Structures 3. Structural Optimization	3	0	0	3
5	V21STET08	Advanced Concrete Technology	2	0	0	2
6	V21STEL01	Advanced Concrete Technology Laboratory	0	0	4	2
7	V21STEL02	Advanced Structural Engineering Laboratory	0	0	4	2
8		Audit Course -1	2	0	0	0
Total			16	0	8	18

Total Contact Hours : 24
Total Credits : 18

II SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V21STET09	Finite Element Methods in Structural Engineering	3	0	0	3
2	V21STET10	Stability of Structures	3	0	0	3
3	V21STET11 V21STET12 V21STET13	Elective III 1. Theory of Plates and Shells 2. Advanced Steel Design 3. Analysis of Offshore Structures	3	0	0	3
4	V21STET14 V21STET15 V21STET16	Elective IV 1. Earthquake Resistant Design ofBuildings 2. Precast and Prefabricated Structures 3. Earth Retaining Structures	3	0	0	3
5	V21STET17	Advanced Reinforced Concrete Design	2	0	0	2
6	V21STEL03	Structural Design laboratory	0	0	4	2
7	V21STEP01	Mini Project With Seminar	0	0	4	2
8		Audit Course -2	2	0	0	0
Total			16	0	8	18

Total Contact Hours : 24
Total Credits : 18

Audit course 1 & 2

1. English for Research Paper Writing - V21PGENT54(BOS English)
2. Disaster Management (BOS of CIVIL) - V21STEAC1
3. Value Education (BOS English) - V21PGENT55
4. Constitution of India (BOS English) - V21PGENT56
5. Pedagogy Studies (BOS English) - V21PGENT51
6. Personality Development through Life Enlightenment Skills (BOS English) - V21PGENT52
7. Stress Management by Yoga - V21PGENT53

III SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V21STET18 V21STET19 V21STET20	Elective III/ MOOCS*/NPTEL* 1. Design of Prestressed ConcreteStructures 2. Structural Health Monitoring 3. Industrial Structures 4. MOOCS-1 through NPTEL/SWAYAM 12 Week Programme related to the programme which is not listed inthe course structure	3	0	0	3
2	V21MAT02 V21MBT56	Open Elective / MOOCS*/NPTEL* 1. Operational Research(BOS of Maths) 2. Cost Management forEngineering Projects (BOS of MBA) 3. MOOCS-2 through NPTEL/SWAYAM 12 Week Programme related to the programme which is not listed inthe course structure	3	0	0	3
3	V21STEP02	Project Phase I	0	0	20	1 0
Total			6	0	20	16

Total Contact Hours: 26
Total Credits : 16

IV SEMESTER

S.No	Course Code	Course Name	L	T	P	C
1	V21STEP03	Project Phase II	0	0	32	16
Total			0	0	32	16

Total Contact Hours: 32
Total Credits : 16

SYLLABI PROPOSED FOR M.Tech

(Structural Engineering)

I SEMESTER – SYLLABUS

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET01
Name of the Course	**THEORY OF ELASTICITY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Relate the stress and deformation and how to determine the components of the stress and strain tensors (K3)
- Apply the conditions of compatibility and equations of equilibrium (K3)
- Employ the mechanical characteristics of materials, constitutive equations and generalized Hook law (K3)
- Use the equilibrium equations stated by the displacements and compatibility conditions stated by stresses (K3)
- Develop index notation of equations, tensor and matrix notation and define state of plane stress, state of plane strain (K3)

SYLLABUS

UNIT I

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations Stress function – Boundary Conditions.

UNIT II

Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading.

UNIT III

Two dimensional problems in polar coordinates - General equations in polar coordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT IV

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

UNIT V

Torsion of Prismatic bars - Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method.

Text Books:

1. 1.Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers
2. Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers
3. Theory of Elasticity By A.I. Lurie

References:

1. Elasticity: Theory, Applications and Numeric Martin H. Sadd, Wiley Publishers
2. Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishers.
3. An Introduction to the Theory of Elasticity
4. By R. J. Atkin, N. Fox · 2005, Dover Publications

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET02

Name of the Course	**STRUCTURAL DYNAMICS**
Branch	STRUCTURAL ENGINEERING

Course Outcomes:

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

- Asses the behavior of structures subjected to dynamic loads Harmonic excitation and earthquake load(K3)
- Demonstrate the behavior and response of SDOF structures with various dynamic loading. (K3)
- Illustrate the response of structural systems to dynamic loads and Realize the behavior and response of linear and nonlinear SDOF and MDOF structures with various dynamic loading. (K3)
- Develop the ability to find out suitable solution for continuous system of various beams with different end conditions. (K3)
- Interpret the analysis of building subject to earthquake by various methods. (K3)

SYLLABUS

UNIT I

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Victorian representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle.

UNIT II

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton‘s law of motion / D‘Alembert‘s Principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems : Formulation and solution of the equation of motion – Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate - SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

Text Books:

1. Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2. Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors
3. Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

References:

1. Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
2. Theory of Vibration -William T Thomson, Springer Science.
3. Mechanical Vibrations- S. S. Rao, 5e, Pearson Publications.
4. Structural Dynamics of Earthquake Engineering - Theory and Application using Mathematica and Matlab- S. Rajasekharan.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET03
Name of the Course	**MATRIX ANALYSIS OF STRUCTURES**					

Branch	STRUCTURAL ENGINEERING

Course Outcomes:

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

- Assess the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods (K3)
- Solve multiple degree of freedom two- and three-dimensional problems involving trusses, beams, frames and plane stress (K3)
- Asses the analysis of grid element by stiffness method (K3)
- Discuss the band width, loads at joints and their support displacement (K2)
- Complete analysis of plane frames with and without side sway by various approaches. (K3)

SYLLABUS

UNIT I

Introduction of matrix methods of analysis - Static and kinematic indeterminacy – Degree of freedom– Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force -displacement equations.

UNIT II

Stiffness method - Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT III

Stiffness method for Grid elements - development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT IV

Additional topics in stiffness methods - discussion of band width – semi band width – static condensation – sub structuring –Loads between joints- Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT V

Analysis of plane frame - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using system approach.

Text Books:

1. Matrix analysis of structures, Robert E Sennet- Prentice Hall-Englewood cliffs,New Jercy.
2. Advanced structural analysis, P. Dayaratnam, Tata McGraw hill publishing company limited.
3. Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hill Education

References:

1. Indeterminate Structural analysis, C.K Wang, Amazon Publications
2. Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E. Bowls, Amazon Publications.
4. Matrix Analysis of Framed Structures -William Weaver, Jr.James M. Gere, Van Nostrand Reinhold, Newyork.
5. Matrix Methods of Structural Analysis Madhu B.Kanchi, Wiley Publications.
6. Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing house.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21MAT01
Name of the Course	**ANALYTICAL& NUMERICAL METHODS FOR STRUCTURAL ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Calculate of Laplace transform methods on heat conduction problems (K3)
- Apply the principles and techniques of Elliptic Equations-Laplace equation (K3)
- Develop the principles and techniques of Integral Equations (K3)
- Adopt the principles and techniques of Finite Difference and their Applications (K3)
- Apply the principles and techniques of Numerical Integration (K3)

SYLLABUS

UNIT I

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT II

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation-Calculus Of Variations-Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods

UNIT III

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT IV

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems - Richardson's extrapolation - Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

UNIT V

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculations of Slopes & Deflections.

Textbooks:

1. Introduction to Partial Differential Equations, Sankar Rao. K, PHI, New Delhi, 1995
2. Numerical Methods For Scientific and Engineering Computations. M. K. Jain- S. R. K. Iyengar – R. K. Jain, New Age International (p) Ltd., Publishers.
3. Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu Macmillan Publishers

References:

1. Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers, Moscow, 1966
2. Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, Sultan Chand & Sons, Reprint 1999.
3. Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4. Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986
5. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers New Delhi

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET04
Name of the Course	**DESIGN OF RCC FOUNDATIONS (Elective-I)**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Attain the perception of site investigation to select suitable type of foundation based on soil category (K3)
- Capable of ensuring design concepts of shallow foundation (K3)
- Can be efficient in selecting suitable type of pile for different soil stratum and in evaluation of group capacity by formulation (K3)
- Design different types of well foundation (K3)
- Explain the properties of soil and mechanism of suitable foundation (K3)

SYLLABUS

UNIT I

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations**.**

Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design of Rectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, Design Calculation for Pedestals.

UNIT II

Wall Footings - Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.

Strip Footings Under Several Columns - Introduction, Design Procedure for Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip

Footing for Unsymmetrical Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT III

Raft Foundations - Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.

Design of Flat Slab Rafts-Mat Foundations - Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailing of Steel, Design of Edge Beam in Flat Slabs.

Beam and Slab Rafts – Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

UNIT IV

Combined Piled Raft Foundations (CPRF) - Introduction, Types and uses of Piled Rafts, , Interaction of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methods of Analysis.

Circular and Annular Rafts - Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT V

Under-reamed Pile Foundations - Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of Free Standing Basement Walls.

Text Books:

1. Design of Reinforced Concrete Foundations by P. C Varghese, PHI Learning Private Limited., New Delhi.
2. Krishnaraju.N – Design of Reinforced Concrete Structurres", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Design of Reinforced Concrete Structures by N. Subramaniam- Oxford University.

References:

1. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill.
2. Ramachandra, —Limit state Design of Concrete Structures— Standard Book House, New Delhi.
3. IS 456 (2000): Plain and Reinforced Concrete - Code of Practice.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET05
Name of the Course	**BRIDGE ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Illustrate the different types of loads and stresses acting on various bridges (K3)
- Asses the various methodologies to analyses the bridges and also interpret the specifications of bridge super structure (K3)
- Demonstrate the box culverts and its design (K3)
- Develop the knowledge on design of plate girder bridges (K3)
- Illustrate the different types of bearings, abutments, piers and various types of foundations for Bridges (K3)

SYLLABUS

UNIT I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces- Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT II

Design of Girders & Slabs: Pigeaud's Method Design of longitudinal girders-Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref: IRC-21), voided slabs.

Super Structure: Slab bridge- Wheel load on slab- effective width method-slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- T-Beam bridges.

UNIT III

Box Culverts: Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT IV

Plate Girder Bridges: Elements of plate girder and their design-web-flange-intermediate stiffener- vertical stiffeners- bearing stiffener-design problem

UNIT V

Sub structure: Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment-culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP-13)

Text Books:

1. 1.Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
3. 3.Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

References:

1. Bridge Deck Behavior- E.C. Hambly 2e- CRC Press
2. Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing Company Limited
3. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4. IRC 112-2011 Code of Practice for Concrete Road Bridges.

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET06
Name of the Course	**REPAIR AND REHABILITATION OF STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures. (K2)
- Describe and suggest repair strategies for deteriorated concrete structures including repairing with composites. (K2)
- Develop the methods of strengthening methods for concrete structures. (K3)
- Demonstrate the fiber reinforced concrete and its properties. (K3)
- Examine the structural member‘s strength by high performance concrete. (K3)

SYLLABUS

UNIT I

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-Non destructive evaluation: Importance- 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 II

Strengthening and stabilization: Techniques- design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT III

Bonded installation techniques: Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding

mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures

UNIT IV

Fibre reinforced concrete: Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Lightweight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Fly ash concrete-Introduction- classification of Fly ash- properties and reaction mechanism of fly ash- Properties of fly ash concrete in fresh state and hardened state- Durability of fly ash concretes

UNIT V

High performance concretes: Introduction- Development of high-performance concretes- Materials of high-performance concretes- Properties of high-performance concretes- Self Consolidating concrete- properties-qualifications.

Textbooks:

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications
3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

References:

1. **Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company**
2. **Concrete Repair and Maintenance illustrated- Peter H Emmons**
3. **Concrete Chemical Theory and Applications- Santa Kumar A.R. Indian Society for Construction Engineering and Technology, Madras**
4. **Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi**

Year/Sem	I Sem	L	T	P	C	COURSE CODE
Regulation	V21	3	0	0	3	V21STET07
Name of the Course	**STRUCTURAL OPTIMIZATION**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Study the optimization methodologies applied to structural engineering
- Solve some continuous structural optimization problems using calculus of variations.
- Have sufficient knowledge on various optimization techniques like, non-linear programming, geometric and dynamic
- Describe numerical algorithms and linear programming suitable for structural optimization problems.
- Use and describe quadratic and dynamic programming .

SYLLABUS

UNIT I
Introduction: Need and scope for optimization – statements of optimization problems Objective function and its surface design variables- constraints and constraint surface Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT II
Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms introduction, characteristics of fully stressed design theoretical basis-examples

UNIT III
Non-Liner programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel‘s method, Newton‘s method and Davidon Fletcher Powell‘s method for multivariable optimization- Constrained minimization- Cutting plane method- Zoutendjik‘s method- penalty function methods

UNIT IV
Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame

UNIT V
Introduction to quadratic programming: Geometric programming- and dynamic programming Design of beams and frames using dynamic programming technique

Text books:

1. Iyengar.N.G.R and Gupta.S.K, —Structural Design Optimization||, Affiliated East West Press Ltd, New Delhi, 1997 .
2. Rao,S.S. —Optimization theory and applications||, Wiley Eastern (P) Ltd., 1984
3. Spunt, —Optimization in Structural Design||, Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971.
4. Uri Krish, —Optimum Structural Design||, McGraw Hill Book Co. 1981

References:

1. G. Hadley,"Linear programming", Narosa Publishing House, New Delhi, 1990.
2. H.A. Taha,"Operations Research:An Introduction", 5th Edition, Macmillan, New York, 1992.
3. K. Deb,"Optimization for Engineering DesignAlgorithms and Examples",Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
4. K.Srinivasa Raju and D. Nagesh Kumar, "Multicriterion Analysis in Engineering and Management",PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.28

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	2	0	0	2	V21STET08
Name of the Course	**ADVANCED CONCRETE TECHNOLOGY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Explain the materials of concrete and its chemical proportions (K2)
- Describe the fresh and hardened properties of concrete (K2)
- Explain high strength and high-performance concrete manufacturing process and its properties (K2)
- Develop the special concrete and enhance the durability properties (K3)
- Describe the formwork considerations used in designs (K2)

SYLLABUS

UNIT I

Concrete Making Materials: Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures - Bureau of Indian Standards (BIS) Provisions.

UNIT II

Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.

Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept – Stress strain Behaviour– Creep and Shrinkage – Durability Tests on Concrete – Non-Destructive Testing of Concrete. BIS Provisions**.**

UNIT III

High Strength Concrete - Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.

High Performance Concrete - Requirements and Properties of High-Performance Concrete – Design Considerations. BIS Provisions.

UNIT IV

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method– Light Weight Concrete, Self-Compacting Concrete.

UNIT V

Form work - materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms - shores – reshoring – failure of form work**.**

Text Books:

1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.
2. Concrete Technology by A. R. Santhakumar, 2nd Edition, Oxford University Press.
3. Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

References:

1. **Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J. Monteiro,. Mc. Graw-Hill Publishing Company Ltd. New Delhi**
2. **Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.**
3. **Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.**
4. **IS 10262-2009: Concrete Mix Proportioning - Guidelines.**

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL01
Name of the Course	**ADVANCED CONCRETE TECHNOLOGY LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop relation between Water / Cement Ratios Vs Workability, Water / Cement Ratios Vs Strength in concrete.
- Develop strength and workability relation between fine aggregate, coarse aggregates.
- Calculate Strain measurement in concrete.
- Assess concrete properties by using Non destructive testing methods.
- Find properties of Self compaction concrete by using L Box , J Box , U box and Slump tests

SYLLABUS

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- Impact Hammer test, UPV test
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests

NOTE: **A minimum of five experiments from the above set have to be conducted.**

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL02
Name of the Course	**ADVANCED STRUCTURAL ENGINEERING LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Conduct various laboratory tests on Cement, Aggregates
- Know strain measurement
- Non destructive testing
- Chemical analysis on concrete and Aggregate and Sand

List of Experiments:

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections
2. Study on Performance of RCC Beams designed for Bending and failing in Shear
3. Study on Performance of RCC Beams designed for Shear and failing in Bending
4. Study on Performance of RCC One way slabs
5. Study on Performance of RCC Two way slabs with simply supported edge conditions
6. Study on Performance of RCC Two way slabs with fixed edge conditions
7. Calculation of Young's Modulus of Elasticity of Concrete
8. Extraction and Study of Concrete Core samples from pavements

NOTE : **A minimum of five experiments from the above set have to be conducted as demonstration to entire class..**

II SEMESTER – SYLLABUS

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET09
Name of the Course	**FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute principle of potential energy of an elastic body (K3)
- Calculate the stiffness matrices of truss element (K3)
- Calculate the stiffness matrices of beam elements (K3)
- Interpret displacements, strains and stress resultants (K3)
- Formulate the shape functions for element (K3)

SYLLABUS

UNIT I

Introduction: Review of stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches -weighted residual methods

UNIT II

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin‘s method for 1-D truss – Computation of stress in a truss element.

UNIT III

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading-Galerkin‘s method - 2-D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame examples.

UNIT IV

Finite element formulation: Plane stress, plane strain and axi-symmetric problems- Derivation of CST and LST stiffness matrix and equations- treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems- comparison of CST and LST elements – convergence of solution- interpretation of stresses.

UNIT V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

Text Books:

1. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & Sons Publications
3. Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Bhatti, M.A. Wiley Publications
4. A first course in the Finite Element Method, Dary L. Logan, Thomson Publications.

References:

1. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D.Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited.
3. Introduction to Finite Element Method, Desai & Abel CBS Publication.
4. An Introduction to Finite Element Method- Reddy, J. N., McGraw-Hill Education.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET10
Name of the Course	**STABILITY OF STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop differential equation based on loading and end conditions of beam column (K3)
- Illustrate and work out the elastic buckling using various methodologies (K3)
- Illustrate and work out the in-elastic buckling using various methodologies (K3)
- Assess the torsional buckling behaviour of pure and non uniform torsion of thin walled bars (K3)
- Illustrate and work out the lateral buckling of various cross sections (K3)

SYLLABUS

UNIT I

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT II

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT III

In-elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical

Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT IV

Torsional Buckling: Pure torsion of thin walled bars of open cross section – Non uniform torsion of thin walled bars of open cross section - Torsional buckling – Buckling of Torsion and Flexure

UNIT V

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

Text Books:

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere-Mc Graw Hill Publications
3. Theory of Elastic Stability by Manikaselvam

References:

1. Fundamentals of Structural Stability by George J Smith & Dewey H. Hodges, Elsevier Publications
2. Elastic Stability of Structural Elements, N.G.R. Iyengar Macmillan Publications
3. Structural stability of Steel, Theodore v. Galambos & andrea e. Surovek

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET11
Name of the Course	**THEORY OF PLATES AND SHELLS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Analyze Navier's solution, Levy's solution and solve for the rectangular and square plates (K3)
- Analyze circular plates with various boundary conditions (K3)
- Practice on the finite difference method of solving plate problems(K3)
- Develop the potential energy principle and find the solution of rectangular plates for various loadings(K3)
- Identify the behavior of folded plates and shells.(K3)

SYLLABUS

UNIT I

Rectangular Plates: Derivation of governing differential equation for plate– in plane bending and transverse bending effects - Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy's type of solutions for various boundary condition.

UNIT II

Circular plates: Symmetrically loaded, circular plates under various loading conditions, annular plates.

UNIT III

Shells: Introduction to Shells- Single and double curvature- Equations of Equilibrium of shells. Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT IV

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT V

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

Text Books:

1. Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw-Hill book company, INC, New York.
2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications
3. Analysis of Thin Concrete Shells by K. Chandrasekhara, New Age International (P) Ltd

References:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill, New York

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET12
Name of the Course	**ADVANCED STEEL DESIGN**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Examine the simple connection used in various joints and design of connection (K3)
- Assess the plastic analysis to different beams based on their considerations (K3)
- Illustrate the eccentric and moment connection on various structural members (K3)
- Develop and analyse the industrial buildings subjected to transverse and lateral loading (K3)
- Complete the design of steel truss girder bridges and strengthening measures to girders (K3)

SYLLABUS

UNIT I

Simple Connections - Riveted, Bolted Pinned And Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT II

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT III

Eccentric and Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT IV

Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT V

Design af Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

Text Books:

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes Journals Department.

References:

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III - 2015

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Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET13
Name of the Course	**ANALYSIS OF OFFSHORE STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Illustrate different types of offshore structures. (K3)
- Calculation of Conservation mass and momentum. (K3)
- Assess the Wave force estimation on small bodies. (K3)
- Assess the Wave force estimation on long bodies. (K3)
- Compute Static and dynamic analysis of fixed offshore structures. (K3)

SYLLABUS

UNIT I

Introduction: Types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

UNIT II

Dynamics and Kinematics : Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy‘s theory, dispersion relationship, water particle kinematics, wave energy.

UNIT III

Wave force on small bodies: Estimation - Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

UNIT IV

Wave force on large bodies: Froude-krylov theory, Diffraction theory.

UNIT V

Static and dynamic analysis of fixed offshore structures.

Text Books:

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.

References:

1. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
2. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis, Inc., Plainfield, Illinois, USA.
3. Dynamic Analysis and Design of Offshore Structures 2015th Edition, by Srinivasan Chandrasekaran

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET14
Name of the Course	**EARTHQUAKE RESISTANT DESIGN OF BUILDINGS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Demonstrate the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, magnitude and propagation of ground motion. (K3)
- Assess the seismic design concepts of various moment resisting frames and their ductility behaviour (K3)
- Compute the earthquake load on various building frames and study on ductile behavior of building frames (K3)
- Assess the Cyclic loading behavior of RC, steel and pre- stressed concrete elements (K3)
- Illustrate the methods of Retrofitting and restoration of buildings subjected to damage due to earthquakes (K3)

SYLLABUS

UNIT I

Engineering seismology: Rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects

UNIT II

Seismic design concepts: EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non-structural elements

UNIT III

Calculation of EQ load: 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames

Concept of strong column weak beams, Design and ductile detailing of shear walls.

UNIT IV

Cyclic loading behavior of RC, steel and pre- stressed concrete elements: modern concepts- Base isolation – Adaptive systems – case studies

UNIT V

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

Text Books:

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice Hall of India, 2007, New Delhi.
2. Earthquake Resistant Design of Structures- S.K. Duggal, Oxford Publications.
3. Seismic design of reinforced concrete and masonry buildings by Paulay and Priestley .

References:

1. Earthquake Resistant Design and Risk Reduction- David Dowrick
2. IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings
3. IS 1893 (Part 1 to 5)- 2016: General Provisions and Building
4. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
5. IS 13920-2016: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
6. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET15
Name of the Course	**PRECAST AND PREFABRICATED STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes

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

- Explain impotence of prefabrication and Principles of Prefabrication. (K3)
- Find Prefabricated Load Carrying Members. (K3)
- Assess Joints for different structural connections. (K3)
- Analyze the production technology of prefabrication. (K3)
- Design and detailing of precast UNIT for factories. (K3)

SYLLABUS
UNIT I

Introduction to prefabrication: General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT II

Prefabricated Members: Load Carrying Capacity - Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls..

UNIT III

Joints: Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT IV

Production Technology: Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection,

techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT V

Designing and detailing of precast: For factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Text Books:

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

References:

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET16
Name of the Course	**EARTH RETAINING STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute the lateral earth pressures associated with different earth systems (K3)
- Assess the failure criterion and stability requirements in selecting the most technically appropriate type of retaining wall (K3)
- Employ different techniques to design a sheet pile structure considering both external and internal stability (K3)
- Apply the knowledge of reinforced earth in the designing the earth retaining systems (K3)
- Relate different methods in analyzing the stability of braced cuts and cofferdams (K3)

SYLLABUS

UNIT I

Earth pressures: Different types and their coefficients; Classical Theories of Earth pressure – Rankine‘s and Coulomb‘s Theories for Active and Passive earth pressure; Computation of Lateral Earth Pressure in Homogeneous and Layered soils; Graphical solutions for Coulomb‘s Theory in active and passive conditions.

UNIT II

Retaining walls: Types, Type of Failures of Retaining Walls – Stability requirements –Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT III

Sheet Pile Structures: Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Rowe‘s moment reduction method – Location of anchors and Design of Anchorage system.

UNIT IV

Soil reinforcement: Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.

UNIT V

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – Types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins' methods.

Text Books:

1. Principles of Foundation Engineering by Braja M Das, Cengage Learning
2. Foundation analysis and design by Bowles, J.E., McGraw Hill
3. Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph B. Peck, John Wiley & Sons.

References:

1. Earth Pressure and Earth Retaining Structures by Chris RI Clayton, Rick I woods, Andrew J Bond and Jarbas Milititsky, CRC Press, Taylor and Francis Group, New York.
2. Analysis and Design of Foundations and Retaining Structures, Samsher Prakash
3. Gopal Ranjan and Swami Saran, Saritha Prakashan Publishers, New Delhi.
4. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

Year/Sem	**I Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	2	0	0	2	V21STET17
Name of the Course	**ADVANCED REINFORCED CONCRETE DESIGN**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Explain the limit state method provisions in analysis of structures (K2)
- Apply the yield line method to analyze slab (K3)
- Develop the designs to flat slabs and ribbed slabs (K3)
- Explain the design steps involved in deep beams, corbel design procedure (K2)
- Interpret the Design method of slender and eccentric column (K3)

SYLLABUS

UNIT I

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams.

UNIT II

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple andcontinuous end conditions**.**

UNIT III

Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements**.**

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs. Detailing of reinforcement.

UNIT V

Design of Slender Columns - Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Detailing of reinforcement.

Text Books:

1. Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford UniversityPress.
3. Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc.Graw-Hill Publishing Company Ltd. New Delhi 2010.

References:

1. Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah.Standard Publishers
2. Reinforced concrete structural elements – behavior, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W.Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International,editions, 2nd edition, 1991.

Year/Sem	**II Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	0	0	4	2	V21SEL03
Name of the Course	**STRUCTURAL DESIGN LABORATORY**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Develop Computer Programs for Analysis and Design of various Structural Elements
- Use different Structural Engineering software's to solve various civil Engineering programs

SYLLABUS

1. Analysis and Design of reinforced concrete multistoried building
2. Analysis of plane and space truss
3. Analysis of plane and space frame
4. Wind analysis on tall structure
5. Analysis of Cylindrical shell
6. Dynamic Analysis of Multistory structure Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

NOTE: A minimum of four from the above set have to be conducted.

References:

1. Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

III SEMESTER – SYLLABUS

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation / Year	V21 / 2021-2022	3	0	0	3	V21STET18
Name of the Course	**DESIGN OF PRESTRESSED CONCRETE STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Compute the Analysis of prestress , losses in prestress and Anchorage slip (K3)
- Deflections of prestressed concrete members (K3)
- Employ types and advantages and analysis of composite sections (K3)
- Apply the knowledge of prestressed concrete slabs (K3)
- Analyze continuity beams in prestressed concrete structures (K3)

SYLLABUS

UNIT I

Introduction – Prestressing Systems – Pretensioning Systems – Postensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing - Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II

Deflections Of Prestressed Concrete Members: Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012. Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III

Composite Constructions: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate

Flexural and shear strength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV

Prestressed Concrete Slabs: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs. Prestressed Concrete Pipes and Poles : Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes - Prestressed Concrete Poles.

UNIT V

Continuous Beams: Advantage of Continuous Members – Effect of Prestressing Indeterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon's Theorem. Redistribution of moments in a continuous beam. Anchorage Zone Stresses in Beams : Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement.

Text Books:

1. Prestressed Concrete, by N. Krishna Raju, Mc Graw Hill Publishers – fourth edition
2. Prestressed Concrete by K. U.Muthu, PHI Learning Pvt Limited - 18 January 2016
3. Design of Prestressed Concrete by S.S.Bhavikatti - 1 January 2019

References:

1. 1 Prestressed Concrete Analysis and Design, Antone E. Naaman, Techno Press 3000
2. Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns
3. 3 Wiley Publications 3. Design of prestressed Concrete by E.G. Nawy

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET19
Name of the Course	**STRUCTURAL HEALTH MONITORING**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Assess the structural health by investigation and regular maintenance (K3)
- Employ various measures for monitoring structural health (K3)
- Employ various Investigations for monitoring structural audit (K3)
- Discover the dynamic field testing (K3)
- Apply the knowledge of Repairing and rehabilitation of structures (K3)

SYLLABUS

UNIT I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration.

UNIT III

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT V

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo– electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Text Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring by Daniel Balageas, Claus-peter fritzen and Alfredo Guemes

References:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.
3. Advances in Condition Monitoring and Structural Health Monitoring: WCCM by Len Gelman .et.al.

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21STET20
Name of the Course	**INDUSTRIAL STRUCTURES**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- functional requirements of structural systems for various industries (K3)
- Get an idea about the materials used and design of industrial structural elements (K3)
- Pre Engineered Buildings (K3)
- Realize the basic concepts and design of power plant structures (K3)
- Design power transmission structures (K3)

SYLLABUS

UNIT I

Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations.

UNIT II

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations

UNIT III

Design of Pre Engineered Buildings

UNIT IV

Power plant structures- Bunkers and silos- chimney and cooling towers- Nuclear containment structures

UNIT V

Power transmission structures- transmission line towers- tower foundations- testing towers

Text books:

1. Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center - 1 July 2017
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company -
3. The Design & Construction of Industrial Buildings by Moritz Kahn

References:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings 3. Design of steel structures by N. Subramanian
3. The Architect's Studio Companion: Rules of Thumb for Preliminary Design by Edward Allen

Year/Sem	**III Sem**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V21	3	0	0	3	V21MBT56
Name of the Course	**COST MANAGEMENT OF ENGINEERING PROJECTS**					
Branch	STRUCTURAL ENGINEERING					

Course Outcomes:

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

- Understand the cost management process and various costs involved in a project (K2)
- Understand various aspects of a project and related processes. (K2)
- Analyze the concepts of Break even and CVP analysis. (K3)
- Demonstrate quality management techniques besides budgeting strategies (K2)
- Apply quantitative techniques for cost management (K4)

SYLLABUS

UNIT I

Introduction and Overview of the Strategic Cost Management Process: Cost concepts in decision-making; relevant cost, Differential cost, Marginal cost, Incremental cost and Opportunity cost. Objectives of Costing System; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project Management: Meaning, Different types of projects.

Various stages of project execution: conception to commissioning, Project execution as a conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution, main clearances and documents.

Project team: Role of each member, Importance of Project site. Project contracts: Types and its contents. CPM & PERT Techniques.

UNIT III

Cost Behavior and Profit Planning: Marginal Costing, Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Standard Costing and Variance Analysis.

UNIT IV

Quality management and Budgeting strategies: Pareto Analysis, Target costing, Life Cycle Costing, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. **Budgetary Control**; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing & decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

ANNEXURE – CE- V

AUDIT COURSES OFFERED IN I & II SEMESTER

Audit course	I & II Sem	Disaster Management	V21STEAC1

Year/Sem		**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation Year	V21 / 2021-2022	3	0	0	3	V21STEAC1
Name of the Course	**DISASTER MANAGEMENT**					
Branch	Common to all					

Course Outcomes:

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

- Describe to student to have a idea on different natural hazards and disaster management (K2)
- Develop the student to understand manmade disaster and their management (K3)
- Prepare the student in such a way inorder to understand building codes and vulnerability of disaster (K3)
- Illustrate to student about role of technology in disaster management (K2)
- Assess the importance of education and community preparedness in disaster management to student (K3)

SYLLABUS

UNIT I

Natural Hazards and Disaster Management: Introduction of DM Disaster Management cycle – Five priorities for action- Case study methods of the following: floods, droughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

UNIT II

Man Made Disastar And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - rail and air craft's accidents-Management of these disasters

UNIT III

Risk And Vulnerability: - Building codes and land use planning – social vulnerability – environmental vulnerability -Financial management of disaster.

UNIT IV

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure - mitigation programme for earth quakes –geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.

UNIT V

Education And Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building.

Text Books:

1. Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy(2009),Universities press.
2. Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

Reference Books:

1. _Disaster Management' edited by H K Gupta (2003), Universities press.
2. Natural Hazards and Disaster Management, Vulnerability and Mitigation by RB Singh
3. Disaster Management by Harish K.Gupta