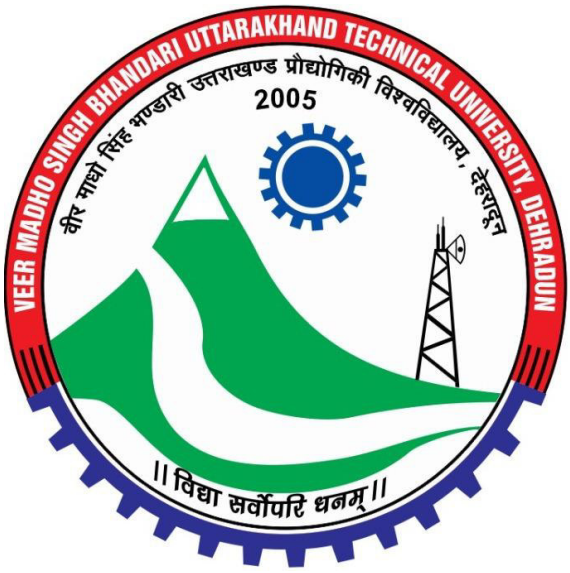
VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)



SYLLABUS

For

Master of Engineering Programmes

(M.Tech. Structural Engineering and Construction)

(For admission in 2022-23 and onwards)

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

ProposedSchemeofExaminationofM.Tech.2YearProgrammeforSpecialization:

StructuralEngineering andConstruction

SemesterI

Sr.No.	Course Type	CourseType/Code	CourseName	Teaching Scheme			Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1		AHT-301	AdvancedMathematics	3	1	0	4	50	100	150
2	Core-I	CET-301	AdvancedStructuralAnalysis	3	1	0	4	50	100	150
3	Core-II	CET-401	AdvancedConstructionTechnology	3	1	0	4	50	100	150
4	Professional Elective-1	CET-402	DesignofFormwork	3	0	0	3	50	100	150
		CET-302	AdvancedSolidMechanics							
		CET-304	StructuralHealthMonitoring							
5	Professional Elective-2	CET-306	TheoryofThinplatesandShells	3	0	0	3	50	100	150
		CET-307	TheoryandapplicationofCement Composites							
		CET-308	TheoryofStructuralStability							
6	Core	CEP-301	StructuralDesignLab	0	0	3	1	25	25	50
7	Core	CEP-302	AdvanceconcreteLab	0	0	3	1	25	25	50
8	Mandatory course	AHT-302	ResearchMethodologyandIPR	2	0	2	2	50	50	100
9	Audit-1	AHT-303	Technical Writing and Presentation Skill	2	0	0	NC	50	0	NC
			Total	**19**	**3**	**8**	**22**	**400**	**600**	**1000**
10	*OpenElective-1 (Optional)	CET-323	Infrastructure Planning and management	3	0	0	3	50	100	150

SemesterII

Sr.No.	Course Type	CourseType/Code	CourseName	Teaching Scheme			Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	Core-III	CET-309	FEMinStructuralEngineering	3	0	0	3	50	100	150
2	Core-IV	CET-310	StructuralDynamics	3	0	0	3	50	100	150
3	Professional Elective-3	CET-311	AdvancedSteelDesign	3	0	0	3	50	100	150
		CET-312	DesignofHighRiseStructures							
		CET-313	DesignofMasonryStructures							
4	Professional Elective-4	CET-314	DesignofAdvancedConcreteStructures	3	0	0	3	50	100	150
		CET-315	AdvancedDesignofFoundations							
		CET-316	DesignofIndustrialStructure							
5	*Open Elective-1	CET-317	RiskmanagementinConstruction	3	0	0	3	50	100	150
		CET-318	EnvironmentalImpactAssesment							
		CET-319	IndustrialSafety							
6	Core	CEP-303	ModelTestingLab	0	0	3	1	25	25	50

7	Core	CEP-304	NumericalAnalysisLab	0	0	3	1	25	25	50
8										
			Total	**15**	**0**	**6**	**17**	**300**	**550**	950
9	Open Elective-2 (Optional)	CET-324	Hydro power Engineering	3	0	0	3	50	100	150

SemesterIII

Sr.No.	**Course Type**	**CourseType/Code**	**CourseName**	**Teaching Scheme**			**Credits**	**Internal Marks**	**External Marks**	**Total Marks**
				L	T	P				
1	Open Elective-2	CET-320	BusinessAnalytics	3	0	0	3	50	100	150
		CET-404	CompositeMaterials							
		CET-322	CostManagementofEngineeringProjects							
2	Seminar	Seminar		0	0	4	2	100		100
3	Project	Project		0	0	10	5	100	150	250
4	Dissertation	Dissertation	Dissertation	0	0	12	6	300		300
			Total	**3**	**0**	**22**	**16**	**550**	**250**	**800**

SemesterIV

Sr.No.	**CourseType**	**CourseType/Code**	**CourseName**	**Teaching Scheme**			**Credits**	**Internal Marks**	**External Marks**	**Total Marks**
				L	T	P				
1	Dissertation	Dissertation	Dissertation	0	0	28	14	250	450	700
			Total	**0**	**0**	**28**	**14**	**250**	**450**	**700**

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus
Advanced Mathematics (AHT-301)

L:T:P:: 3:1:0 **Credits-4**

Course objectives:

From this course, students will be able to:

1. learn distinct methods of solving simultaneous equations.
2. well-versed with partial differential equations and their solutions and applications.
3. acquire the knowledge of transformation to ease the complex problems.
4. acquaintance with basics of random variables and their distribution for dealing with events by chance.
5. study different mathematical domains to deal with real-time engineering problems.

Learning outcomes:

1. Comprehend with engineering problems in different mathematical realm.
2. Learn analytical and numerical methods to deal with mathematical problems.
3. Understand how to model the engineering problems and their solutions.
4. Implement the solutions to real-time complex engineering problems.
5. Apprehend with mathematical methodology.

Course content:

Unit I: Solution of linear simultaneous equations: (8 hours)

Consistency, Iterative method, Convergence, Cholesky's (Crout's) method, Gauss-Jordan method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems, Smallest, largest, and intermediate Eigen values

Computer based algorithm and programme for these methods (non-evaluative)

Unit II: Partial differential equation and its applications: (10 hours)

Introduction and classification of partial differential equation, Four standard forms of non-linear partial differential equations and their solutions, linear equations with constant coefficients. Applications of partial differential equationsone and two-dimensional wave equation, one and two-dimensional heat equation, Two-dimensional Laplace's equation.

Syllabus
Advanced Mathematics (AHT-301)

L:T:P:: 3:1:0 **Credits-4**

Unit III: Transform calculus-I: **(8 hours)**

Laplace transform, Properties of Laplace transform, Inverse Laplace transform,Applications of Laplace transform, Fourier integral theorem, Fourier transforms, Application of Fourier transform

Unit IV: Transform calculus-II: **(8 hours)**

Z-transform, Properties of Z-transform, Shifting theorems, Initial and final value theorem, Convolution theorems, Inverse Z-transform, Application of Z-transform

Unit V: Basic probability theory: **(8 hours)**

Concept and laws of probability,Discrete and continuous random variable and their distributions; Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Continuous uniform, Normal, Exponential, Weibull, Moments,Moment generating functions, Expectation and variance

Practical demo with statistical software like R, SPSS, SAS, etc. (non-evaluative)

Text Books / References:

1. B.S. Grewal, Engineering Mathematics, Khanna Publications, 44th edition.
2. F.B. Hilderbrand, Method of Applied Mathematics, PHI Publications, 2nd edition.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publication, 20th edition.
4. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathmematical Statistics, S. Chand Publication, 4th edition.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition.
6. S. Ross, A First Course in Probability, Pearson Education, 8th edition.

Syllabus

Advanced Structural Analysis (CET-301)

3L:1T:0P **Credit: 4**

Course Objectives:

1. To impart the principles of elastic structural analysis and behavior of indeterminate structures.
2. To impart knowledge about various methods involved in the analysis of indeterminate structures.
3. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
4. To enable the student get a feeling of how real-life structures behave
5. To make the student familiar with latest computational techniques and software used for structural analysis.

Course outcomes:

At the end of the course, students will be able

1. to analyze the skeleton structures using stiffness analysis code.
2. Use direct stiffness method understanding its limitations

Syllabus:

UNIT – I **(6 Hours)**

Influence Coefficients: Physical Significance, Effects of Settlements, Temperature Change andLack of Fit, Member Approach and Structure Approach.

UNIT – II **(10 Hours)**

Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates.

Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

UNIT – III **(08 Hours)**

Applications to Simple Problems: Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

UNIT – IV **(08 Hours)**

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin 's Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin's Method.

UNIT – V **(08 Hours)**

Linear Element: Shape Functions, Solution for Poisson's Equation, General One-Dimensional Equilibrium Problem.

References:

1. Matrix Analysis of Framed Structures, Weaver and Gere.
2. The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co. Computer
3. Methods in Structural Analysis, MeekJ. L., E and FN, Span Publication.
4. The Finite Element Method, Desai and Able, CBS Publication.

Syllabus

Advanced Construction Technology(CET – 401)

L:T:P:: 3:1:0 **Credits-4**

Course Objectives:

This course will enable students to Understand the various types of equipment used for Construction. and understand the various methods of Construction Techniques

- To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
- To study different methods of construction to successfully achieve the structural design with recommended specifications.
- To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
- To study of construction equipment, and temporary works required to facilitate the construction process

Course Outcomes: On completion of this course, students are able to decide which type and capacity of construction equipment can be used for a particular job on site and to know the methods of drilling and blasting. The students will gain an experience in the implementation of new construction technology on engineering concepts which are applied in field advanced construction technology.

- The students will get a diverse knowledge of Advanced technology practices applied to real life problems.
- The students will learn to understand the theoretical and practical aspects of new technology in civil engineering along with the design and management applications.

Syllabus:

UNIT – I **(08 Hours)**

Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario. Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, Excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells. Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates.

UNIT – II **(10 Hours)**

Mechanization in rebar fabrication Mechanization in concrete production and placement. Mechanization through construction: formwork and scaffolding types, materials and design principles. Mechanization through construction Methods/technologies: segmental construction of bridges/flyovers, box pushing. technology for tunneling, trench-less technology. Pile Driving Equipment : Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact

UNIT – III **(06 Hours)**

Mechanization through construction methods of Drilling, Blasting and Tunneling Equipment : Definition of terms, bits, Jackhammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills,

shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; electing drilling pattern. Safety and Environmental issues in mechanization

UNIT – IV **(06 Hours)**

Coffer Dams: Definition, uses, selection of coffer dams, types of coffer dams, design features of coffer dams; leakage prevention, economic height.

Control of Ground Water in Excavations: Methods- pumping, well points, bored wells, electro-osmosis, injections with cement, clays and chemical, freezing process, vibro-flotation.

UNIT – V **(10 Hours)**

Construction of Earthquake Resistant Buildings: Planning of earthquake resistant building, Construction of walls –provision of corner reinforcement, Construction of beams and columns. Base isolation.

Special Structures: Tall structures, Spatial structures, Pre-stressed structures.

Fire Protection In Buildings : General – causes and effects of fire – precautionary measures to minimize dangers of fire – limiting fire spread – factors to be considered – Fire resisting properties of common building material – general rules for fire resisting buildings – alarm system – protection of openings – common wall stair-floor fire extinguishing arrangement – fire protection systems – types - Emergency exit arrangements – Strong room construction

Text Books:

1. "Construction Equipment and its Planning and Applications", Mahesh Varma, Metropolitan Book Co.(P) Ltd.,New Delhi. India.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 1988
3. Peurifoy R L, "Construction Planning, Equipment and Methods", Mc Graw Hill
4. James F Russell, "Construction Equipment", Prentice Hall
5. S.K. Sarkar and S. Saraswati, Construction Technology, Oxford University Press, New Delhi

Reference Books:

1. "Construction Machinery and Equipment in India". (A compilation of articles Published in Civil Engineering)

2. "Construction Review" Published by Civil Engineering and Construction Review,New Delhi, 1991.

3. R. Chudley, Construction Technology Vol. I, II, III, IV, Longman Group Limited, London, Ist Edition, 1977

Syllabus

CET – 402 Design of Formwork

L:T:P:: 3:0:0 **Credits-3**

Course Objectives: To impart knowledge on common form work and special form works, and design of form work with different materials for various structural elements.

Course Outcomes: At the end of the course, students will be able to:

1 Select proper formwork, accessories and material.
2 Design the form work for Beams, Slabs, columns, Walls and Foundations.
3 Design the form work for Special Structures.
4 Understand the working of flying formwork.
5 Judge the formwork failures through case studies.

Syllabus:

UNIT – I **(10 Hours)**

Introduction: Requirements and Selection of Formwork.
Formwork and false work – Temporary work systems, construction planning and site constraints.
Temporary Works: Form work for R.C.C. wall, slab, beam and column, Centering for arches of large spans and dams, design features for temporary works, Slip formwork, False work for bridges, Specialty form work.

UNIT – II **(06 Hours)**

Materials and construction of the common formwork and false work systems; Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontaland Vertical Formwork Supports Special, and proprietary forms. Concrete pressure on forms..

UNIT – III **(10 Hours)**

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams. Design of timber and steel forms; Loading and moment of formwork, Effects of wind load
Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges. Types of beams, decking and column formwork; Design of decking; False work design;

UNIT – IV **(08 Hours)**

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award. Foundation and soil on false work design; The use and applications of special forms; Sequence of construction; Safety use of formwork and false work.

UNIT – V **(06 Hours)**

Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi-StoryBuilding Construction.

Text Books:

1. Austin, C.K., Formwork for Concrete, Cleaver, Hume Press Ltd., London, 1996.
2. Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015
3. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education,2012

Reference Books:

1. Michael P. Hurst, Construction Press, London and New York, 2003.
2. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS

Syllabus

Advanced Solid Mechanics(CET – 302)

L:T:P:: 3:0:0 **Credits-3**

Course Objectives: To introduce the Advanced concepts of equilibrium and deformation in components, and structures for engineering design.

Course Outcomes: At the end of the course, students will be able to

1 Solve advanced problems of elasticity and plasticity understanding the basic concepts.
2 Apply numerical methods to solve continuum problems

Syllabus:

UNIT – I **(10 Hours)**

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.
Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.
Stress-Strain Relationships : Hooke's law and its application to isotropic materials, elastic constants and their relationships, plane stress and plain strain conditions.

UNIT – II **(08 Hours)**

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.
Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

UNIT – III **(08 Hours)**

Members in Uniaxial State of Stress : Uniform cross-section and tapered bars subjected to uniaxial tension and compression, composite bars and statically indeterminate bars, thermal stresses; Introduction to plasticity; S.E. under axial loading.
Members Subjected to Axi-Symmetric Loads : Stresses and strains in thin cylindrical shells and spheres under internal pressure, stresses in thin rotating rings

UNIT – IV **(08 Hours)**

Members Subjected to Torsional Loads : Torsion of solid and hollow circular shafts, stepped and composting shafts, close-coiled helical springs subjected to axial loads, S.E. in torsion.

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.
Members Subjected to Combined Loads: Short struts subjected to eccentric loads, shafts subjected to combined bending, torsion and axial thrust, concept of theory of failure.

UNIT – V **(06 Hours)**

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, vonMises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening
Elastic Stability of Columns: Euler's theory of initially straight columns, critical loads for different end condition of columns, eccentric loading, columns with small initial curvature, empirical formulae

Text Books:

1 Gere, J.M. and Goodno, B.J., "Strength of Materials", Indian Edition (4th reprint), Cengage Learning India Private Ltd. 2009
2 Beer, F.P., Johuston, Jr., E.R., Dewolf, J.T. and Mazureu, D.E., "Mechanics of Materials", Fifth Edition, McGraw Hill, 2009
3 Hibbeler, R.C., "Mechanics of Materials", Sixth Edition, Pearson. 2005
4 Crandall, S.H., Dahl, N.C. and Lardner, T.J., "An Introduction to the Mechanics of Solids", 2nd Edition, McGraw Hill, 1999

Reference Books:

1 Timoshenko, S.P. and Young, D.H., "Elements of Strength of Materials", Fifth Edition, (In MKS Units), East-West Press Pvt. Ltd.

Open Electives (Optional)

1 Infrastructure Planning and management
2 Hydropower Engineering

Syllabus

Structural Health Monitoring(CET-304)

3L:0T:0P **Credit: 3**

Course Objective: To understand the structural health monitoring for structures and to understand the conditional assessment & techniques for strengthening and retrofitting of structures.

Course Outcomes: At the end of the course, students will be able to

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests. Suggest repairs and rehabilitation measures of the structure

Syllabus:

UNIT – I **(**08 **Hours)**
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II **(08 Hours)**
Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

UNIT – III **(08 Hours)**
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT – IV **(08 Hours)**
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT – V **(08 Hours)**
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.

Reference Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.

Syllabus

Structural Health Monitoring (CET-304)

3L:0T:0P **Credit: 3**

2. Health Monitoring of Structural Materials and Components Methods with Applications,Douglas E Adams, John Wiley and Sons, 2007.

3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan,Taylor and Francis Group, London, UK, 2006.

4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

Syllabus

Theory of Thin Plates and Shells (CET-306)

3L:0T:0P **Credit: 3**

Course Objectives: To introduce the concept of plate theory and to study the behavior and analysis of thin plates and rectangular plates and classification of shell surfaces

.

Course Outcomes: At the end of the course, students will be able to

1. Use analytical methods for the solution of thin plates and shells.Use analytical methods for the solution of shells.
2. Apply the numerical techniques and tools for the complex problems in thin plates.Apply the numerical techniques and tools for the complex problems in shells.

Syllabus:

UNIT – I **(**08 **Hours)**

Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

UNIT – II **(**08 **Hours)**

Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

UNIT – III **(**08 **Hours)**

Circular Plates: Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

UNIT – IV **(**08 **Hours)**

Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells,

Shells of Revolution: with Bending Resistance - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels.

Syllabus

Theory of Thin Plates and Shells(CET-306)

3L:0T:0P **Credit: 3**

UNIT – V **(**08 **Hours)**

Thermal Stresses in Plate/ Shell. Case Studies

References:

1. Theory of Plates and Shells, Timoshenko S. and Krieger W., McGraw Hill.
2. Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill.
3. Thin Elastic Shells, Kraus H., John Wiley and Sons.
4. Theory of Plates, Chandra shekhara K., Universities Press.
5. Design and Construction of Concrete Shells, Ramaswamy G.S.

Syllabus

Theory and application of cement composites (CET -307)

3L:0T:0P **Credit: 3**

Course Objectives: The Student shall learn about composite materials, stress strain relations of orthotropic and anisotropic materials, Mechanical behavior of materials. The student shall also learn about types of cement composites, Mechanical properties of Cement composites and application of cement composites.

Course Outcomes: At the end of the course, students will be able to

1. Formulate constitutive behavior of composite materials – Ferro cement, SIFCON and FibreReinforced Concrete - by understanding their strain- stress behavior.
2. Classify the materials as per orthotropic and anisotropic behavior.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyze and design structural elements made of cement composites.

Syllabus Content:

UNIT – I **(**08 **Hours)**

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT – II **(**08 **Hours)**

Mechanical Behavior: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

UNIT – III **(**08 **Hours)**

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fiber Reinforced Concrete - Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT – IV **(**08 **Hours)**

Mechanical Properties of Cement Composites: Behavior of Ferro cement, Fiber Reinforced Concretein Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.
Application of Cement Composites: FRC and Ferro cement- Housing, Water Storage, Boats and

Syllabus

Theory and application of cement composites (CET -307)

3L:0T:0P **Credit: 3**

Miscellaneous Structures. Composite Materials-Orthotropic and Anisotropic behavior, Constitutive relationship, Elastic Constants.

UNIT – V **(**08 **Hours)**

Analysis and Design of Cement Composite Structural Elements - Ferro cement, SIFCON and Fiber Reinforced Concrete.

Reference Books:

1. Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis, B SP Books,1998.
2. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.
3. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman& Hall, 1983.

Syllabus

Theory of Structural Stability(CET-308)

3L:0T:0P **Credit: 3**

Course Objectives: To achieve fundamental understanding of the subject of stability of structures and apply it to diverse problems in civil, mechanical, and Aerospace engineering.

Course Outcomes: At the end of the course, students will be able to:

1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analysing discrete and continuous systems,

Syllabus:

UNIT – I **(**08 **Hours)**

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

UNIT – II **(**08 **Hours)**

Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT – III **(**08 **Hours)**

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT – IV **(**08 **Hours)**

Stability of Beams: lateral torsion buckling.

Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT – V **(**08 **Hours)**

Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981.
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
3. Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt. Ltd.
4. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

Syllabus

CEP-301 Structural Design Lab (CEP-301)

0L:0T:3P **Credit: 1**

Course Objectives: To execute the methods of Design and detail drawing of a building.

Course Outcomes: At the end of the course, students will be able to

1. Design and Detail all the Structural Components of Frame Buildings.
2. Design and Detail complete Multi-Storey Frame Buildings.

Syllabus Content:

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

Syllabus

Advanced Concrete Lab(CEP-302)

0L:0T:3P **Credit: 1**

Course Outcomes: At the end of the course, students will be able to

- Design high grade concrete and study the parameters affecting its performance.
- Conduct Non Destructive Tests on existing concrete structures.
- Apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

1. Study of stress-strain curve of high strength concrete,
2. Determination of Correlation between cube strength, cylinder rstrength, split tensile strength and modulus of rupture.
3. Study the Effect of cyclic loading on steel.
4. Non-Destructive testing of existing concrete members.
5. Behavior of Beams under flexure, Shear and Torsion.

Reference Books:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

Open Elective 1 (Optional)

Infrastructure Planning and management(CET-323)

3L:0T:0P **Credit: 3**

COURSE OBJECTIVES: To study the necessity of infrastructure and its management and the infrastructural planning. To study the theoretical concepts which are applied to real problems encountered in the planning, management and operation of infrastructure and the finance management Fundamentals & Evaluation and managerial economics.

COURSE OUTCOMES:

1. Understand infrastructure organizations.
2. Achieve Knowledge of Planning and development of problem solving skills in management.
3. Understand the principles of financial fundamentals.
4. Prepare tender documents for infrastructure project contract.

SYLLABUS:

UNIT – I **(**10 **Hours)**

Infrastructure: Definitions of infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems.

UNIT – II **(**10 **Hours)**

Infrastructure Planning: Typical infrastructure planning steps, Planning and appraisal of major infrastructure
projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding.

UNIT – III **(**10 **Hours)**

Project Management in Construction: Introduction to project management processes - Initiating, Planning, Executing, Controlling, and Closing processes; Project Integration Management - Project plan development, Project plan execution, and Overall change control; Project Scope Management - Initiation, Scope planning, Scope definition, Scope verification, and Scope change control.

UNIT – IV **(10 Hours)**

Contracts and Management of Contracts: Engineering contracts and its formulation, Definition and

Open Elective 1 (Optional)

Infrastructure Planning and management (CET-323)

3L:0T:0P **Credit: 3**

essentials of a contract, Indian Contract Act 1872, types of contracts and clauses for contracts, Preparation of tender documents, Issues related to tendering process, Awarding contract.

References books:

1. A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
2. J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
3. P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
4. J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.
5. L. Squire and H. G.van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
6. T. Hegazy, Computer-based construction project management, Prentice Hall, New Jersey, 2002.
7. S. M. Levy, Project management in construction, 5th ed., McGraw Hill, New York, 2007.

Technical Writing and Presentation Skills (AHT-303)

L:T:P::2:0:0 **Non-credits**

Course Objectives:

- To develop effective writing and presentation skills in students.
- To develop textual, linguistic and presentation competencies instudents appropriate for their professional careers.

Course Outcomes:

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

CO1: Write clearly and fluently to produce effective technical documents.

CO2: Demonstrate an appropriate communication style to different types of audiences both orally and written as per demand of their professional careers.

CO3: Communicate in an ethically responsible manner.

Course Contents:

WRITING SKILLS

Unit-I **(4 hours)**

Technical Writing-Basic Principles: Words-Phrases-Sentences, Construction of Cohesive Paragraphs, Elements of Style.

Unit-II **(4 hours)**

Principles of Summarizing: Abstract, Summary, Synopsis

Unit-III **(6 hours)**

Technical Reports: Salient Features, Types of Reports, Structure of Reports, Data Collection, Use of Graphic Aids, Drafting and Writing

PRESENTATION SKILLS

Unit-IV **(6 hours)**

Speaking Skills: Accuracy vs. Fluency, The Audience, Pronunciation Guidelines, Voice Control.

Unit-V **(8 hours)**

Professional Presentations: Planning, Preparing, Presentation Strategies, Overcoming, Communication Barriers, Using Technology, Effective Presentations.

References:

1. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford UniversityPress,2011.
2. Quirk & Randolph, “A University Grammar of English”, Pearson,2006.
3. Rutherford, Andrea J., “Basic Communication Skills for Technology”, Pearson 2007.
4. Rizvi, M Ashraf, “Effective Technical Communication”, McGraw Hill,2009.
5. Leigh, Andrew & Maynard, Michael, “The Perfect Presentation”, Random House.

6. Barker, Larry L., “Communication”, Prentice-Hall.
7. Lesikar&Flatley, “Basic Business Communication-Skills for Empowering the Internet Generation”, Tata McGraw-Hill.

Syllabus

FiniteElementMethodin StructuralEngineering (CET-309)

3L:0T:0P **Credit: 3**

Course Objective: To introduce importance and applications of Finite Element Method. Simple one dimensional problem, analysis of beams and simplified modeling of two dimensional problems were discussed. The analysis of one dimensional steady state heat transfer is elaborate

Course Outcomes: At the end of the course, students will be able to

1. UseFinite Element Method forstructural analysis.
2. ExecutetheFiniteElementProgram/Software.
3. Solvecontinuumproblemsusingfiniteelementanalysis.

Syllabus:

UNIT – I **(08 Hours)**

Introduction: History andApplications. Spring andBar Elements, Minimum Potential EnergyPrinciple, Direct Stiffness Method, Nodal Equilibrium equations, Assembly ofGlobal StiffnessMatrix,Element Strain andStress.

UNIT – II **(06 Hours)**

BeamElements: FlexureElement,ElementStiffnessMatrix,Element LoadVector.

UNIT – III **(12 Hours)**

MethodofWeightedResiduals:GalerkinFiniteElementMethod,ApplicationtoStructuralElements, Interpolation Functions, Compatibility andCompleteness Requirements, PolynomialForms,Applications.

Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, IsoparametricFormulation,Axi-SymmetricElements,NumericalIntegration,GaussianQuadrature.

UNIT – IV **(08 Hours)**

Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element,Iso-parametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis,Strainand Stress Computations.

UNIT – V **(06 Hours)**

ComputerImplementationofFEMprocedure,Pre-Processing,Solution,Post-Processing,UseofCommercial FEA Software.

ReferenceBooks:

1. FiniteElementAnalysis,SeshuP.,Prentice-HallofIndia,2005.
2. Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
3. FundamentalsofFinite ElementAnalysis, HuttonDavid,Mc-Graw Hill, 2004.
4. FiniteElementAnalysis,BuchananG.R.,McGrawHillPublications,NewYork,1995.
5. FiniteElementMethod,ZienkiewiczO.C.&TaylorR.L.Vol.I,II&III,Elsevier,2000.
6. FiniteElementMethodsinEngineering,BelegunduA.D.,Chandrupatla,T.R.,PrenticeHallIndia,1991.

Syllabus

StructuralDynamics (CET-310)

3L:0T:0P **Credit: 3**

Course Objective: The objective is to provide the fundamental understanding of the structural dynamics and the problem solving ability for dynamic response in civil engineering design, analysis and research. Introduce students to analytical and numerical methods in structural dynamics with emphasis on vibration and to opportunities to optimize system for desired dynamic response

CourseOutcomes: At the end of the course, students will be able to

1. Analyze and study dynamics response of single degree freedom system using fundamental theoryand equation of motion.
2. Analyze and study dynamics response ofMultidegreefreedom system using fundamental theory and equation of motion.
3. Use the available software for dynamic analysis.

Syllabus:

UNIT – I **(08 Hours)**

Introduction: Objectives, Importance of Vibration Analysis, Nature of ExcitingForces, Mathematical Modeling of Dynamic Systems.

UNIT – II **(08 Hours)**

Single Degreeof Freedom System: Freeand Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.

UNIT – III **(08 Hours)**

Numerical Solution to Response using New mark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.

UNIT – IV **(10 Hours)**

Multiple Degree of Freedom System (Lumped parameter): Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equationof Motion.

Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

UNIT – V **(06 Hours)**

Special TopicsinStructural Dynamics (Conceptsonly): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

ReferenceBooks:

1. Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw Hill.
2. Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
3. Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
4. Dynamics of Structures, Humar J. L., Prentice Hall.
5. Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication. Dynamics of Structures, Hart and Wong

Syllabus

AdvancedSteelDesign(CET-311)

3L:0T:0P **Credit: 3**

CourseObjective: To recognize limit states and failure modes in structural steel members and systems; To become familiar with design specification and codes for steel structures, and understand their basis in mechanics, testing, and analysis; To design steel and composite members and connections with an understanding of their limit states / failure modes and current design specifications / codes

Course Outcomes: At the end of the course, students will be able to

1. Designsteelstructures/componentsbydifferentdesignproc esses.
2. Analyze anddesignbeams andcolumnsforstabilityand strength,anddrift.
3. Designweldedandboltedconnections.

Syllabus:

UNIT – I **(08 Hours)**

Propertiesof Steel: MechanicalProperties,Hysteresis,Ductility.

Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.

UNIT – II **(08 Hours)**

Designof SteelStructures:
InelasticBendingCurvature,PlasticMoments,DesignCriteriaStability,Strength, Drift.

UNIT – III **(08 Hours)**

StabilityofBeams: LocalBucklingofCompressionFlange&Web,LateralTorsionalBuckling.

StabilityofColumns: SlendernessRatio, LocalBucklingofFlanges andWeb,BracingofColumnabout WeakAxis.

UNIT – IV **(08 Hours)**

Method ofDesigns: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design;

StrengthCriteria: Beams-Flexure,Shear,Torsion,Columns - MomentMagnificationFactor,EffectiveLength, PMInteraction,Biaxial Bending,Joint PanelZones.

UNIT – V **(08 Hours)**

DriftCriteria:PEffect,Deformation BasedDesign;
Connections: Welded,Bolted, LocationBeamColumn,ColumnFoundation,Splices.

ReferenceBooks:

1. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
2. DesignofSteel Structures-AryaA.S.,AjmaniJ.L.,NemchandandBros.,Roorkee.
3. TheSteelSkeleton-Vol. II,PlasticBehaviourandDesign-BakerJ.F.,HorneM.R.,HeymanJ.,ELBS.
4. PlasticMethodsofStructuralAnalysis,NealB.G.,ChapmanandHall London.
5. IS800:2007–GeneralConstructioninSteel-CodeofPractice,BIS,2007.
6. SP–6-HandbookofStructuralSteelDetailing,BIS,1987

Syllabus

Designof High-RiseStructures(CET-312)

3L:0T:0P **Credit: 3**

Course Objectives: To study the behaviour and design criteria of tall structures and various structural systems under wind loads. To learn analysis and design of buildings for wind loads. To familiarize the students about stability analysis of tall structures.

CourseOutcomes: At theend ofthecourse,students willbeable to

1. Analyse,designanddetailTransmission/TVtower,MastLight andTrestleswithdifferentloadingconditions.
2. Analyse,designanddetailtheRCandSteelChimney.
3. Analyse.designanddetailthetallbuildingssubjectedtodifferentloadingconditionsusingrelevantcodes.

Syllabus:

UNIT – I **(12 Hours)**

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysisanddesign forvertical transverse and longitudinal loads.

UNIT – II **(12 Hours)**

AnalysisandDesignofRCandSteelChimney,Foundationdesignforvariedsoilstrata.

UNIT – III **(10 Hours)**

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads,Dynamic approach, structural design considerations and IS code provisions. Firefighting designprovisions.

UNIT – IV **(06 Hours)**

Applicationofsoftwareinanalysis anddesign.

ReferenceBooks:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers,NewDelhi, 2002.
2. StructuralAnalysisandDesignofTallBuildings, TaranathB.S.,McGrawHill,1988.

3. Illustrated Design of Reinforced ConcreteBuildings(GF+3storeyed), Shah V. L. &Karve S. R.,StructuresPublications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.
6. HighRiseBuildingStructures, WolfgangSchueller, Wiley.,1971.
7. TallChimneys,Manohar S.N.,TataMcGrawHillPublishingCompany,NewDelhi

Syllabus

Designof MasonryStructures(CET-313)

3L:0T:0P **Credit: 3**

Course Objective: To develop an understanding for implementation of Masonry structures. To present fundamental principles and methodologies of design of Masonry structures. To categorize, classify and understand the masonry building component. To have the ability to analyze and design of masonry structure.

Courseoutcomes: At the end of the course, students will be able to:

1. Understand the masonry design approaches.
2. Analyzereinforcedmasonry members and determine interactions between members.
3. Determine shearstrengthand ductility of Reinforced Masonry members.
4. Check the stability of walls
5. Perform elastic and inelastic analysis of masonry walls.

Syllabus:

UNIT – I **(10 Hours)**

Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression behaviour of Masonry, Masonry Wall Configurations, Distribution ofLateral Forces.

UNIT – II **(08 Hours)**

Flexural Strengthof Reinforced Masonry Members: In planeand Out-of-plane Loading.

UNIT – III **(10 Hours)**

Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation. Shear Strength and Ductility of Reinforced Masonry Members.

UNIT – IV **(06 Hours)**

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

UNIT – V **(06 Hours)**

Elastic and Inelastic Analysis, Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra.

Reference Books:

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,
2. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
4. Earthquake-resistant Design of Masonry Buildings,TomaeviMiha, Imperial College Press, 1999.

Syllabus

DesignofAdvancedConcreteStructures(CET-314)

3L:0T:0P **Credit: 3**

Course Objective: The main objective of is to provide students with a rational basis of the design of reinforced concrete members and structures through advanced understanding of material and structural behavior.

CourseOutcomes: At theend ofthe course, studentswill beableto

1. Analysethe specialstructures byunderstandingtheirbehaviour.
2. Design andpreparedetailstructuraldrawingsforexecutioncitingrelevantIScodes.

Syllabus:

UNIT – I **(08 Hours)**

Designphilosophy,ModelingofLoads,MaterialCharacteristics.

UNIT – II **(16 Hours)**

Reinforced Concrete-P-M, M-phi Relationships, Strut-and- Tie Method, Designof DeepBeam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, DesignagainstTorsion;IS, ACIand Eurocode.

UNIT – III **(16 Hours)**

Steel Structures -- Stability Design, Torsional Buckling - Pure, Flexural and Lateral, DesignofBeam-Columns,FatigueResistantDesign,IS code,AISCStandardsandEurocode.

ReferencesBooks:

1. ReinforcedConcreteDesign,PillaiS.U.andMenonD.,TataMcGraw-Hill,3rdEd,1999.
2. Designof SteelStructures, SubramaniamN.,OxfordUniversityPress,2008.
3. Reinforced Concrete Structures, Park R.andPaulayT. , John Wiley & Sons, 1995.
4. AdvancedReinforcedConcreteDesign,VargheseP.C.,PrenticeHallofIndia,NewDelhi.
5. UnifiedTheoryofConcrete Structures,Hsu T. T. C. andMo Y.L.,John Wiley&Sons, 2010.
6. SteelStructuresDesignandBehaviorEmphasizingLoadandResistanceFactorDesign,Salm

on
C.G., JohnsonJ. E.andMalhas F. A., PearsonEducation, 5th Ed, 2009.
7. Design ofSteel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
8. PlasticMethodsofStructuralAnalysis,NealB.G.,ChapmanandHall London.

Syllabus

AdvancedDesign of Foundations(CET-315)

3L:0T:0P **Credit: 3**

COURSE OBJECTIVES: To Study the advanced design methods of foundations. Impart knowledge on earth pressure theories in design of gravity and cantilever retaining wall. Narrate the importance of apparent earth pressure diagrams in design of sheet piles & braced cuts. Design of foundations in Expansive soils.

Course Outcomes: At the end of the course, students will be able to

1. Decidethesuitabilityof soil strata fordifferent projects.
2. Designshallowfoundationsdecidingthebearingcapacityofsoil.
3. Analyze and design the pile foundation.Understandanalysismethodsforwel lfoundation.

SyllabusContents:

UNIT – I **(08 Hours)**

Planning of Soil Explorationfor Different Projects, Methods of Subsurface Exploration, Methods ofBoringsalongwithVariousPenetrationTests.

UNIT – II **(08 Hours)**

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods ofEstimatingBearingCapacity,SettlementsofFootingsandRafts,ProportioningofFoundationsusi ngFieldTestData, Pressure -SettlementCharacteristicsfromConstitutive Laws.

UNIT – III **(08 Hours)**

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations,Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimationof Load- Settlement Behaviorof Piles, Proportioning of Pile Foundations, Lateral and Uplift CapacityofPiles.

UNIT – IV **(08 Hours)**

WellFoundation,ISandIRCCode Provisions, ElasticTheoryandUltimateResistanceMethods. **Tunnels** andArchinginSoils,PressureComputationsaroundTunnels.

UNIT – V **(08 Hours)**

OpenCuts,SheetingandBracingSystems inShallowand DeepOpenCuts inDifferentSoilTypes. **Coffer Dams**, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structureinteraction

ReferenceBooks:

1. Design of foundation system, N.P. Kurian, Narosa Publishing House
2. FoundationAnalysisandDesign,J.E.Bowles,TataMcGrawHillNewYork
3. Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, NewDelhi.

Syllabus

Designof IndustrialStructures(CET-316)

3L:0T:0P **Credit: 3**

Course Objectives: To understand the numerical methods for solving simultaneous equation. The students are introduced to the analysis of trusses, beams and simple portal frames using flexibility and stiffness methods by element approach. The students are introduced to the concepts of direct stiffness method involving formulation and assembly of stiffness matrices, and analyzing beams and trusses.

CourseOutcomes:Attheendofthecourse,thestudentwillbeableto:

1. DesignSteel GantryGirders.
2. Design Steel Portal, Gable Frames.DesignSteelBunkers andSilos.
3. DesignChimneysandWaterTanks.

SyllabusContents:

UNIT – I **(08 Hours)**

Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail,design procedure.

UNIT – II **(08 Hours)**

PortalFrames–Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

UNIT – III **(08 Hours)**

Steel BunkersandSilos-Design of square bunker – Jansen's andAiry's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners.

UNIT – IV **(08 Hours)**

Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings andaccess ladder, loading and load combinations, design considerations, stability consideration,designof baseplate, designoffoundation bolts, designoffoundation.

UNIT – V **(08 Hours)**

Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchorbolts –

Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottomwatertank–sideplates –Bottomplates– joints –Ringgirder –Designofstagingandfoundation.

ReferenceBooks:

1. DesignofSteelStructure, PunmiaB.C.,JainAshokKr.,JainArunKr.,2ndEd., LakshmiPublishers, 1998.
2. DesignofSteelStructures,RamChandra,12thEd.,StandardPublishers,2009.
3. Designof Steel Structures, Subramaniyam.

Syllabus

Risk management in construction(CET 317)

3L:0T:0P **Credit: 3**

Course Objectives: to find out the various risk which affect the construction Project

Corse Outcomes: At the end of the course the student will be able to

1. To recognize various risks that can delay the construction of any project.
2. Various mitigation measure to minimize risks

Syllabus:

UNIT – I **(08 Hours)**

Risk analysis

General – Importance of Risk, types of risks, quantifiable and un-quantified risks. Micro, market, project level risk analysis approach. Risk analysis and Management for projects (RAMP) – Identifying risk events. Probability distribution. Stages in Investment, life-cycle; determination of NPV and its standard deviation for perfectly co-related,
moderately co-related and un-correlated cash flows.Dealing with uncertainties Sensitivity analysis, scenario analysis simulation, decision tree analysis, risk profile method, certainly equivalent method; risk adjusted discount rate method, certainty index method,
point estimated method.

UNIT – II **(08 Hours)**

Use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading
of construction entities for reliable risk assessment. Risk Mitigation – by elimination, reducing,
transferring, avoiding, absorbing or pooling. Residual risk, mitigation of un-quantified risk.
Coverage of risk through CIDC‘s MOU with the Actuarial Society of India

UNIT – III **(08 Hours)**

Safety Risk: safety hazards, dangerous tasks, Accidents, Case Studies

UNIT – IV **(08 Hours)**

Financial Risk and Legal Risk: requirement of cash, cash flow, increase in cost, legal constraints, violations of code and contracts terms, disputes with clients and venders

UNIT – I **(08 Hours)**

Project Risk and Environmental Risk: risks associated with managing the projects**,** management of the resources, missing deadlines, acts of GOD, natural disasters

ReferenceBooks:

1. Project Risk Analysis And Management Guide By John Bartlett APM Publishing Limited,2004 2nd Edition
2. Industrial Engineering And Management Of Manufacturing Systems.- Dr.Surendra KumarSatya Prakashan
3. RAMP Handbook By Institution Of Civil Engineers And The Faculty And Institute OfActuariesthomas Telford Publishing, London.
4. Construction Engineering And Management – Seetharaman.
5. Projects Planning Analysis Selection Implementation And Review – Prasanna Chandra.
6. Construction Project Management, K. K. Chitkara, Tata Mcgraw Hill Publ.
7. Construction Management Practice, Dr.V.K.Raina, Shroff Publ.
8. Projects, Prasanna Chandra, Tata Mcgraw Hill Publ.
9. Project Management, K.Nagarajan, New Age International

Syllabus

Environmental Impact Assessment (CET 318)

3L:0T:0P **Credit: 3**

Course objective: The objectives of the course are to define and classify Environmental Impacts and the terminology, Understands the environmental Impact assessment (EIA) procedures and methodology and List and describe environmental audit

Corse Outcomes: At the end of the course the student will be able to

1. Identify the environmental attributes to be considered for the EIA study
2. Formulate objectives of the EIA studies
3. Identify the methodology to prepare rapid EIA
4. Prepare EIA reports and environmental management plans

Syllabus:

UNIT – I **(08 Hours)**

Introduction:The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements

UNIT – II **(08 Hours)**

EIA Methodologies: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts

UNIT – III **(08 Hours)**

Environmental Management Plan:EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre-Appraisal and Appraisal**.**

UNIT – IV **(08 Hours)**

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste managementrules.Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria- case studies.

UNIT – V **(08 Hours)**

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports**.**

Reference Books:

1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", WileyInterscience, New Jersey. 2003.
3. World Bank –Source book on EIA.
4. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
5. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook",
McGraw Hill Inc., New York, 1996.
6. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual
by CLRI, 1990.
7. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and
Control, 4th Edition, Butterworth Heineman, 2012.

Syllabus

IndustrialSafety(CET 319)

3L:0T:0P **Credit: 3**

Course Objectives: 1. To study about Industrial safety programs and toxicology, Industrial laws , regulations and source models. To understand about fire and explosion, preventive methods, relief and its sizing methods and Toanalyse industrial hazards and its risk assessment.

Course Outcomes: By the end of the course the students will be able to

1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.
5. Understand the methods of hazard identification and preventive measures

Syllabus:

UNIT – I **(08 Hours)**

Industrial Safety: Accident, causes, types, results and control, mechanical and electricalhazards, types,causes and preventive steps/procedure,describe salient points of factoriesact 1948for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressurevessels,etc, Safetycolorcodes.Firepreventionand firefighting,equipmentandmethods.

UNIT – II **(08 Hours)**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation withreplacementeconomy, Servicelifeofequipment.

UNIT – III **(08 Hours)**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reductionmethods,lubricants-typesandapplications,Lubricationmethods,generalsketch,workingandapplications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravitylubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition,principleandfactors affectingthe corrosion. Typesof corrosion,corrosionprevention methods.

UNIT – IV **(08 Hours)**

Faulttracing:Faulttracing-conceptandimportance,decisiontreeconcept,needandapplications,sequenceoffaultfindingactivities,showasdecisiontree,drawdecisiontreeforproblemsinmachinetools,hydraulic,pneumatic,automotive,thermalandelectricalequipment'slike,i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi.Electricalmotors, Typesoffaults in machine toolsand theirgeneral causes.

UNIT – IV **(08 Hours)**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing,cleaning and repairing schemes, overhauling of mechanical components, overhauling of electricalmotor, common troubles and remedies of electric motor, repair complexities and its use, definition,need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventivemaintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets,Program and schedule of preventive maintenance of mechanical and electrical equipment, advantagesofpreventivemaintenance. Repair cycle conceptand importance

Reference:

1. MaintenanceEngineeringHandbook,Higgins&Morrow,DaInformationServices.
2. Maintenance Engineering, H.P. Garg, S.Chand and Company.
3. Pump-hydraulicCompressors,Audels,McgrewHillPublication.
4. FoundationEngineeringHandbook,Winterkorn, Hans,Chapman&Hall London.

Syllabus
Model TestingLab(CEP-303)

0L:0T:3P **Credit:1**

Course Objectives: To study the models of various elements of building under field conditions

CourseOutcomes: At theend ofthe course, studentswill beableto

1. Understandtheresponseof structures.
2. Preparethemodels.
3. Conductmodel testingfor staticloading
4. Conductmodeltestingforfreeand forcedvibrations

Experiments:

1) Experiment on a 2 hinged arch for horizontal thrust and influence line for horizontal thrust.
2) Experimental and analytical study of a 3 bar pin jointed truss.
3) Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
4) Beggdefometer- verification of Muller Breslau principle.
5) Experimental and analytical study of an elastically coupled beam.
6) Sway in portal frames- demonstration.
7) To study the cable geometry and statics for different loading condition.
8) To plot stress –strain curve for concrete.
9) Use of mechanical and electrical strain and stress gauge.

Syllabus

NumericalAnalysisLab(CEP-304)

0L:0T:3P **Credit:1**

Course Objectives: To determine the solution of various equations for data fitting

CourseOutcomes: At theend ofthecourse,students willbeable to

1. FindRootsofnon-linearequationsbyBisectionmethodandNewton'smethod.Do curve fittingbyleastsquareapproximations
2. SolvethesystemofLinearEquationsusingGauss-Elimination/Gauss-SeidalIteration/Gauss-Jorden Method
3. ToIntegrate NumericallyUsingTrapezoidalandSimpson'sRules
4. ToFindNumericalSolutionofOrdinaryDifferentialEquationsbyEuler'sMethod,Runge - KuttaMethod.

Experiments:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. CurveFittingbyLeastSquareApproximations.
4. SolvetheSystemofLinearEquations UsingGauss-Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. SolvetheSystem ofLinearEquations UsingGauss-JordenMethod.
7. Integrate numericallyusingTrapezoidal Rule.
8. IntegratenumericallyusingSimpson'sRules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. NumericalSolution ofOrdinaryDifferential EquationsByRunge-KuttaMethod

Syllabus

Open Elective 2 (Optional)

Hydro power Engineering(CET-324)

3L:0T:P **Credit:3**

COURSE OBJECTIVES: To understand the concept of Hydropower. To understand the various methods and procedure to plan and design a hydropower schemes. To have the knowledge of different types of Hydropower Schemes and their purposes. To learn to design and planning of different components of Hydropower plants

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

1. Determine the need, requirements and constraints of hydropower development
2. Analyze the stream flow data to determine the hydropower potential
3. Classify the different types of hydropower plants and the different parts of a typical hydroelectric power structure
4. Determine the requirements of power generation as well as the water conveyance system.
5. Analyze the hydraulic transients and model the water hammer effects using HAMMER and EPANET software

Syllabus:

UNIT – I **(08 Hours)**

Introduction: Prospects of hydropower, sources of energy, hydropower potential, distribution and development, basin-wise development of hydropower, constraints in hydro power development.

UNIT – II **(08 Hours)**

Stream Flow Data and Hydropower Potential: Flow and load duration curves, estimation of flow duration, curve at ungauged site, primary and secondary power, storage and pondage, load factor, capacity factor, utilizationfactor, diversity factor.

UNIT – III **(08 Hours)**

Types of Hydro Power Plants: Base and peak load Hydro-power plants, run-ofriver plants, valley damplants, diversion canal plants, high head diversion plants, pumped-storage power plants. Intake Structures:Functions of intake structures, its location types, trash rack dimensions, design, spacing of bars, methods of cleaning; design of transition.

UNIT – IV **(08 Hours)**

Conveyance System: Power canal-location, site, surges in canals, pen stocks types, design and layout,economical diameter of penstock, hydraulic losses, branches, air vent, forebay. Hydraulic Turbines: Types ofturbines, characteristics and efficiency of turbines, selection of turbines, selection of turbines, cavitation, casing,draft tubes, tail trace and their hydraulic design.

UNIT – V **(08 Hours)**

Hydraulic Transients: Basic equations of Unsteady flow through conduits, method of characteristics

TEXT/REFERENCE BOOKS:

1. Barrow, H.K., "Water Power Engineering", Tata McGraw-Hill, 1943
2. Choudhary, M.H., "Applied Hydraulic Transients, Van Nastrand Reinhold, 1987
3. Warnick, C.C., "Hydropower Engineering", Prentice-Hall, 1984

Syllabus
Research Methodology and IPR (AHT-302)

L:T:P:: 2:0:0 **Credits-2**

Course Objectives: Students will be able to:

1. To understand the fundaments of research in today's world controlled by technology, ideas, concept, and creativity.
2. To understand different methods of research designing and data collections.
3. To understand the methods of report writing and its different methods of interpretations.
4. To understand research ethics and methods of research publications
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and inturn brings about, economic growth and social benefits.

Course Outcomes:

1. To understand research problem formulation.
2. To study research design and method of data collections.
3. To study methods of report writing.
4. To follow research ethics.
5. To enhance student's competence to discover new inventions.

Syllabus Contents:

UNIT I: FUNDAMENTAL OF RESEARCH

Meaning of research; objectives of research; basic steps of research; criteria of good research; Research methods vs. Methodology. Types of research –criteria of good research; Meaning of research problem; selection of research problem; Approaches of investigation of solutions for research problem, Errors in selecting a research problem, Scope and objectives of research problem, Review of related literature- Meaning, necessity and sources.

Unit 2: RESEARCH DESIGN AND DATA COLLECTION

Research design: Types of research design- exploratory, descriptive, diagnostic and experimental;Variables- Meaning and types; Hypothesis- Meaning, function and types of hypothesis; Null/Alternative hypothesis; Sampling- Meaning and types of sampling; Probability and Non-Probability; Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc.

Unit 3:REPORT WRITING AND ITS INTERPRETATION

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions.

Syllabus
Research Methodology and IPR (AHT-302)

L:T:P:: 2:0:0 **Credits-2**

Unit 4:RESEARCH ETHICS AND SCHOLARY PUBLISHING

Ethics-ethical issues, ethical committees (human & animal); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism and its concept and importance for scholar.

Unit 5: INTELLECTUAL PROPERTY RIGHT (IPR)

IPR- intellectual property rights and patent law, commercialization, New developments in IPR; copy right, royalty, trade related aspects of intellectual property rights (TRIPS); Process of Patenting and Development; Procedure for grants of patents, Patenting under PCT;Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science &engineeringstudents'"
2. WayneGoddardandStuartMelville,"ResearchMethodology:AnIntroduction"
3. RanjitKumar,2ndEdition,"ResearchMethodology:AStepbyStepGuideforbeginners"
4. Halbert,"ResistingIntellectualProperty",Taylor&FrancisLtd,2007.
5. Mayall,"IndustrialDesign",McGrawHill,1992.
6. Niebel,"ProductDesign",McGrawHill,1974.
7. Asimov,"IntroductiontoDesign",PrenticeHall,1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age",2016.
9. T.Ramappa,"IntellectualPropertyRightsUnderWTO",S.Chand,2008