COURSE STRUCTURE

AND

SYLLABUS

STRUCTURAL ENGINEERING

For

M.TECH. TWO YEAR DEGREE COURSE

(Applicable for the batches admitted from 2018-19)

VAAGDEVI COLLEGE OF ENGINEERING

(Autonomous)
Bollikunta, Warangal – 506 005
Telangana State, India

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
STRUCTURAL ENGINEERING
COURSE STRUCTURE
(Applicable for the batches admitted from A.Y. 2018-2019 onwards)

I-SEMESTER

Sl. No	Code	Subject	L	T	P	Credit
1	M18SE01	Theory of Elasticity	3	0	0	3
2	M18SE02	Behaviour of Concrete Structures	3	0	0	3
3	M18SE12 M18SE13 M18SE14	**Elective –I** Matrix Methods of Structural Analysis Stability of Structures Advanced Concrete Technology	3	0	0	3
4	M18SE15 M18SE16 M18SE17	**Elective –II** Forensic Engineering and Rehabilitation of structures Prefabricated Structures Theory of Plates	3	0	0	3
5	M18SE03	Structural Design Laboratory	0	0	4	2
6	M18SE04	Advanced Concrete Laboratory	0	0	4	2
7	M18MC01	Research Methodology	2	0	0	2
8	M18AC02	Stress Management	2	0	0	0
		Total credits	**16**	**0**	**8**	**18**

II-SEMESTER

Sl. No	Code	Subject	L	T	P	Credit
1	M18SE05	Finite Element Methods	3	0	0	3
2	M18SE06	Structural Dynamics	3	0	0	3
3	M18SE18 M18SE19 M18SE20	**Elective III** Experimental Techniques Analysis of Foundations Neo Construction Materials	3	0	0	3
4	M18SE21 M18SE22 M18SE23	**Elective IV** Offshore Structures Tall Buildings Design of Prestressed Concrete Structures	3	0	0	3
6	M18SE07	Advanced Computing Laboratory	0	0	4	2
7	M18SE08	Numerical Analysis Laboratory	0	0	4	2
8	M18SE09	Mini Project	0	0	4	2
9	M18AC01	English for Research Paper Writing	2	0	0	0
		Total credits	**14**	**0**	**12**	**18**

VAAGDEVI COLLEGE OF ENGINEERING
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COURSE STRUCTURE
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III-SEMESTER

Sl. No	Code	Subject	L	T	P	Credit
1	M18SE24 M18SE25 M18SE26	**Elective V** Design of Steel Concrete Composite Structures Underwater Construction Earthquake Analysis and Design of Structures	3	0	0	3
2	M18MB22 M18MB30 M18MA01	**Open Elective** Business Law and Ethics Project Management Advanced Optimization Techniques	3	0	0	3
3	M18SE10	Dissertation Phase I	0	0	20	10
		Total credits	**6**	**0**	**20**	**16**

IV-SEMESTER

Sl. No	Code	Subject	L	T	P	Credit
1	M18SE11	Dissertation Phase II	0	0	32	16
		Total credits	**6**	**0**	**32**	**16**

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE01)THEORY OF ELASTICITY

M. Tech – I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objectives

1. To make students understand the principles of elasticity and plasticity.
2. To familiarize students with basic equations of elasticity.
3. To expose students to two dimensional problems in Cartesian and polar coordinates.
4. To make students understand the principle of torsion of prismatic bars.
5. To familiarize students with the concepts of plasticity and yield criteria.

Unit I

Basic concepts of deformation of bodies - Notations of stress and strain in 3D field - Transformation of stress and strain in a 3D field - Equilibrium equations in 2D and 3D Cartesian coordinates.

Unit II

Plane stress and plane strain problems - 2D problems in Cartesian coordinates as applied to beam bending using Airy's stress function - Problems in 2D - Polar coordinate - Equations of equilibrium and compatibility - Curved beam bending - stress concentration in holes - Circular disc subjected to diametral compressive loading - semi-infinite solid subjected to different types of loads.

Unit III

Energy principle - Theorem of minimum potential energy and complementary energy.

Unit IV

Torsion of non-circular sections - St. Venant's theory – Torsion of elliptical sections - Torsion of triangular sections - Prandtl's membrane analogy - Torsion of rolled profiles - Stress concentration around re-entrant corners - Torsion of thin walled tubes - Stress concentration.

Unit V

Plasticity – Introduction - Plastic stress-strain relations - Different hardening rules - Yield criteria for metals - Graphical representation of yield criteria - Application to thin and thick cylinders under internal pressure.

Reference Books:

1. Timoshenko and Goodier, Theory of Elasticity and Plasticity, McGraw-Hill, 2006.
2. Mohammed Amin, Computation Elasticity, Narosa Publications, 2005.
3. Chen and Han, Plasticity for Structural Engineers, Springer Verlag, 1998.
4. K. Baskar, T.K. Varadan, Theory of Isotropic/Orthotropic Elasticity, An Introductory Primer, Anne books Pvt. Ltd., 2009.
5. Chakrabarty. J., Theory of Plasticity, Elsevier Butterworth-Heinmann-UK, Third Edition, 2006.

Course outcomes:

After the completion of this course, the students should be able to

CO 1	apply elastic analysis to study the fracture mechanics
CO 2	apply linear elasticity in the design and analysis of structures such as beams, plates, shells and sandwich composites
CO 3	applyhyperelasticity to determine the response of elastomer-based objects.
CO 4	analyze the structural sections subjected to torsion.
CO 5	understand various theories of failure and concept of plasticity.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE02) BEHAVIOUR OF CONCRETE STRUCTURES

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To impart knowledge on the behavior and design on various reinforced concrete structuralelements.

UNIT-I

The nature of concrete, stress-strain relationships of concrete, stress-strain relationships of reinforcing steel, stress block parameters. Failure criteria for concrete.

UNIT-II

Behaviour of concrete flexural members, general equations for calculation of moment capacities at ultimate limit state and at limit state of local damage, flexural rigidity, calculation of deflection, redistribution of moments, design examples.

UNIT-III

Axially loaded compression members combines axial load and uniaxial bending. Interaction diagrams, combined axial load and biaxial bending, slender compression members, design example using I.S.456-2000.

UNIT-IV

Shear cracking of ordinary reinforced concrete members, web reinforcement, design examples, shear in tapered beams. Development length of reinforcement, anchorage. Significance of Torsion, Torsional resistance of concrete beams, reinforcement for torsion, design examples.

UNIT-V

General principles, effective depths, detailing of reinforcement, design of main reinforcement, design of transverse reinforcement, conditions at loads and at supports. Yield line theory.

Reference Books:

1. Varghese P.C, Design of Reinforced Concrete Structures, Prentice hall of India, 2004.
2. Krishnamurthy, K.T, Gharpure S.C. and A.B. Kulkarni – Limit design of reinforced concrete structures, Khanna Publishers, 1985.

Course Outcomes:

After the completion of this course, the students should be able to

CO-1: Obtain Knowledge ofthebehaviorofreinforcedconcretestructures and Identify reinforced concrete failure modes from crack patterns
CO-2: Understand the behaviour of flexural members
CO-3: Determine bond length, lap splice and detailing requirements for reinforced concrete members
CO-4: Demonstrates the behaviour of short column under axial, uni-axial & bi-axial bending and slender columns.
CO-5: Understand the concept of Yield line theory.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE12) MATRIX METHODS OF STRUCTURAL ANALYSIS

M. Tech– I Sem. (Structural Engineering) **L T PC**
3 0 0 3

Objective: To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portalframes.

Pre Requisites: Strength of Materials, Structural Analysis

UNIT-I
Generalised Measurements- Degrees of freedom- Constrained Measurements -Behaviour of structures - Principle of superposition- Stiffness and flexibility matrices in single, two and n-co-ordinates - Structures with constrained measurements.

UNIT-II
Stiffness and flexibility matrices from strain energy - Betti's law and its applications- Determinate and indeterminate structures - Transformation of element matrices to system matrices - Transformation of system vectors to element vectors.

UNIT-III
Flexibility method applied to statically determinate and indeterminate structures – Choice of redunants - Transformation of redundants-Internal forces due to thermal expansion and lack of fit.

UNIT-IV
Displacement method - Internal forces due to thermal expansion and lack of fit - Application to symmetrical structures – Code system in the stiffness methods - Computer program for the code system - Comparison between stiffness and flexibility methods.

UNIT-V
Analysis by substructures using the stiffness method and flexibility method with tridiagonalization- Analysis by Iteration method - frames with prismatic members - non-prismatic members.

Reference Books:

1. Moshe, F., Rubenstein, Matrix Computer Analysis of Structures, Prentice Hall, New York, 1966.
2. Kanchi, Matrix Structural Analysis, Wiley Eastern Ltd., Newdelhi 1981.
3. Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001.

Course Outcomes:
After the completion of this course, the students should be able to

CO 1	Distinguish between stable and unstable and statically determinate and indeterminate structures.
CO 2	Apply strain energy (Betti's law) for determinate and indeterminate structures
CO 3	Form the stiffness and loading matrices of an idealized structure, with a focus on building and bridge structures
CO 4	Analyze indeterminate beams, frames and trusses using displacement method and flexibility method
CO 5	Discuss the fundamental concepts and theories of Matrix Methods for analysis of skeletal structures such as beams, plane and spacetrusses, plane and space frames and grillage structures

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE13) STABILITY OF STRUCTURES

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To study the concept of buckling and analysis of structural elements.

UNIT – I

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load – application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowablestresses.

UNIT - II

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built upcolumns.

UNIT - III

In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various endconditions

UNIT - IV

Torsion 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 by torsion andflexure.

UNIT – V

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and twodirections.

Reference Books:

1. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company, 1963.
2. Stability of metallic structures by Blunch- McGrawHill
3. Theory of Beam- Columns Vol I by Chem. &Atste Mc. GrawHill
4. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi,2003.
5. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall,1974.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Understand stability of static and dynamic equilibrium.
CO 2	Determine the buckling loads for simple columns and frames, have an understanding of the concept of effective length and its use in design
CO 3	Analyse the beams for lateral-torsional buckling
CO 4	Differentiate how the tangent modulus and double modulus theories of inelastic buckling led to the column paradox, thereby preventing further difficulties for a general theory of structures.
CO 5	Apply advanced numerical techniques to bucking analysis of structures.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE14) ADVANCED CONCRETE TECHNOLOGY

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To impart knowledge on concrete making materials, concrete mix design for proportioning and theirtesting.

UNIT – I

Concrete Making Materials: Cement- Bogue's compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined aggregate-Alkali Silica Reaction - Admixtures – Chemical and Mineral admixtures.

UNIT – II

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation andbleeding.

Hardened Concrete: Abram's law- Gel space ratios, Maturity Concept – Stress Behavior – Creep and Shrinkage – Durability tests on concrete - Non destructive testing of concrete.

UNIT - III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design 0s HSC Using EntroyShaklok Method- Ultra High Strength Concrete.

High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

UNIT –IV

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete– Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete.

Concrete mix design: Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOEmethod.

UNIT –V

Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal for forms – reshoring – failure of formwork.

Reference Books:

1. Neville, A. M., "Properties of Concrete," 4th and final Edition, 2003.
2. Mehta, P. K. and Monteiro, P. J. M., "Concrete: Microstructure, Properties, and Materials," 3rd Edition, 2006.
3. Shetty M S, Concrete Technology, - Theory and Practice", S.Chand and Company, New Delhi, 1992.
4. Mindess S and Young JF, "Concrete", Prentice-Hall, USA,1981
5. H. Okamura and K. Ozawa, "Mix Design for Self-Compacting Concrete," Concrete Library of JSCE, No. 25, 1995, pp. 107 – 120
6. G. H. Tattersall, "Workability and Quality Control of Concrete," E&FN Spon, London, 1991
7. Hewlett P C Concrete Admixtures use and applications, ed M R Rixom, The Concrete press, London, 1972

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Develop an advanced knowledge of the mechanical performance of cement based materials
CO 2	Use advanced laboratory techniques to characterize cement-based materials and determine the properties of concrete ingredients i.e. cement, sand, coarse aggregate by conducting different tests.
CO 3	Understand the mix design and engineering properties of special concretes such as high-performance concrete, self-compacting concrete, fibre reinforced concrete, etc.
CO 4	Understand the safety steps involved in the design of form work and false work
CO 5	Design high grade concrete and study the parameters affecting its performance

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE15) FORENSIC ENGINEERING AND REHABILITATION OF STRUCTURES

M. Tech –I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To study the damages, repair and rehabilitation of structures.

UNIT – I

Failure of Structures

Review of the construction theory – performance problems – responsibility and accountability – case studies – learning from failures – causes of distress in structural members – design and material deficiencies – over loading

UNIT – II

Diagnosis and Assessment of Distress

Visual inspection – non destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests – Bremor test – Windsor probe test – crack detection techniques – case studies – single and multistorey buildings – Fibreoptic method for prediction of structural weakness

UNIT – III

Environmental Problems and Natural Hazards

Effect of corrosive, chemical and marine environment – pollution and carbonation problems – durability of RCC structures – damage due to earthquakes and strengthening of buildings – provisions of BIS 1893 and 4326

UNIT – IV

Modern Techniques of Retrofitting

Structural first aid after a disaster – guniting, jacketing – use of chemicals in repair – application of polymers – ferrocement and fiber concretes as rehabilitation materials – strengthening by pre-stressing – case studies – bridges – water tanks – cooling towers – heritage buildings – high rise buildings.

UNIT – V

Seismic Retrofitting of reinforced concrete buildings

Introduction; Considerations in retrofitting of structures; Source of weakness in RC frame building – Structural damage due to the discontinuous load path; Structural damage due to lack of deformation; Quality of workmanship and materials; Classification of retrofitting techniques; Retrofitting strategies for RC buildings – Structural level (global) retrofits methods; Member level (local) retrofit methods; Comparative analysis of methods of retrofitting

References Books

1. Diagnosis and treatment of structures in distress by R.N.Raikar, Published byR&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai,1994.

2. Dovkaminetzky, Design and Construction Failures, Galgotia Publication, New Delhi,2001 2. Jacob Feld and Kenneth L Carper, Structural Failures, Wiley Europe

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Learn various distress and damages to concrete and masonry structures.
CO 2	Understand NDT techniques for condition assessment of structures for identifying damages in structures.
CO 3	Describe and applythe importance of quality controlin concrete construction and significance ofprotection and maintenance of structures.
CO 4	Identify repairs and remedies to be adopted for rehabilitation of buildings.
CO 5	Asses existing conditions of buildings.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE16) PREFABRICATED STRUCTURES

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To Study the design principles, analysis and design of elements**.**

UNIT I

Types of prefabrication, prefabrication systems and structural schemes- Disuniting of structures- Structural behaviour of precast structures.

UNIT II

Handling and erection stresses- Application of prestressing of roof members; floor systems two way load bearing slabs, Wall panels, hipped plate and shellstructures.

UNIT III

Dimensioning and detailing of joints for different structural connections; construction and expansionjoints.

UNIT IV

Production, Transportation & erection- Shuttering and mould design Dimensional tolerances- Erection of R.C. Structures, Total prefabricated buildings.

UNIT V

Designing and detailing prefabricated units for 1) industrial structures 2) Multistorey buildings and 3) Water tanks, silos bunkers etc., 4) Application of prestressed concrete in prefabrication.

Reference Books:

1. Hass, A.M. Precast Concrete Design and Applications, Applied Science Publishers,1983.
2. Promyslolw, V Design and Erection of Reinforced Concrete Structures, MIR Publishers, Moscow1980.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Gain Knowledge on basic concepts of prefabrication, types and its systems
CO 2	Obtain knowledge on handling and erection stresses in prefabrication and adopt the design principlesfor prefabricated structures
CO 3	Get knowledge on production, transportation and erection of prefabricated structures
CO 4	To have a detailed knowledge in designing and detailing of various prefabricated units
CO 5	Identify suitable prefabricated components for specific use

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE17) THEORY OF PLATES

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To impart knowledge on the behavior of plates and to analyze the problems pertaining to beams on elasticfoundation.

UNIT I

Cylindrical Bending : Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.

Pure Bending of Plates : Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending – Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNITII

Small Deflection Theory of Thin Rectangular Plates:

Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier's solution –Application todifferent cases–Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostaticpressure.

UNIT III

Circular Plates : Symmetrical loading – Relations between slope, deflection, moments and curvature– Governing differential equation – Uniformly loaded plates with clamped and simply supported edges– Central hole – bending by moments and shearing forces uniformly distributed.

Orthotropic Plates: Introduction – Bending ofanisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet – Application to the theory of gridworks.

UNIT IV

Plates on Elastic Foundations: Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions - Large plate loaded at equidistant points by concentrated forcesP.

UNIT V

Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane ofplate

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simpleloading.

References Books:

1. Timoshenko and Krierger, "Theory of Plates and Shells", 2nd Edition, Tata McGraw Hill, 2010.
2. AnselC.Ugural, "Stresses in plate and shells", McGraw Hill International Edition, 1999.
3. Bairagi, "Plate Analysis", Khanna Publishers, 1996.
4. Bulson.P.S.,"Stability Of Flat Plates.,American Elsevier Publisher. Co.,1969.
5. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.
6. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2006.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Understand the behavior of cylindrical bending in plates
CO 2	Analyze plates under different boundary connections by various classical methods, special and approximate methods
CO 3	Perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and small deflection theories for various boundary conditions.
CO 4	Understand the behaviour of orthotropic plates, grids and folded plates.
CO 5	Enrich research capability in plates and apply the theory of plates in engineering designs.

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE03) STRUCTURAL DESIGN LABORATORY

M. **Tech– I Sem. (Structural Engineering)**

L	T	P	C
0	0	4	2

Objectives: To impart knowledge on the use of various software

Experiments:

1. Program using arrays and functions for matrixmanipulation.
2. Programs to draw bending moment and shear forcediagrams.
3. Program for design ofslabs.
4. Program for design ofbeams.
5. Program for design of column andfooting.
6. Analysis of truss.
7. Analysis of multistoried spaceframe.
8. Analysis of Bridge deckslab.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1 Create a program using arrays and functions for matrix manipulation
CO 2 Create a program to draw bending moment and shear force diagrams
CO 3 Learn program to design slab, beams, columns and footings
CO 4 Learn program to analyze truss, multi storey frame and bridge deck slab

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE04) ADVANCED CONCRETE LABORATORY

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
0	0	4	2

Objectives: To impart knowledge on the test on cement and aggregates.

Experiments:

1 Tests on cement - Consistency, Setting times, Soundness, Specific Gravity and CompressiveStrength.
2. Test on Fine Aggregate: Surface Moisture Content & Absorption, Silt Content Test, Bulking of Sand, Sieve Analysis, Fineness Modulus andSpecific gravity.
3. Test on Coarse aggregate: Crushing Value, Impact Value, Shape test,Specific gravity and water absorption test
4. Design of concrete mix by IS method and casting
5. Test on fresh concrete (a) Slump cone test (b) Compaction Factor test
6. Test on hardened concrete- Study of stress and strain characteristics, and determination of Young's modulus- Compression Test - Split Tensile Test
7. a)Test on concrete using Non - Destructive Testing Techniques
   i. Ultrasonic method
   ii. Rebound Hammer method
   iii. Comparison of destructive test results with the NDT results
8. Workability tests on fresh self compactingconcrete
9. Air Entrainment test on freshconcrete.
10. Permeability test on hardenedConcrete.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Test Fineness, Specific Gravity, Setting Time, Soundness and Compressive Strength of Cement
CO 2	Test physical properties of Coarse Aggregate and Fine Aggregate
CO 3	Test Workability of Fresh Concrete and Compressive strength, Split Tensile Strength of Hardened Concrete
CO 4	Demonstrate ability to make selection of materials based on their properties, behaviour and intended use in design and construction

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18MC01) RESEARCH METHODOLOGY

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
2	0	0	2

Course Objectives:

- To develop an understanding of IPR/ research methodology in the process of creation of patents through research.
- To develop further research capabilities.
- To learn better report writing skills and Patenting.

UNIT I

RESEARCH METHODOLOGY: Objectives and Motivation of Research, Significance of Literature review, Types of Research, Research Approaches, and Research Methods verses Methodology, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria of Good Research.

UNIT II

RESEARCH DESIGN: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Data collection methods, Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data.

UNIT III

RESEARCH REPORT WRITING: Format of the Research report, Synopsis, Dissertation, References/Bibliography/ Webliography, Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNITIV

NATURE OF INTELLECTUAL PROPERTY: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

UNIT V:

PATENT RIGHTS: Scope of Patent Rights. Licensing and transfer of technology. Patentinformation and databases. New Developments in IPR: Administration of Patent System.

Reference Books:

1. C.R Kothari, "Research Methodology, Methods &Technique".New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.
5. Satarkar, S.V,."Intellectual property rights and copy right". ESS Publications, 2000.

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18AC02) STRESS MANAGEMENT

M. Tech– I Sem. (Structural Engineering)

L	T	P	C
2	0	0	2

Objectives:

- To utilize effective relaxation and stress reduction techniques
- Develop a Personal Action Plan for Stress Management

UNIT I

UNDERSTANDING STRESS

Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress -sources of stress – consequence of stress-burnout-symptoms of Burnout- stress verses Burnout-model of stress-strategies for coping stress (individual and organizational strategies) –case study

UNIT II

TIME MANAGEMENT

Techniques – Importance of Planning the day –developing concentration – Prioritizing Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No"

UNIT III

CAREER PLATEAU

Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

UNIT IV

CRISIS MANAGEMENT

Implications – People issues – Structure issues – Environmental issues – Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humour, Developing a sense of Humour – Learning to laugh – role of group cohesion and team spirit.

UNIT V

SELF DEVELOPMENT

Improving personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

ReferenceBooks

1. Bhatia R.L., The Executive Track: An Action Plan for Self Development Wheeler Publishing, New Delhi
2. Charavathy.S.K, "Human Values for Manager", McGraw Hill/Henely Management Series
3. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi
4. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE05) FINITE ELEMENT METHODS

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objectives: To study the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems.

Pre Requisites: Structural Analysis, Matrix Methods of Structural Analysis.

UNIT I

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination - Raleigh - Ritz method of functional approximation.

Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT II

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements. Two dimensional FEM: Different types of elements for plane stress and plane strainanalysis- displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT III

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis - formulation of 4-noded and 8-noded isoparametric quadrilateral elements- Lagrange elements - serendipityelements. Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetricelements.

Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

UNIT IV

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT V

Introduction to non-linear analysis-basic methods-application to Special structures.

Reference Books:

1. O.C. Zeinkiewicz, “Finite Element Method: Its Basic and Fundamentals”, 6thEdition, Butterworth Heinemann,2007.
2. R D Cook, “Concepts and Applications of Finite Element Analysis”, Willey Publication, 1995.
3. SS Rao, “The Finite Element Method in Engineering”, Elsevier Publication,2009.
4. ChandrupatlaBelegundu, “Finite Element Method”, McGraw-Hill,1997.

5. P Seshu, "Textbook of Finite Element Analysis", 1st Edition, PHI,2009.
6. C.S. Krishna Murthy, "Finite Element Analysis – Theory and Programming, 2nd Edition, Tata McGraw Hill,2005.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Understand the fundamental concepts of the Finite Element Method (FEM).
CO 2	Make use of shape function and interpolation function to study structural behavior.
CO 3	Apply linear and quadratic elements in the finite element analysis of various types of structures.
CO 4	Gain knowledge on basic concept on non linear analysis
CO 5	Learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE06) STRUCTURAL DYNAMICS

M. Tech – II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To expose the students the principles and methods of dynamic analysis of structures and to prepare them for designing the structures for wind, earthquake and other dynamic loads.

UNIT I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial 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 -Dynamic magnification factor – Phase angle –Bandwidth

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 Hamiltonprinciple.

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 superpositionprocedure.

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 continuousbeams.

UNIT V

Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation - Lumped mass approach - SDOF and MDOF systems - I. S. Code methods of analysis for obtaining response of multi storeyed buildings.

Reference Books:

1. Dynamics of Structures by Clough &Penzien, McGraw Hill, Newyork
2. Structural Dynamics by Mario Paz, C.B.S Publishers, NewDelhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore),Delhi.
4. I.S: 1893 - 1984, "Code of practice for Earthquake resistant design of Structures" and latest I.S: 1893 - 2002 (version)Part-1

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Apply the fundamental concepts and definitions used in structural dynamics.
CO 2	Characterize the dynamic properties of a structure such as natural frequencies and mode shapes and to compare these to the properties of the load.
CO 3	Calculate the natural frequency of a system using equilibrium or energy methods.
CO 4	Determine the effect of viscous damping on the response of a freely vibrating system.
CO 5	Determine the response of a system to a harmonic excitation.
CO 6	Evaluate forces and design earthquake resistant structure.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE18) EXPERIMENTAL TECHNIQUES

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.

UNIT I

Forces and Strain Measurement

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – vibrating wire sensors– Fibre optic sensors.

UNIT II

Measurement of Vibration and Wind Flow

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

UNIT III

Distress Measurements and Control

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

UNIT IV

Non Destructive Testing Methods

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission– ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR , Ground penetrating radar (GPR).

UNIT V

Model Analysis

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations – structural problems –Usage of influence lines in model studies.

Reference Books:

1. Dalley .J. W and Riley. W. F, “Experimental Stress Analysis”, McGraw Hill Book Company, N.Y. 1991
2. Ganesan.T.P, “Model Analysis of Structures”, University Press, India, 2000.
3. Ravisankar.K.andChellappan.A., “Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures”, SERC, Chennai, 2007.
4. Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi, 2006.
5. Sirohi.R.S.,Radhakrishna.H.C, “Mechanical Measurements”, New Age International (P) Ltd. 1997.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Apply experimental techniques using strain gauges to solve field problems.
CO 2	Gain knowledge on characteristics of structural vibrations and wind flow.
CO 3	Measuredistress in the structures using various electronic equipment.
CO 4	Obtain knowledge on advanced NDT methods in accessing the load testing of structures.
CO 5	Usevarious vibration measuring instruments and analyze the structures using digital display unit.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE19) ANALYSIS OF FOUNDATIONS

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To develop an understanding of the modern principles of design of pile foundations and the application of those principles to practice.

UNIT I

Functions and requisites of a foundation - Different types - Choice of foundation type – Types of deep foundation – Types of pile foundations- Factor governing choice of type of pile – Choice of pile materials.

UNIT II

Load carrying capacity of piles by static formulae- Introduction: IS code method- API method-Piles in cohesive and cohesionless soils – Piles in layered cohesive and cohesionless soils – Settlement of single pile – Piles bearing on rock – Piles in fill and Negative skin friction.

UNIT III

Load carrying capacity of piles by dynamic formulae: Introduction- Pile driving formulae- selection of pile hammers- Determination of temporary elastic compression- Driving stresses in piles- Field measurement- Wave equation analysis.

UNIT IV

Group action in piled foundations: Introduction- Minimum spacing of piles- group efficiency- Estimation of group bearing capacity- Effect of pile arrangement- Effect on pile groups of installation methods- precaution against heave effect in pile group-Settlement of pile group- Reduce differential settlement in pile group.

UNIT V

Pile subjected to lateral load: Introduction- Lateral resistance of single pile-IS 2911 method for lateral resistance of pile- Broms charts for lateral load analysis- Elastic analysis-p-y curves, use of p-y curves- improving lateral resistance of piles- field test onpiles.

Reference Books:

1. J.E. Bowles, “Foundation Analysis and Design”, McGraw Hill,1996.
2. M.J. Tomlinson, “Foundation Design and Construction”, Addison Wesley,2001.
3. M.J. Tomlinson, “Pile Design and Construction Practice”, E & FN Spon,1987.
4. Braja M. Das., “Principles of Foundation Engineering”, Thomson Asia Pte , 1987, London Ltd., Singapore, 2005, A viewpointpublication.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Obtain knowledge on types of deep foundation and factors governing on it.
CO 2	Analyze the piles with static formulae
CO 3	Gain knowledge on piles placed in group
CO 4	Design appropriate foundation systems based on ground-investigation data and be able to select correct soil parameters for the designs
CO 5	Appraise foundation design concepts in the choice of appropriate foundation and design simple foundations.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE20) NEO CONSTRUCTION MATERIALS

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objectives: - Itgives students a comprehensive understanding of the composition, microstructure, and engineering behavior of materials used in civil engineering applications.

UNIT-I

Introduction, Historical back ground of Light weight aggregate concrete - Artificial aggregates, Physical properties of aggregates, Light weight aggregate concrete - Applications of light weight aggregate concrete - Properties of green light weight aggregate concrete - Effect of size aggregate on the strength properties of LWAC made with palm oil shells - Recycled aggregate – High performance concrete –applications - Pre placed aggregate concrete

UNIT-II

Fibers in Concrete: Fiber reinforced concrete, Behavior of steel fibers in concrete, Glass fiber reinforced concrete, GFRC in construction, Natural fiber reinforced concrete, Polymer Fiber Reinforced Concrete.

UNIT-III

Special Concretes: High strength concrete, Effect of RHA on the properties of HSC, High performance concrete–applications, Self-Compacting Concrete, Concrete made with waste rubber, Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics, Nano Concrete, Changes in concrete with respect to time.

UNIT-IV

Corrosion in Concrete: Corrosion in concrete and its protection, Corrosion of rebars in concrete, Influence of fly ash on the corrosion steel bar in concrete.

UNIT-V

Advanced Materials: Adhesives in construction industry- Acrylics, Bridge bearings, Industrial waste materials in concrete Rapid wall panels, Moisture Barriers.

Reference Books:

1. A.M. Neville, “Properties of Concrete”, 5thEdition, PHI,2012.
2. Kumar Mehta. P and Paulo J M Monteiro, “Concrete Microstructure, Properties and Materials”, McGraw Hill, 2006.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Demonstrates the knowledge on light weight aggregate concrete and its application
CO 2	Gain knowledge on high strength and high performance concrete methods
CO 3	Know behaviour of special concrete and its effects oon properties of concrete
CO 4	Study about corrosion and its prevention in reinforced concrete
CO 5	Understand the use of advanced materials in construction projects

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18SE21) OFFSHORE STRUCTURES

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To study the concept of wave theories, forces and design of jacket towers, pipes andcables**.**

UNITI

Wave Theories

Wave generation process, small, finite amplitude and nonlinear wave theories.

UNITII

Forces ofOffshoreStructures

Wind forces, wave forces on small bodies and large bodies - current forces and use of Morison equation.

UNITIII

Offshore Soil andStructure Modelling

Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling.

UNITIV

Analysis ofOffshoreStructures

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNITV

Design ofOffshore Structures

Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipe lines.

Reference Books:

1. API RP 2A-WSD, "Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design" - API Publishing Services,2005
2. Chakrabarti, S.K., Handbook of "Offshore Engineering" by, Elsevier,2005.
3. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", WIT press,2001.
4. Dawson.T.H., "Offshore Structural Engineering", Prentice Hall Inc Englewood Cliffs, N.J. 1983.
5. James F. Wilson, "Dynamics of Offshore Structures", John Wiley & Sons, Inc,2003.
6. TurgutSarpkaya, "Wave Forces on Offshore Structures", Cambridge University Press,2010.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Calculate wave forces on fixed and floating structures
CO2	Illustrates different types of foundations for offshore structures
CO 3	Gain Knowledge on static and dynamic analysis for foundations of offshore structures
CO 4	Conduct analysis of floating platform and Interpret transfer functions on the basis of a thorough understanding of the governing physical effects
CO 5	Conduct fundamental global stability checks of various floating and bottom supported offshore structures

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE22)TALL BUILDINGS

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To impart knowledge on analysis of tall buildings.

Unit-I

Introduction : Classification of Buildings – Low-rise, medium-rise, high-rise – Evolution of tall buildings – Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements –Strength, Stiffness & Stability.

Unit-II

Lateral load resisting elements : Frames, Shear walls & Tubes – Shear, Bending & combined modes of deformation – Structural behavior of Rigid frames – Simplified methods of analysis – Substitute frame method, Portal method, Cantilever method, Equivalent frame method –Structural behaviour of Shear walls – Approaches of analysis – Elastic continuum approach & Discrete approach -- Structural behavior of Tubes– Actions.

Unit-III

Choice of System for a Building : Frame building, Shear wall building, Shear walls acting with frames, Single framed tubes – Other structural forms – Staggered Wall-beam system, Tube-in-tube system, Base isolation technique for earthquake resistance. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffnessmethod.

Unit-IV

Methods of Analysis: Shear walls without Openings – Estimation of Stiffness by simple Cantilever theory & Deep beam theory – Shear walls with Openings – Equivalent frame for large openings – Muto's method for small openings –Elastic Continuum approach – Coull&Chowdhry's method – Design Charts – Limitations of Continuum approach. Shear wall- Frame Interaction : Sharing of loads between wall & frame - Different methods –comparison

- Khan &Sbrounis' method – Design charts - Mac Leod'smethod - Advantages & limitations -

Cooperation of Floor slabs – Equivalentwidth.

Unit-V

Modern Methods: Analysis of Tall buildings by Stiffness method – Available Softwares for analysis of tall buildings.

Reference Books:

1. Beedle.L.S., "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 1986.
2. Bryan Stafford Smith and Alexcoull, "Tall Building Structures - Analysis and Design", John Wiley and

Sons, Inc., 2005.
3. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,1995.
4. Lin T.Y and Stotes Burry D, "Structural Concepts and systems for Architects and Engineers", John Wiley, 1988.
5. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 1988.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1 Study the behavior of different types of tall structural systems
CO 2 Analyzetall structures for vertical and lateral loads with various methods and approaches
CO 3 Gain the knowledge to select appropriate type of tall building depending on physical factors
CO 4 Understand approximate analysis, accurate analysis and reduction techniques
CO 5 Acquisition of skills and competences for the analysis and design of Tall Buildings

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE23) DESIGN OF PRESTRESSED CONCRETE STRUCTURES

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objectives: Toimpartknowledgeonbasicsofprestressinganddesigningofdifferentstructuralelements using Prestressing techniques.

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 – AnchorageSlip.

UNIT II:

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS: Importance of Control of Deflections–FactorsInfluencingDeflection–Short-termDeflectionsofUncrackedMembers- Prediction of Long-time Deflections – Deflections of Cracked Members – Requirementsof IS1343-2012.

Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNITIII:

COMPOSITE CONSTRUCTIONS: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shearstrengthofcompositesections-DeflectionofCompositeBeams.DesignofComposite sections.

UNITIV:

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 PrestressingInderterminate 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.

Reference Books:

1. PrestressedConcretebyKrishnaRaju–FifthEdition-TataMcGrawHillBook–Co., NewDelhi.
2. DesignofPrestressConcreteStructuresbyT.Y.LinandBurn,JohnWiley,NewYork.
3. Prestressed Concrete by N. Rajagopalan, Narosa PublishingHouse
4. IS1343-2012,PrestressedConcrete–CodeofPractice,BureauofIndianStandards.
5. PrestressedConcrete:AnalysisandDesignPracticebyKarunaMoyGhosh,Prentice Hall ofIndia

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	To understand the principles of pre-stressing, materials of pre-stressing, different systems of pre-stressing, structural behaviour, advantages, losses of pre-stress, deflection of pre-stressed members.
CO 2	Analyze and design prestressed flexure members and horizontal and vertical shear in prestressed members
CO 3	Study the behaviour of composite sections under prestressing
CO 4	Realize the importance of prestessing the long span structures and heavily loaded members..
CO 5	Develop skills in planning, analysis and design of prestressed concrete beams, and slabs.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE07)ADVANCED COMPUTING LABORATORY

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
0	0	4	2

Objectives:

• Students will gain skill working with Finite Element Modelling (FEM) tooland learn to analysis different elements andstructures through FEM analysis
• At the end of the course students gains knowledge about the analysis of prestressed concrete elements.
• Ability to analyse the retaining walls and structures subjected to seismic loads.

List of Experiments:

1. FEM – Preprocessing: Element Type, Material/ Geometric properties, Modeling, MeshGeneration – Solution: Loads, Constraints – Post Processing
2. FEM Analysis of RCC Beam – Column – Slab.
3. Finite Element Modelling and Analysis of Plane frame and Space frame.
4. Analysis of Pre-stressed concrete elements through Finite Element Modeling.
5. Finite Element Analysisof truss member
6. Buckling analysis of steel member using FEM tool
7. Finite Element Modelling and Analysis of Bridge Structure.
8. Dynamic Analysis of Structure Subjected to Seismic Load.
9. Analysis of Retaining wall in Geotechnical module.
10. Finite Element Modelling and Analysisof water storage tanks

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Gain knowledge about Modelling, analysis and designing of RCC elements using FEM tool.
CO 2	Understand to design pre-stressed concrete elements.
CO 3	Able to analyze steel member and bridge structure using FEM analysis.
CO 4	Gain knowledge about response of dynamic analysis of structure
CO 5	Able to analyze retaining wall and water storage structures

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE08) NUMERICAL ANALYSIS LABORATORY

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
0	0	4	2

Syllabus Contents:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. Numerical Solution of Ordinary Differential Equations ByRunge- Kutta Method.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Obtain Roots of non-linear equations by Bisection method and Newton's method.
CO 2	Perform calculations on system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
CO 3	Integrate Numerically Using Trapezoidal and Simpson's Rules
CO 4	Calculate Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-KuttaMethod

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE09) MINI PROJECT

M. Tech– II Sem. (Structural Engineering)

L	T	P	C
0	0	4	2

Objectives:

- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Structural Engineering in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.

SYLLABUS:

The students individually undertake training in reputed Industries during the vacation for a specified period. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

Course Outcomes:

They are trained in tackling a practical field/industry orientated problem related to Structural Engineering.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18AC01) ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course-II)

M. Tech – II Sem. (Structural Engineering)

L	T	P	C
2	0	0	0

Course Objectives:

- To understand the nuances of language and vocabulary in writing a Research Paper.
- To develop the content, structure and format of writing a research paper.
- To give the practice of writinga Research Paper.
- To enable the students to evolve original research papers without subjected to plagiarism.

UNIT I:

ACADEMIC WRITING: What is Research? - Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT II:

RESEARCH FORMAT: Title – Abstract – Introduction – Discussion - Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT III:

RESEARCH METHODOLOGY: Methods (Qualitative – Quantitative) – Literature Review – Who did what – Criticizing, Paraphrasing & Plagiarism.

UNIT IV:

PROCESS OF WRITING A RESEARCH PAPER: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - Typing the final draft

UNIT V:

HOW TO & WHERE TO GET PUBLISHED: Reputed Journals – National/International – ISSN No, No. of volumes, Scopes Index/UGC Journals – Freepublications - Paid Journal publications – /Advantages/Benefits

Reference Books:

1. MLA Hand book for writers of Research Papers, East West Press Pvt. Ltd, New Delhi, 7th Edition.
2. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4th Edition.
3. LauriRozakis, Schaum's Quick Guide to Writing Great Research Papers, Tata McGraw Hills Pvt. Ltd, New Delhi.
4. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers
5. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	The student will be able to understand the nuances of research writing
CO 2	The student will be able to write a research paper with required writing skills and be confident to share their writing with others
CO 3	The student will be able to publish a paper using the requisite standard in a journal
CO 4	The student will be able to work on citations and ably place them in her research paper
CO 5	The student will be able to avoid plagiarism and be able to develop her own writing skills in presenting the research work

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE24) DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES

M. Tech– IIISem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To develop an understanding of the behaviour and design concrete composite elements and structures.

UNIT I

Design of members subjected to lateral loads and axial loads - Principles of analysis and design of Industrial buildings and bents - Crane gantry girders and crane columns - Analysis and design of steel towers - Design of industrial stacks - Self supporting and guyed stacks lined and unlined.

UNIT II

Types of connections, Design of framed beam connections, Seated beam connection, Un- stiffened, Stiffened Seat connections, Continuous beam – to - beam connections and continuous beam–to–column connection both welded and bolted.

UNIT III

Cold formed Steel Sections - Types of cross sections - Local buckling and post buckling - Design of compression and Tension members - Beams - Deflection of beams - Combined stresses and connections.

UNIT IV

Introduction to composite design – shear connectors – types of shear connectors – degrees of shear connections – partial and full shear connections – composite sections under positive bending – negative bending – propped conditions – un-propped conditions – deflection of composite beams.

UNIT IV

Introduction – Composite slabs – profiled sheeting – sheeting parallel to span – sheeting perpendicular to span - Types of Composite columns – design of encased columns – design of in-filled columns – axial, uni-axial and bi-axially loaded columns. Composite shear wall – double skinned composite deck panels – composite trusses – composite frames – composite plate girders.

Reference Books:

1. Arya, A.S., Design of Steel Structures, New Chand & Brothers, New Delhi1982.
2. R.P. Johnson, “Composite Structures of Steel & Concrete”, Blackwell Scientific publications, UK,1994.
3. Necessary Indian &Eurocodes.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Design of members subjected to axial and lateral loads
CO 2	Design the connection for composite members
CO 3	Design tension and compression members
CO 4	Understand the concept of steel-concrete composite construction
CO 5	Get introduced to composite construction and composite behaviour of steel concrete composite structures

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE25) UNDERWATER CONSTRUCTTION

M. Tech– IIISem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objectives: - To create dry and water free environment for working so that the stability of the structure is balanced

UNIT-I

Introduction-sitepreparation-temporaryroads-sitedrainage-deeptrenchanddeepbasement excavations - bulkexcavation.

UNIT-II

Coastal structures - stability of slopes to open excavations - support of excavation by timbering and sheet piling.

UNIT-III

Offshore Platforms - retaining walls and sheet pile design - requirements for shorting and underpinning - methods of shoring of Underpinning.

UNIT-IV

Dewatering and Groundwater Control for Soft Ground Tunneling - Tunneling in touch, medium- tough and soft rocks - tunneling by borls shield tunneling.

UNIT-V

Deep water foundations - Design of piles - pile load tests - Foundation design for dynamic conditions.

Reference Books:

1. BenC.GerwickJr.,"ConstructionofMarineandOffshoreStructures",3rded.CRCPress, 2007.
2. PatrickPowers.J.,"ConstructionDewatering:NewMethodsandApplications",JohnWiley and Sons,1992.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Understand problems in site preparation, drainage and shoring during excavation.
CO 2	Understand the concept of stability of slopes in excavation.
CO 3	Perform analysis of offshore platform on the basis of a thorough understanding of the governing physical effects.
CO 4	Make use of underwater tunnelling techniques in practical applications.
CO 5	Obtain knowledge on underwater foundation for structures.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE26) EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES

M. Tech – IIISem. (Structural Eng)

L	T	P	C
3	0	0	3

OBJECTIVE: To study the effect of earthquakes, analysis and design of earthquake resistantStructures.

UNITI

Earthquakes andGroundMotion

Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon), Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters,Microzonation.

UNITII

Effects of Earthquakeon Structures

Dynamics of Structures (SDOFS/ MDOFS), Response Spectra - Evaluation of Earthquake Forces as per codal provisions - Effect of Earthquake on Different Types of Structures - Lessons Learnt From Past Earthquakes

UNITIII

Earthquake Resistant Design of Masonry Structures

Structural Systems - Types of Buildings - Causes of damage - Planning Considerations - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Masonry Buildings - Design consideration – Guidelines.

UNITIV

Earthquake Resistant Design ofRcStructures

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis – Capacity based Design and detailing – Rigid Frames – Shear walls.

UNITV

Vibration ControlTechniques

Vibration Control - Tuned Mass Dampers – Principles and application, Basic Concept of Seismic Base Isolation – various Systems- Case Studies, Important structures.

Reference Books:

1. Bruce A Bolt, “Earthquakes” W H Freeman and Company, New York,2004.
2. C. A. Brebbia,"Earthquake Resistant Engineering Structures VIII”,WIT Press,2011
3. Mohiuddin Ali Khan “Earthquake-Resistant Structures: Design, Build and Retrofit”, Elsevier Science & Technology,2012
4. PankajAgarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall of India,2009.
5. Paulay,T and Priestley, M.J.N., “Seismic Design of Reinforced Concrete and Masonry buildings”, John Wiley and Sons,1992.
6. S K Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press,2007.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1	Understand the basics of earthquake engineering and how they influence the structural design.
CO 2	Predict the sources of earthquakes understanding seismology and conceptually design the buildings
CO 3	Apply basic methods employed for analysis of civil engineering problems involving dynamics and earthquake.
CO 4	To access seismic performance of non-structural components and structural components and identify effective measures to mitigate potential damage.
CO 5	Understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18MB22)BUSINESS LAW AND ETHICS

M. Tech – III Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: To understand the Legal and Regulatory Framework for doing business in India.

UNIT – I:

Companies Act, 2013: Steps and procedure for incorporation of the company, Appointment ofDirectors, Powers, duties, & liabilities of Directors, Company Meetings, Resolutions, Winding-up of a Company.

UNIT – II:

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance,Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT – III:

Negotiable Instruments Act - 1881: Negotiable Instruments- Promissory Note, Bills of Exchange, &Cheque, and their definitions and characteristics, Types of endorsements, Holder- Holder in due course, Discharge of Parties. Introduction to Goods and Services Tax (GST).

UNIT – IV:

Business Ethics: The Changing Environment: Business Ethics-why does it matter? ; Levels ofBusiness Ethics-Five Myths about Business Ethics-can Business Ethics be taught and trained? stages of Moral development Kohlberg's study-carol Gilligan's Theory-Principles of Ethics.

UNIT – V:

Cyber Crime: The Legal Landscape - Need for cyber laws in the Indian context - The Indian IT Act-challenges to Indian Law and cyber crime scenario in Indian – issues and Challenges in Cyber Crime.

ReferenceBooks:

1. Ravinder Kumar, Legal Aspects of Business, 4e,Cengage Learning, 2016.
2. P.P.S.Gogna, Company Law, S.Chand, 2016.
3. RSN Pillai, Bagavathi, Legal Aspects of Business, S.Chand, 2016.
4. AkhileshwarPathak , Legal Aspects of Business, Tata McGraw Hill, 3e, 2011.
5. Nina Godbole&SunitBelapure, Cyber Security, Wiley India, 2012.

Course Outcomes:

1. Students will be able to understand a) Business Laws related to incorporating acompany b) Importance of Ethics in Business c) Cyber Crime and Legal Aspects.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18MB30)PROJECT MANAGEMENT

M. Tech – III Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

Objective: The objective of this course is to lay an important foundation to students inmanaging projects with a special focus on every phase such as project planning, execution, monitoring and evaluation.

UNIT - I:

Introduction: Introduction to Project management –Project Characteristics- Project Life cycle –Project Identification, Formulation and Implementation- Project management in different sectors: Construction, Services Sector, Public sector and Government Projects. Systems approach to project management.

UNIT - II:

Project Planning and Appraisal: Project Planning – Project Appraisal- Feasibility study-Technical,Commercial, Economic, Financial, Management, Social Cost Benefit Analysis-Project Risk Analysis.

UNIT - III:

Project Finance : Project Cost Estimation, Project Financing- Investment Criteria, Project EvaluationTechniques- Pay Back Period, Accounting rate of return, Net present value, Internal Rate of return, Profitability Index, Cash Flows Estimation for new and replacement projects- Cost of Capital, Risk Analysis.

UNIT - IV:

Project Planning and Control: Planning Steps- Scheduling- Network Diagrams, Network Analysis,Critical Path, Quality Management, Project Execution, Monitoring and control, Agile project Management, Scrum, Lean Production and project management.

UNIT - V:

Organizational Behavior and Project Management: Organizational Structure and Integration, Roleof project manager, Roles in the project team, Project stakeholder engagement, Leadership in project management, participative management, team building approach, Conflict Management in Projects, Stress Management.

Reference Books:

1. John M, Nicholas and Herman Steyn, Project Management for Engineering, Business, and Technology, 5e, Routledge, 2017.
2. Prasanna Chandra, Projects, Planning, Analysis, Selection, Financing, Implementation, and review, 6e, Tata McGraw Hill 2008.
3. K. Nagrajan, Project Management, New Age International Publishers, 7e 2015.
4. Jack Gido, Jim Clements Rose Baker, Successful Project Management, Cengage Learning, 7e 2015.
5. R. Paneerselvam, P. Senthil Kumar, Project Management, PHI, 2009.

Course Outcomes:

After the completion of this course, the students should be able to

CO 1 Importance of Project Management
CO 2 Project Planning, Execution and implementation
CO 3 Significance of teams in projects
CO 4 Evaluate the project techniques
CO 5 Understand the organizational behaviour of project management

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18MA01) ADVANCED OPTIMIZATION TECHNIQUES

M. Tech – III Sem. (Structural Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE: To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.

UNIT- I Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods:- Uni-modal function, elimination methods, ,, Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

UNIT-II Multi variable non-linear unconstrained optimization: Direct search method – Univariant method - pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

UNIT- III Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints. Simulation – Introduction – Types- steps – application – inventory – queuing systems

UNIT -IV Integer Programming: Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method Stochastic programming: Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution- stochastic linear, dynamic programming.

UNIT- V Geometric Programming: Polynomials – arithmetic - geometric inequality – unconstrained G.Pconstrained G.P (<= TYPE ONLY) Non-traditional optimization Techniques: Genetic Algorithms-Steps-Solving simple problemsComparitions of similarities and dissimilarities between traditional and non-traditional techniquesParticle Swarm Optimization (PSO)- Steps(Just understanding)-Simulated Annealing-Steps-Simple problems.

Reference Books:

1. Optimization theory & Applications / S.S. Rao / New Age International.
2. Engineering Optimization-Kalyan Deb/ PHI
3. Introductory to operation Research / Kasan& Kumar / Springar
4. Optimization Techniques theory and practice / M.C.Joshi, K.M. Moudgalya/ Narosa 5. Publications
6. Operation Research / H.A. Taha /TMH
7. Optimization in operations research / R.L Rardin 8. Optimization Techniques /Benugundu&Chandraputla / Pearson Asia

Course Outcomes:

1. The student will be able to understand the basic principles of optimization, and in a position to formulate optimization models for a wide range of civil engineering problems and able to solve them.

VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE10) DISSERTATION PHASE - I

M. Tech – III Sem. (Structural Engineering)

L	T	P	C
0	0	20	10

Objectives:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Course Outcomes:

1. At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M18SE11) DISSERTATION PHASE - II

Tech – IV Sem. (Structural Engineering)

L	T	P	C
0	0	32	16

Objectives:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Course Outcomes:

1. On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

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