MVN University

Civil Engineering Department

Syllabus of M.tech in Civil Engineering (2014 – 16) Regular

I SEMESTER

CEP 501	**Elasticity and Plasticity (E&P)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Stress transformation and Strain transformation at a point in an elastic body, 3D Problems, Rigid body translation and rotation of an element in space. Generalized Hook law, Separation of Elastic Strains and rigid body displacement for a general displacement field u, v, w. Principal Stress and Strains.

Unit-II: Two Dimensional Problems in Elasticity- Plane Stress and Plane Strain Problems. Differential equations of equilibrium and compatibility equations. Boundary Conditions & Stress Functions. Problems in Rectangular coordinates, Polynomial solutions, Cantilever loaded at the end, simply supported load beam under uniformly distributed load, linear loading.

SECTION-B

Unit-III: Three dimensional problems in Elasticity. Differential equation of equilibrium in 3D, Condition of Compatibility, Determination of Displacement, Principal of superposition, Uniqueness theorem. Problems of Rods under axial stress, Bar under its own weight, Pure bending of Prismatic roads. Torsion of Prismatic bars.

SECTION-C

Unit-IV: Energy Theorems-Applications of complimentary energy theorems to the problems of elasticity.

SECTION-D

Unit-V: Introduction to plasticity, Criteria of yielding, strain hardening, rules of plastic flow, different stress strains relations. Total Strain theory, theorems of limit analysis. Elastoplasic bending and torsion of bars.

Books:

1. Wang, “Applied Elasticity”, McGraw hill book Co.

2. Timoshenko, “Theory of Elasticity”, McGraw hill book Co.
3. J. Chakrabarti, “Theory of Plasticity”, McGraw hill book Co.

CEP 503	Advance Structural Analysis (ASA)	L	T	P	Cr.
		4	0	0	4

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Formulation of Finite Element Method. Using principle of virtual Displacement- erivation of Element Stiffness and loads for Pin Jointed Bar element, Beam element, Triangular Plate element (In plane forces), Triangular and Rectangular Plate Element in Bending. Variational Formulation of Finite Element Method (FEM).

Unit-II: Isoparametric element-Local vs. Natural Co-ordinates system, Line, Triangular, Quadrilateral and Tetrahedral Element-Interpolation Displacement Models Formulation of Isoparametric Finite element matrices in Local and Global Coordinate system.

SECTION-B

Unit-III: Implementation of FEM-Discretization of the Structure-Calculation of Element Stiffness, Mass and Equivalent Nodal Loads, Assemblage of Structures Matrices, Boundary Conditions-Solutions of the overall problem. Calculations of Element Stresses,

SECTION-C

Unit-IV: Introduction to Non Linear Analysis-Geometric Non-Linearity- Geometric Stiffness of an Axial Element, Stability of Bar Spring System. General Formulation of a Geometrically Non linear Problem.

SECTION-D

Unit-V**:** Geometric Stiffness of a Beam-Column of Triangular element. Non linear material behavior. Non linear spring-Elastic Plastic Analysis by FEM-Elasto-Plastic Analysis of Truss-Two Dimensional Element Formulations-General Formulation of a Physically Nonlinear

Books:

1. Zienkiewicz O.C, “The Finite Element Method in Engineering Science”, McGraw Hill Book Co.
2. J.N. Reddy, “Finite Element Analysis”, McGraw Hill Book Co.
3.Chandragupta T.R. and Belagundu A.D., “Introduction to Finite Elements in Engineering”,

4. Prentice Hall of India Pvt. Ltd.
5. Rajshekaran S., “Finite Element Analysis”, Wheeler publishing
6. Krishnamoorthy C.S, “Finite Element Analysis”, Tata McGraw Hill.
7. Cook R.D., Malkus D.S. and Plesha M.E. “Concepts and Applications of Finite Element
8. Analysis”, John Wiley & Sons (Asia) Pvt Ltd.
9. Bickford W.B., “A First Course in Finite Element Method”, IRWIN, Homewood, IL60430.
Rao S.S, The Finite Element Method in Engineering, Pergamon Press.
11. Weaver W and Johnston P.R., “Finite Element for Structural Analysis”, Prentice Hall.

AHL 501	Numerical Techniques (E&P)	L	T	P	Cr.
		4	0	0	4

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

Section- A

Unit – I

NUMBERS AND THEIR ACCURACY: Mathematical preliminaries, Errors and their computation, General error formula, Error in a series approximation. Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods.

Unit – II

INTERPOLATION AND APPROXIMATION AND CURVE FITTING : Lagrange’s and Newton-divided difference formula, Newton interpolation formula for finite differences, Newton’s forward and backward interpolation formulae, Gauss’s forward and backward interpolation formulae, Bessel’s and Laplace-Everett’s formulae, Cubic spline, least squares approximation using Chebyshev polynomial , Cubic splines and Least squares curve fitting .

UNIT – III

NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximating the derivative, Numerical differentiation formulas, Maxima& Minima of a tabulated function, Introduction to Numerical quadrature, Newton-Cotes formula, Gaussian Quadrature, Trapezoidal rule, Simpson’s rule 1/3 and 3/8 Rules, Weddle’s Rule.

Section- B

Unit – IV

SOLUTION OF LINEAR SYSTEM: Direct Methods, Gaussian elimination and pivoting, Matrix inversion, UV factorization, Iterative methods for linear systems.

Unit – V

THE ALGEBRAIC EIGEN VALES PROBLEM: The power method, Jacobi's method, Given Method and House Holder Method for Eigen value problems, Eigen values of a symmetric Tridiagonal matrix

Unit – VI

SOLUTION OF ORDINARY DIFFERENTIAL EQUATION AND PARTIAL DIFFERENTIAL EQUATION :

Introduction to differential equations, Initial value problems, Euler's methods, Heun's method, Runge-Kutta methods, Taylor series method, Predictor- Corrector methods, Systems of differential equations, Boundary valve problems, Finite-difference method, Solution of hyperbolic, parabolic and elliptic equations .

Suggested Readings:

1. B. S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.
2. E. Balagurusamy, Numerical Methods, Tata McGraw hill, 2009.
3. Numerical Solution of Differential Equations, by M.K. Jain, Published by Wiley Eastern, New York.
4. Numerical Methods for Mathematics, Science and Engineering by John H.Mathews, PHI New Delhi.
5. Elementary Numerical Analysis S.D. Conte McGraw Hill
6. Numerical Method for Scientific and Engineering Computation M.K. Jain, S.R.K. Iyenger and R.K. Jain Wiley Eastern Ltd.
7. Numerical Methods for Engineers S.K. Gupta Wiley Eastern Ltd.

ELECTIVE I

CEP 505	**Urban Transportation Planning and Simulation (E&P)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: **Introduction**: Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation,Future Developments.

Unit-II: **Urban Transportation System Planning - Conceptual Aspects**: Transport Planning Process, Problem Definition, Solution Generation, Solution Analysis, Evaluation and Choice, Implementation, Sequence of Activities Involved in Transport Analysis.

Unit-III: **Trip Generation Analysis**: Trip Production Analysis; Category Analysis; Trip Attraction Modelling.

SECTION-B

Unit-IV: **Mode Choice Modelling**: Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode-Choice, Binary Choice Situations, Multinomial Logit Model, Model Calibration, Case Studies.

Unit-V: **Trip Distribution Analysis**: Presentation of Trip-Distribution Data, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model, Singly and Doubly Constrained, Gravity Models, Case Studies. Growth Factor Methods of Trip Distribution, Uniform Factor Method,Average Factor Method,Fratar Growth-Factor Method,Disadvantage of Growth Factor Methods.

SECTION-C

Unit-VI: **Route Assignment**: Description of Transport Network, Route Choice Behaviour, The Minimum Path, Minimum Path Alhorithm, Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment.

Unit –VII: **Transportation Survey**: Definition of Study Area Zoning, Types of Movements, Types of Surveys, Home-Interview Survey, Commercial Vehicle Survey, Intermediate Public Transport Survey,

Cordon-Line Survey, Post-Card Questionnaire Survey, Registration-Number Survey, Tag-on-Vehicle Survey.

SECTION-D

Unit -VIII **Transport Related Land-use Models**: Development of Land-use Models, The Lowry Model, and Application of Lowry Model.

Unit-IX: **Urban Structure**: Urban Activity Systems, Urban Movement Hierarchies, Types of Urban Structure, Centripetal - Type Urban Structure, Grid-Type Urban Structure, Linear-Type Urban Structure, Directional Grid Urban Structure.

Unit-X**: Urban Goods Movement**: Classification of Urban Goods Movements, Methodology of Approach to Analysis of Goods Movement., Modelling Demand for Urban Goods Transport.

Books:

1. Kadiyali, L.R., "Traffic Engineering and Transport Planning Khanna Publishers, New Delhi, 2006

ELECTIVE I

CEL 507	**Repairs and Rehabilitation of Structure (E&P)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: MAINTENANCE AND REPAIR STRATEGIES: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

Unit-II: SERVICEABILITY AND DURABILITY OF CONCRETE: Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and acking. - Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking.

SECTION-B

Unit-III: MATERIALS FOR REPAIR: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

SECTION-C

Unit-IV: TECHNIQUES FOR REPAIR AND DEMOLITION: Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures - case studies.

SECTION-D

Unit-V: REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

Books:

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1987.
3. M.S.Shetty, Concrete Technology - Theory and Practice, S.Chand and Company, New Delhi, 1992.
4. Santhakumar, A.R., Training Course notes on Damage Assessment and repair in Low Cost Housing , "RHDC-NBO" Anna University, July 1992.
5. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
6. N.Palaniappan, Estate Management, Anna Institute of Management, Chennai, 1992.
7. Lakshmipathy, M. etal. Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

ELECTIVE I

CEL 509	**Construction Planning and Management**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory
Class Work: 50 Marks
Exam: 100 Marks
Total: 150 Marks
Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities coding-systems.

Unit-II: Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software.

SECTION-B

Unit-III: The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

SECTION-C

Unit-IV: Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control withSampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

SECTION-D

Unit-V **:** Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow

Books:

1. Chitkara, K.K. “Construction Project Management Planning”, Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.

2. Srinath,L.S., “Pert and CPM Priniples and Applications “, Affiliated East West Press, 2001

3. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals Concepts for Owners”, Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.

4. Moder.J., C.Phillips and Davis, “Project Management with CPM”, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.

5. Willis., E.M., “Scheduling Construction projects”, John Wiley and Sons 1986.

6. Halpin,D.W., “Financial and cost concepts for construction Management”, John Wiley and Sons, New York, 1985.

II SEMESTER

		L	T	P	Cr.
CEL502	**Advance Concrete Design (ACD)**	**4**	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I Review of Limit State Method: Reinforced concrete design by Limit State Method, Review of limit state method as per IS Code-456-2000. Limit state of collapse in flexure, Direct compression, Compression with bending, shear & torsion, Limit state of serviceability for deflection and cracking, application to beam slab system.

SECTION-B

Unit–II Retaining Wall: Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of T-shaped retaining wall, Concept of Counter fort retaining wall.

SECTION-C

Unit-III Foundation: Design of Raft foundation and Pile foundation including pile cap.

SECTION-D

Unit- IV Water Tank: Design criteria, material specifications and permissible stresses for Water tanks, Design concept of circular and rectangular Water tanks.

Books:

1. Karve S.R. and Shah V.C, "Design of reinforced cement concrete structures using Limit State Approach", Structures Publishers.

2. Jain O.P and Jaikrishna, "Plain and reinforced concrete", Vol-II, Nemchand and Bros.

3. Ramamrutham S. Design of reinforced Concrete Structures. Dhanpat Rai and Sons.

4. P. C. Varghese, Advanced Reinforced Concrete Design, PHI Learning Pvt. Ltd.

5. Ramachandra, Design of Concrete Structures Vol. I & II. Standard Book House.

		L	T	P	Cr.
CEL504	**Pavement Analysis and Design (PAD)**	**4**	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Material characteristics, Mix design concepts, Stresses in flexible pavements, Stresses in rigid pavements, factors affecting pavement design.

SECTION-B

Unit-II: Analysis and Design of Flexible Pavements.

SECTION-C

Unit-III: Analysis and Design of Rigid Pavements.

SECTION-D

Unit-IV: Analysis and Design of Pavement Shoulders and drainage.

Books:

1. Huang, Y. H., Pavement Analysis and Design, Pearson Prentice Hall, New Jersey, USA, 2004.

2. Mallick, R. B., and El-Korchi, T., Pavement Engineering - Principles and Practice, CRC Press, Taylor and Francis Group, Florida, USA, 2009.

3. Papagiannakis, A. T., and Masad, E. A., Pavement Design and Materials, John Wiley and Sons, New Jersey, USA, 2008.

4. Yoder, E. J., and Witczak, M. W., Principles of Pavement Design, 2nd Edition, John Wiley and Sons, New York, USA, 1975.

		L	T	P	Cr.
CEL506	**Structural Dynamics (SD)**	**4**	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I Introduction to structural Dynamics: Definition of Basic Problem in Dynamics, Static vs Dynamic loads, Different types of dynamics loads.

Unit-II Single Degree of Freedom (SDOF) Systems: Undamped vibration of SDOF system natural frequency and period of vibration, Damping in structures, viscous damping and Coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, Logarithmic decrement, Forced vibration, response to periodic loading, response to pulsating forces, dynamic load factor, Response of structure subjected to General dynamic load, Duhamel's Integral, Numerical Evaluation of Dynamic Response of SDOF systems, Response of structure in frequency domain subjected to general periodic and not periodic/impulsive force of short duration, use of complex frequency response function, use of Fourier series for Periodic Forces, Introduction to vibration isolation, Distributed mass system idealized as SDOF system, use of Rayleigh's method. Response of SDOF system subjected to ground motion.

SECTION-B

Unit-III Lumped mass multidegree of freedom (MDOF) system, coupled and uncoupled system, Direct determination of frequencies of vibration and mod shape, Orthogonality principle, Vibration of MDOF systems with initial conditions, Approximate method of determination of natural frequencies of vibration and mode shapes – Vector Integration Method, Energy methods and use of Lagrange's method in writing equation of motions, decoupling of equations of motion, modal equation of motion, concept of modal mass and modal stiffness, Forced vibration of MDOF system, Modal Analysis. Application to multi-storey rigid frames subjected to lateral dynamic loads.

SECTION-C

Unit-IV Earthquake analysis: Introduction, Seismicity of a region, causes of earthquake, Intensity of earthquake, Richter Scale, Measurement of Earthquake ground motion, Seismogram Application of modal analysis concept to seismic disturbance, Response spectrum Method, I.S code provisions for seismic analysis of buildings and water towers, Approximate method of earthquake analysis – Seismic co-efficient method and its limitation Introduction to history analysis.

SECTION-D

Unit- V Structure with distributed mass system: use of partial differential equation, Free vibration analysis of single span beams with various boundary conditions, determination of frequencies of vibration and mode shapes Forced vibration of single span beams subjected to the action of specified dynamic loads.

Unit- IV: Design of earthquake resistant structures: Pseudo design.

Books:

1. Roy R. Carig., Structural Dynamics – An Introduction to computer methods, John Wiley & Sons. Physical and General Geology by S.K.Garg

2. Anil K. Chopra, Dynamics of Structures, Prentice Hall of India.

3. Clough & Penzsien, Dynamics of Structures McGraw-Hill.

4. John M. Bigg, Structural Dynamics McGraw-Hill.

5. Mario Paz, Structural Dynamics Theory and Computation, CBS Publisher.

Elective II (E II)

		L	T	P	Cr.
CEL512	**Advance Foundation Engineering (AFE)**	**4**	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I Introduction, soil exploration, analysis and interpretation of soil exploration data, estimation of soil parameters for foundation design.

Unit-II Shallow Foundations: Methods for bearing capacity estimation, total and differential settlements of footing and raft, code provisions. Design of individual footings, strip footing, combined footing, rigid and flexible mat, buoyancy raft, basement raft, underpinning.

SECTION-B

Unit-III Pile Foundations: Estimation: load carrying capacity of single and pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), settlement of pile foundation, code provisions, design of single pile and pile groups, and pile caps.

SECTION-C

Unit-IV Well Foundations: Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

SECTION-D

Unit-V Retaining Walls: Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging). Support systems for flexible retaining walls (struts, anchoring), construction methods, stability calculations, design of flexible and rigid retaining walls, design of cantilever and anchored sheet pile walls.

Books:

1. Taylor D. W., Foundation of Soil Mechanics, Asia Publications, Bombay.

2. Terzaghi & Peck, Soil Mechanics in Engineering Practice, Wiley & Sons.

3. Bowels J. E., Foundation Analysis and Design, McGraw Hill Book co.

4. Dr. Alamsingh, Soil Mechanics and Foundation Engineering, Vol. I- II. Standard BookHouse.

5. Dr. Alamsingh, Geotechnical Engineering, Standard Book House

6. Dr. B.C.Punimia, Soil Mechanics and Foundation Engineering.

7. Dr. Koner, Designing with Geosynthetics.

8. Swami Saran, Analysis and Design of Substructures. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Elective II (E II)

		L	T	P	Cr.
CEP 514	**Advance Bridge**	**4**	**0**	**0**	**4**

	Engineering (ABE)				

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Introduction to bridge engineering, classification and components of bridges, layout, planning, Investigation for bridges. Choice of the types of bridges, Conceptual bridge design. Structural forms of bridge decks, beam and slab decks, cellular decks. Standard specification for bridges, IRC loadings for road bridges, IRS loading standards for railway bridges. Bridge appurtenances.

Unit-II: Design of slab culvert, box culvert and skew bridge.

SECTION-B

Unit-III: 4 Behaviour, analysis and design of RC and PSC box girder bridge decks. Introduction to Structural classification of Rigid Frame bridge, analysis and design of Rigid Frame bridge.

SECTION-C

Unit-IV: Classification and design of bearings. Expansion joints. Forces acting on abutments and piers, analysis and design, types and design of wing walls.

SECTION-D

Unit-V**:** Bridge foundations: Shallow and deep foundation – design and construction aspects including open well, pile and caisson foundation.

Books:

1. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publication Co. Pvt. Ltd., New Delhi.

2. T.R. Jagadeesh, M.A. Jayaram - Design of Bridge Structures, Prentice-Hall of India.

3. N. Krishna Raju - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

4. David Lee – Bridge Bearings and Expansion Joints,E & FN Spon.

5. V.K. Raina – Concrete Bridge Practice Analysis, design and Economics, Tata McGraw Hill.

6. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83.

7. Joseph E. Bowles – Foundation Analysis and Design, McGraw-Hill International Edition.

8. Ponnuswamy S. Bridge Engineering, Tata McGraw Hill.

Elective II (E II)

CEP 516	Civil Engineering Material (CEM)	L	T	P	Cr.
		4	0	0	4

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Light weight aggregate concrete - fiber reinforced concrete - High strength concrete.

Unit-II: Changes in concrete with time, Corrosion of rebars in concrete.

SECTION-B

Unit-III: Industrial waste materials in concrete - Concrete at high temperature - Ferro-cement Polymers.

SECTION-C

Unit-IV: Fibre reinforced plastic in sandwich panels - Adhesives and sealants.

SECTION-D

Unit-V**:** Structural elastomeric bearings, Moisture barriers.

Books:

1. Adam M. Neville, Properties of Concrete, 5th Edition, Longman Sc and Tech Publishers, 2011.

2. Kumar Mehta. P. and Paulo J.M. Monteiro, Concrete Microstructure, Properties and Materials, McGraw Hill, 2006.

ELECTIVE III (E III)

CEP 518	**Design of Prestress Concrete (DPCS)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Prestressing Systems and Material Properties: Introduction, Advantages and Types of Prestressing, Pre-tensioning Systems and Devices, Post-tensioning Systems and Devices.

Unit-II: Losses in Prestress: Introduction, Elastic Shortening, Friction, Anchorage Slip, Force Variation Diagram, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-dependent Loss.

SECTION-B

Unit-III: Members under Axial Load: Introduction, Analysis at Transfer, Analysis at Service, Analysis for Ultimate Strength, Analysis of Behavior, Design of Sections for Axial Tension.

SECTION-C

Unit-IV: Members Under Flexure: Introduction, Analyses at Transfer and at Service, Cracking Moment, Kern Point, Pressure Line, Determination of Limiting Zone, Design and Detailing of Rectangular and Flanged Section.

SECTION-D

Unit-V: Continuous Beams: Introduction: Incorporation of Moment due to Reactions, Pressure Line due to Prestressing Force, Principle of Linear Transformation, Concordant Tendon Profile, Tendon Profiles, Determination of Limiting Zone, Design Continuous Beams.

Books:

1. T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley Publishers.
2. N.Krishna Raju , Prestressed Concrete ,Tata McGraw Hill.
3. Y.Guyon, Prestressed Concrete, Contractors Record Ltd. 4.
R.H.Evans & E.W.Bennette, Prestressed Concrete, McGraw Hill Book Co. 5.
S. Ramamrutham, Prestressed Concrete, Dhanpat Rai & Sons.

ELECTIVE III (E III)

		L	T	P	Cr.
CEP 520	**Stability Analysis of Structures (SAS)**	**4**	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Fundamental concepts, elastic structural stability, structural instability, analytical methods for the stability analysis, equilibrium, imperfections and energy methods.

SECTION-B

Unit-II: Elastic buckling of columns, assumptions, critical load for various boundary conditions, columns with geometric imperfection, large deflection theory of columns, Southwell plot, Orthogonality of buckling modes, eccentrically loaded columns, numerical techniques – Finite difference and Finite element approach.

SECTION-C

Unit-III: Elastic buckling of beam-column, differential equations of beam-column, beam-column with concentrated point load, several point loads, continuous lateral load, single couple, uniformly distributed load, end couples.

SECTION-D

Unit-IV: Elastic buckling of frames, triangular, partial, multi-storey portal and box frames with symmetric & anti symmetric buckling, stiffness method approach, approximate method, buckling of open sections, torsional buckling.

Books:

1. Timoshenko S.P. and Gere J.M., Theory of Elastic Stability, Mc Graw Hill, Singapore.
2. George Gerard, Introduction to Structural Stability Theory, Mc Graw Hill, New York.
3. Iyenger N.G.R., Elastic Stability of Structural elements, Mc Millan, India.
4. Ashwini Kumar, Stability of Structures, Allied Publishers, New Delhi.

ELECTIVE III (E III)

CEP 522	**Traffic System Design (TSD)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Geometric design of highways;

Unit-II: Geometric design of at grade intersections.

SECTION-B

Unit-III: geometric design of grade separated intersections.

SECTION-C

Unit-IV: design of bicycle and pedestrian facilities.

SECTION-D

Unit-V**:**parking layout and design, terminal design, street lighting.

Books:

1. AASHTO Design Guide, A Policy on Geometric Design of Highways and Streets, 2001.
2. Fruin, Pedestrian Planning and Design, McGraw Hill Publication, 2003.
3. Institution of Transportation Engineers, Traffic Engineering Hand Book, 4th Edition, Prentice Hall, 1999.
4. Khisty, C. J., and Lall, B. K., Transportation Engineering: An Introduction, Prentice Hall International,Inc., 2002.

		L	T	P	Cr.
CEP 508	**Seminar I (S 1)**	**0**	**0**	**2**	**1**

Guidelines for Seminar

1. Seminar should be based on thrust areas in Structural Engineering including materials and allied subjects involving the knowledge of Structural Engineering (e.g. Geotechnical Engineering, Transportation Engineering, Hydraulics Engineering with emphasis in the context soil- structure interaction, fluid- structure interaction, fluid-soil-structure interaction, pavement engineering, etc.)
2. The objective behind seminar is to equip the student for carrying out literature survey, summarize the findings of the literature and formulate the problem or arrive upon the statement of the problem. Along similar lines, the student can work for their dissertation in the subsequent stages.
3. The student in consultation with the Guide/ Supervisor shall settle or finalize / identify the topic of the seminar in the context of the specialization or allied theme. The students shall carry out literature survey pertaining to the topic, various sub-topics/ approaches/ methods falling within the purview of the topic. The student shall use multiple literatures and understand the topic, analyze the literature and summarize the findings. The report shall be compiled in a standard format.
4. The assessment of the seminar shall be assessed in respect of the following points:

- Quality of Literature survey and Novelty in the topic
- Relevance to the specialization

- Understanding of the topic
- Quality of Written and Oral Presentation

IMPORTANT NOTE:

1. Assessment of Seminar will be carried out by a pair of examiner.

2. Literature survey in case of seminar is based on the broader area of interest in recent developments and for dissertation it should be focused mainly on identified problem.

3. At least 4-5 hours of course on Research Methodology should be conducted which includes Literature Survey, Problems Identification, Analysis and Interpretation of Results.

		L	T	P	Cr.
CEP 510	**Structural Engineering Lab (SE LAB)**	**0**	**0**	**3**	**2**

Lab

Class Work: 20 Marks

Exam: 30 Marks

Total: 50 Marks

Duration of Exam: 3Hrs

Experiment No.	Title
1	Tests on Aggregate (a) Impact value test (b) Los angles abrasion value test
2	Fabrication , Testing and Analysis of an RC T- Beam
3	Fabrication , Testing and Analysis of a Concentric Column
4	Test on post tension pre stressed concrete beam
5	Test on Steel Beam
6	Non Destructive tests (a) Rebound Hammer test

	(b) Ultrasound pulse velocity test Special tests on concrete (a) Splitting tensile test (b) Stress – Strain relationship of concrete by longitudinal extensometer
7	Study of Vibration testing of floors
8	Study of Modal analysis of beam.

Books:

1. A. M. Nevilli, Properties of Concrete, 5th Edition, Prentice Hall, 2012
2. M. S. Shetty, Concrete Technology, S. Chand & Co. 2006.
3. Leonard Meirovitch (2001)," Elements of vibration analysis", 2nd Ed, Tata Mcgraw – Hill publishing company limited, New Delhi.
4. N.Krishna Raju , Prestressed Concrete ,Tata McGraw Hill.

SEMESTER III

ELECTIVE IV

CEL 611	**Shell Structures (SS)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Introduction to Structural behavior of thin shells, membrane and bending actions.

Unit-II: Mathematical representation of a shell surface, Principal curvatures, Gauss curvature.

SECTION-B

Unit-III: Classification of shells, membrane theory of thin shells, Stress resultant, Application to cylindrical shells under symmetrical loads and surfaces of revolution under axi-symmetric loads.

SECTION-C

Unit-IV: Bending theory of open circular cylindrical shell with special emphasis on approximate theories of Finster walder and Shorer theories. Introduction to DJK, Flugg and other exact theories, Different boundary conditions for single and multiple shells.

SECTION-D

Unit-V: Bending theory of closed circular cylindrical shell, stiffness coefficients at free edges along radial and rotational directions, Bending theory of spherical shells. Geckelers approximations, stiffness coefficients.

Books:

1. Timoshenko, 'Theory of Plates and Shells", McGraw Hill Book Co.
2. Chandrashekhara, Analysis of thin concrete shells, McGraw Hill Book Co.
3. Ramaswamy G.S, Design and Construction of concrete shell Roofs, McGraw Hill Book Co.
4. Varadan T.K. and Bhaskar K. Analysis of plates Theory and Problems, Narros Publishing House.

ELECTIVE IV

CEL 613	**High Rise Structures (HRS)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Functional requirements and building techniques of tall buildings: foundation systems. structural systems including structural steel construction and reinforced concrete construction.

Unit-II: Enclosure systems including metal and glass cladding; ceiling and partition systems.

SECTION-B

Unit-III: Various methods and materials commonly used to solve functional demands. comparison of systems of construction and their interrelationship.

SECTION-C

Unit-IV: Material handling and management including selection of cranes, hoists, and concrete pumps.

SECTION-D

Unit-V**: P**rinciples of fire protection in tall building; on site observation and report on tall building construction.

Books:

1. Taranath, B, Steel, Concrete and Composite Design of Tall Buildings, 2nd Edition, McGraw Hill, 1998.

2. White and Salmon, Building Structural Design Handbook, John Wiley & Sons, 1987.

3. Wolfgang Schueller, The Design of Building Structures, Prentice Hall, New Jersey, 1996.

ELECTIVE IV

CEL 615	**Offshore Structures (OSS)**	**L**	**T**	**P**	**Cr.**
		4	**0**	**0**	**4**

Theory

Class Work: 50 Marks

Exam: 100 Marks

Total: 150 Marks

Duration of Exam: 3 Hrs

SECTION-A

Unit-I: Structural forms of offshore structures, loads. Introduction to structural dynamics, Vibration of bars, beams and cones with reference to soil as half-space.

Unit-II: Behaviour of concrete gravity platform as a rigid body on soil as a continuum.

SECTION-B

Unit-III: Wind load. Effect of size, shape and frequency. Aerodynamic admittance functions and gust factor.

SECTION-C

Unit-IV: Spectral response due to wind for various types of structures.

SECTION-D

Unit-V: Wave loads by Morison equation. Static and dynamic analysis of fixed structures.

Books:

1. Graff W. J. Introduction of Offshore Structures, Gulf Publication.

2. Clough. R. W and Penzien, J., Dynamics of structures, McGraw Hill Co.

3. Gerwick.B.C. Construction of Offshore Structures, John Wiley & Sons.

		L	T	P	Cr.
CEP 601	**Seminar II (S 1I)**	**0**	**0**	**2**	**1**

Guidelines for Seminar

1. Seminar should be based on thrust areas in Structural Engineering including materials and allied subjects involving the knowledge of Structural Engineering (e.g. Geotechnical Engineering, Transportation Engineering, Hydraulics Engineering with emphasis in the context soil- structure interaction, fluid- structure interaction, fluid-soil-structure interaction, pavement engineering, etc.

2. The objective behind seminar is to equip the student for carrying out literature survey, summarize the findings of the literature and formulate the problem or arrive upon the statement of the problem. Along similar lines, the student can work for their dissertation in the subsequent stages.

3. The student in consultation with the Guide/ Supervisor shall settle or finalize / identify the topic of the seminar in the context of the specialization or allied theme. The students shall carry out literature survey pertaining to the topic, various sub-topics/ approaches/ methods falling within the purview of the topic.

The student shall use multiple literatures and understand the topic, analyze the literature and summarize the findings. The report shall be compiled in a standard format.

4. The assessment of the seminar shall be assessed in respect of the following points:

- Quality of Literature survey and Novelty in the topic
- Relevance to the specialization
- Understanding of the topic
- Quality of Written and Oral Presentation

IMPORTANT NOTE:

1. Assessment of Seminar will be carried out by a pair of examiner.
2. Literature survey in case of seminar is based on the broader area of interest in recent developments and for dissertation it should be focused mainly on identified problem.
3. At least 4-5 hours of course on Research Methodology should be conducted which includes Literature Survey, Problems Identification, Analysis and Interpretation of Results.

		L	T	P	Cr.
CEP 603	**CAD Lab (C Lab)**	**0**	**0**	**3**	**2**

Lab

Class Work: 20 Marks

Exam: 30 Marks

Total: 50 Marks

Duration of Exam: 3Hrs

Study and practicle application of different civil engineering software, like STAAD.Pro, ANSYS with Civil FEM, E-Tab, SAP, ABACUS

Books:

1. STAAD.pro manual.
2. ANSYS Manual.
3. E-Tab Manual
4. SAP Manual.
5. ABACUS Manual.

CEP 605	Comprehensive Viva Voce (CVV)	L	T	P	Cr.
		0	0	0	4

This will be based on the syllabi of theory subjects, it shall consist of the internal viva based on the syllabus of the all subjects.

CEP 607	Project Work (PW)	L	T	P	Cr.
		0	0	0	4

Guidelines for Project work

o Student should carry out the preliminary literature survey and subsequently, identify the poblem in broad terms for Prpject and finalize/ settle it in consultation with Guide/Supervisor.

o Pursuant to this, the student shall refer multiple literatures pertaining to the theme of the poblem and understand the problem and define the problem in the precise terms.

o Student should attempt solution to the problem by analytical/simulation/experimental methods.

The solution shall be validated with proper justification. The students shall compile the report in standard format.

o Student should publish at least one paper based on the work in reputed International / National Conference in which papers are blindly reviewed

o The topic of the Project should be such that it is a value addition for the existing knowledge in the field and has some worthwhile research input.

CEP 609	Dissertation Part I (DP I)	L	T	P	Cr.
		0	0	15	15

Guidelines for Dissertation

o Student should carry out the preliminary literature survey and subsequently, identify the poblem in broad terms for Dissertation and finalize/ settle it in consultation with Guide/Supervisor.

o Pursuant to this, the student shall refer multiple literatures pertaining to the theme of the poblem and understand the problem and define the problem in the precise terms.

o Student should attempt solution to the problem by analytical/simulation/experimental methods.

The solution shall be validated with proper justification. The students shall compile the report in standard format.

o Student should publish at least one paper based on the work in reputed International / National Conference in which papers are blindly reviewed (desirably in Refereed Journal). More weightage shall be given for the journal publication.

o The work to be pursued as a part of the dissertation shall be divided broadly in two parts, namely- Dissertation Stage I and Dissertation Stage II.

o The topic of the Dissertation should be such that it is a value addition for the existing knowledge in the field and has some worthwhile research input.

Guidelines for Assessment of Dissertation I

o Dissertation I should be assessed based on following points

 Quality of Literature survey and Novelty in the problem

 Clarity of Problem definition and Feasibility of problem solution

 Relevance to the specialization

 Clarity of objective and scope

 Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)/ Data Collection, etc.

o Dissertation I should be assessed through a presentation by a panel of internal examiners appointed by the Head of the Department/Institute of respective Programme.

SEMESTER IV

		L	T	P	Cr.
CEP 602	**Dissertation Part II (DP II)**	**3**	**1**	**0**	**4**

Guidelines for Dissertation

o Student should carry out the preliminary literature survey and subsequently, identify the poblem in broad terms for Dissertation and finalize/ settle it in consultation with Guide/Supervisor.

o Pursuant to this, the student shall refer multiple literatures pertaining to the theme of the poblem and understand the problem and define the problem in the precise terms.

o Student should attempt solution to the problem by analytical/simulation/experimental methods.

The solution shall be validated with proper justification. The students shall compile the report in standard format.

o Student should publish at least one paper based on the work in reputed International / National Conference in which papers are blindly reviewed (desirably in Refereed Journal). More weightage shall be given for the journal publication.

o The work to be pursued as a part of the dissertation shall be divided broadly in two parts, namely- Dissertation Stage I and Dissertation Stage II.

o The topic of the Dissertation should be such that it is a value addition for the existing knowledge in the field and has some worthwhile research input.

Guidelines for Assessment of Dissertation II

After completion of about 80% of the work (which shall be decided by the Guide/ Supervisor), proposed to be a part of the Dissertation, the student shall deliver a Pre-submission seminar based on the work pursued by him/ her during the second stage. It will be assessed by the panel of internal examiners appointed by the Head of the Department/ Institute of the respective programme, as the case may be.

The student shall take into account the suggestions made by the examiners/s during pre-submission seminar in view of the work pursued by the students and shall try to incorporate it in the work, if the suggestions are worthwhile, consistent with the situation and provided they are such that those can be accommodated/ included in the work being pursued by the candidate at that point of time. After the pre-submission seminar, the student shall compile the report in a standard format and written in the systematic manner and chapter wise.

The student shall adhere to the following scheme of chapterization while compiling the final report in general. The Guide/ Supervisor shall ensure the student has written the Dissertation Report in appropriate language (grammatically correct).

1. Introduction: The student shall give the introduction to the theme of the subject chosen as a Dissertation, give further current state of art related to the theme (i.e., brief review of literature), broad problem definition and scope of the work. The student shall also state at the end of this chapter the scheme of chapterization included in his/ her Dissertation.

2. Theoretical Aspects/ Review of Literature: The student is expected to highlight the various theoretical aspects pertaining to the topic chosen, literature (updated) available related to the various aspects of the topic chosen citing the research work carried out by the earlier researchers and summarize the findings of the literature. The student may state the precise the problem definition.

3. Formulation/ Methodology/ Experimental Work: In this chapter, the student is expected to explain the methodology for pursuing his/ her work. In case of analytical work, student may give the Formulation

along with validation for assessment of accuracy of the numerical procedure being used/ proposed by him/ her. In respect of experimental work, the student may outline the experimental set up/ procedure. In case of the work in which either approach is involved, the student may appropriately provide the methodology to cover either approach. This chapter may be supported by the Data Collection if the work involves the Collection of the Data and its subsequent processing.

4. Analysis/ Results and Discussion: The student is expected to present the results emerging from the analytical/ theoretical/ experimental study/ studies being pursued by the students.The results shall be discussed properly. The results may be compared with the results published by the earlier researchers if the work being pursued by the student warrants the same. The student may indicate the broad conclusions/ inferences at the end.

5. Summary and Conclusions: Based on the results discussed in the previous chapter, the student shall give in the systematic manner the conclusions/ inferences emerged from the study and summarize it properly. The student shall indicate the scope of the future work which can be extended by any other student/ researcher in the future. The student may point out the limitation/s left out in the work pursued by him/ her while carrying out the work contained in the Dissertation.

6. References: The student shall at the end give the list of the references in the appropriate manner. This part should not be treated as a Chapter. For referencing style, student may refer any standard journal of national and international repute.

7. Publication/s: The student shall give the list of the technical/ research papers published / accepted publication in the referred journal/ conference proceedings. This part should not be treated as a Chapter.

Dissertation II should be assessed based on following points:

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization or current Research / Industrial trends
- Clarity of objective and scope
- Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)
- Quality of work attempted
- Presentation of the results along with the validation of results or part thereof.
- Quality of Written Report and Oral Presentation
- Publication of the technical/ research paper by the student in a conference of National / Iternational repute. Publication of paper in a referred/ peer reviewed journal is highly peferred.

- Dissertation II shall be assessed through a presentation jointly by the Internal Examiner (Guide/ Supervisor) and External Examiner appointed by the MVN University.