Department of Civil Engineering

CURRICULUM AND SYLLABUS

(2023-2024)

M.Tech. Civil Engineering

Civil Engineering

M.Tech. (CE)

CURRICULUM AND SYLLABUS

Vision Statement of University

Be an internationally acclaimed University recognised for its excellent teaching, research, innovation, outreach and creating top class technocrats and professionals who can serve the mankind as multi skilled global citizen.

Mission Statement of University

- Establish state-of-the-art facilities for world class education and research.
- Conduct scholarly research and creative endeavours that impact quality of life.
- Attract quality staff and students to cater for diverse needs and preferences and widen participation.
- Build a foundation for students to be successful at all levels through high-quality, innovative programs.
- Collaborate with institute, industry, and society to address current issues through research and align curriculum.
- Involve in societal outreach programs to identify concerns and provide sustainable ethical solutions.
- Encourage life-long learning and team-based problem solving through an enabling environment.

Vision of the Department:

To emphasize deep understanding of fundamental principles, development of creative ability to handle the challenges of Civil Engineering, and the analytical ability to solve problems which are interdisciplinary in nature.

Mission of the Department:

1. To offer an exceptional curriculum including in-depth coverage in three technical sub-disciplines of civil engineering: structural engineering, Construction Management and Environmental engineering, as well as broad coverage in Computer Aided Design.
2. To engage students in creating innovative design solutions of civil engineering problems that include realistic constraints such as economic, environmental, sustainability, social, ethical, health and safety.
3. To provide research experiences, allowing students to work closely with members of the faculty.
4. To employ highly dedicated faculty members who are effective teacher scholars committed to maintaining a learner-centered environment with emphasis on student mentoring.

Department of Civil Engineering

Program Education Objectives (PEOs)

PEO 1 To prepare graduates with advanced knowledge of engineering principles computing and Science to develop necessary skills to synthesize and create Civil Engineering projects.

PEO 2 To prepare graduates as component to evaluate provide and create economically feasible and socially acceptable solution to real life technical problems in industry research and academic related to environment infrastructure science business and public policy.

PEO 3 To prepare graduates to excel in professionalism and adaptability at the global level with professional competence and ethical administrative skills so as to be able to handle critical situation and meet deadlines.

PEO 4 To inculcate an attitude in graduates to undergo research work as well as to involved in scientific innovations for global and sustainable development in Civil and allied engineering.

PEO 5 To prepare graduates to communicate effectively adopt lifelong learning, pursue higher education and act with integrity and have interpersonal skills needed to engage in lead and nurture diverse teams, with commitment to their ethical and social responsibilities.

Department of Civil Engineering

PROGRAMME OUTCOMES (POs)

PO 01	Create select and apply appropriate techniques resources and modern engineering tools such as CAD, FEM and GIS including prediction and modelling to complex civil engineering activities with an understanding of the limitations.
PO 02	Use research-based knowledge in research methods including design of experiments analysis and interpretation of data and synthesis of the information to provide valid conclusion related to Civil Engineering problem.
PO 03	Apply the knowledge of mathematics Science Engineering fundamentals and civil engineering principles to the solution of complex problems in civil engineering.
PO 04	Identify formulate research literature and analyse complex civil engineering problems reaching substantiated conclusion using first principle of mathematics and engineering science.
PO 05	Communicate effectively on complex civil engineering activities with engineering community and with society at large such as being able to comprehend and write effective reports and design documentation make effective presentation and give and receive clear instruction.
PO 06	An ability to differentiate identify formulate and solve complex engineering problems an ability to select and implement proper analysis modelling and implementation techniques for the identify engineering problems.
PO 07	An ability to develop solution-based approach and a model for engineering problem and design and manage an experiment.
PO 08	Ability to use modern engineering tools techniques and facilities in design and other Engineering applications.
PO 09	Ability to effectively use knowledge in the field to work in disciplinary/multi-disciplinary teams and the skills to lead these teams.
PO 10	Professional and ethical responsibility to gather and interpret data apply and announce solutions to Civil engineering problems.
PO 11	An ability to investigate, improve social connections and their conducting norms with the critical view and act to change them when necessary.
PO 12	Ability to design civil engineering systems fulfilling sustainability in environment and manufacturability and economic constraints.

Department of Civil Engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1 Graduates will be able to apply the knowledge of core and allied civil engineering domains to formulate design evaluate and create complex structure.

PSO 2 Graduates will be industry ready to work in structural engineering and allied interdisciplinary projects and provide solutions to specific problems related to structure withconcern to natural hazard, sustainability environmental context and professional ethics.

Medi-Caps University Indore (M.P.)
DEPARTMENT OF CIVIL ENGINEERING
Choice Based Credit System-Scheme of M.Tech CE (2023 Batch)

Scheme for Structural Engineering

SEMESTER I

Sr.No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5BS01	Mathematics	4	0	0	4	4
2	CE5CS02	Advanced Structural Analysis	4	0	0	4	4
3	CE5CS03	Concrete lab	0	0	4	4	2
4	CE5PC03	Minor Project-I	0	0	16	16	8
5	EN5RD01	Research Methodology	4	0	0	4	4
		Total	12	0	20	32	22

SEMESTER II

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5EL01	Advance Concrete Technology	4	0	0	4	4
2	CE5CS01	Theory of Elasticity	4	0	0	4	4
3	CE5CS06	Design of concrete structures	4	0	4	8	6
4	CE5PC04	Minor Project-II	0	0	16	16	8
		Total	12	0	20	32	22

SEMESTER – III

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5CS05	Structural Dynamics	4	0	0	4	4
2	CE5EL03	Finite Element Method	4	0	0	4	4
3	CE5CS07	Structural Software Lab.	0	0	4	4	2
4	EN5HS02	Technical Paper writing	0	0	2	2	1
5	EN5MC01	Value and Ethics	2	0	0	2	0
6	CS5PC01	Dissertation Phase-I	0	0	0	20	10
		Total	10	0	6	36	21

SEMESTER-IV

Sr. No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5CS04	Advanced CAD Lab	0	0	4	4	2
2	CE5EL02	Pre-Stressed Design of Concrete Structures	4	0	0	4	4
3	EN5HS01	Entrepreneurship and Management	3	0	0	3	3
4	CS5PC02	Dissertation Phase-II	0	0	0	32	16
		Total	7	0	4	43	25

Choice Based Credit System Scheme- M. Tech CE

Batch 2023-2025

M.Tech. (I year)

Scheme (2023-25 Batch)

SEMESTER I

Sr.No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5BS01	Mathematics	4	0	0	4	4
2	CE5CS02	Advanced Structural Analysis	4	0	0	4	4
3	CE5CS03	Concrete lab	0	0	4	4	2
4	CE5PC03	Minor Project-I	0	0	16	16	8
5	EN5RD01	Research Methodology	4	0	0	4	4
		Total	12	0	20	32	22

Subject Code	Subject Name	Hours per Week			Total	Total
		L	**T**	**P**	**Hrs.**	Credits
CE5BS01	Mathematics	4	0	0	4	4

In relation to mechanical engineering applications, such as, heat transfer, fluid mechanics, vibrations, the

following topics will be covered:

Unit-I

Linear algebra: Vector spaces, subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis, Linear transformations and their representation as matrices, the algebra of linear Transformations, The rank- nullity theorem, Eigen value analysis.

Unit-II

Numerical Methods: Solution of linear system of algebraic equation solution using Gauss elimination and Gauss sedial methods, ill conditioned matrix, method to improve accuracy of ill conditioned system, Power method to solve Eigen value problems. Concept of explicit and implicit methods ,Solution of differential equation using multi-step methods: Runge-Kutta and Predictor-Corrector methods, shooting method to solve boundary value problems, Lagrange interpolation, splines interpolation.

Unit-III

Partial differential equations: Characteristics and classification of second order PDEs. Separation of variables. Numerical solution of PDE(Laplace , Poisson, Heat, Wave) using finite difference methods: Elliptic partial differential equations, Parabolic PDE, Crank–Nicholson Method(Two-Dimensional Parabolic PDE), Hyperbolic PDE (Two-Dimensional Hyperbolic PDE).

Unit-IV

Fourier transform: Review of Fourier transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Short time Fourier Transform(STFT) and their properties .

Unit-V

Probability distribution and Reliability: Probability distribution with the Concept of continuous distribution functions, Normal distribution, Exponential distribution, Memory less property, Hypo exponential , Weibull distribution. Introduction to reability, Measure of reliability, reliability functions, derivation of reliability function, failure rate and failure models, mean time to system failure (MTSF), Failure time distribution. System configuration: series and parallel, k out of n systems, Redundancy.

Text/Reference Books

1. S. P. Venkateshan, Prasanna Swaminathan, Computational Methods in Engineering, Ane Books
2. Steven C. Chapra, Numerical Methods for Engineering, Mc-Graw Hill Education.
3. Gilbert Strang, Computational Science and Engineering, Wellesley-Cambridge Press.
4. B. S. Grewal, Higher Engineering Mathematics, Khanna Publ.
5. T. Veerajan , Probability, Statistics and Random Processes, Tata McGraw Hills, New Delhi, 2002.
6. E. Balagurusamy, Reliability Engineering, Tata McGraw-Hill Education, 1984.
7. A.k. Sharma, Linear Algebra, , Discovery Publishing House, 2007.
8. Shrinivasan Keshav ,Mathematical Foundation of computer networking , Pearson Eduaction,2013

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CE5CS02	Advance Structural Analysis	4	0	0	4	4

UNIT 1

Introduction to matrix methods of analysis - static indeterminacy and kinematic indeterminacy - Degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - Suitability element stiffness equations - elements flexibility equations
Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT 2

Matrix Method (stiffness Method): Displacement methods, Basic concepts, Evaluation of stiffness coefficients, direct stiffness method, energy approach in stiffness method. Effect of support displacement and temperature.

UNIT 3

Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods.

UNIT 4

Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT 5

Symmetrical & anti-symmetrical problems, Stiffness of plane & space frames solution of problems, comparison of force and displacement methods.

Reference Books:

1. Rajsekeran, Sankarsubramanian, Computational structural Mechanics, PHI
2. Pandit, Structural Analysis: a matrix approach, TMH
3. W Wearer Jr. & James M. Gere, Matrix Analysis of Framed Structures, CBS Pub.
4. C.S. Reddy, Basic Structural Analysis, TMH, Publishers

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CE5CS03	Concrete lab	0	0	4	4	2

1. Cement

i. Normal Consistency,

ii. Setting time,

iii. Soundness by Auto clave method

iv. Compression strength test and Air permeability test for fineness

v. Specific gravity of cement.

2. Fresh Concrete

i. Workability – slump

ii. Compaction factor and VeeBee tests.

3. Hardened Concrete

i. Compression strength and Split tensile tests

ii. Test on flexural strength of RCC beams

iii. Permeability of concrete.

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN5RD01	Research Methodology	4	0	0	4	4

Unit-I Introduction to Research Techniques

Meaning of research, objectives of research, motivation in research, types of research- empirical and experimental research, algorithmic research, simulation research, mathematical modeling approach, characteristics and prerequisites of research, significance of research, research process, Sources of research problem, criteria of identifying the problem, necessity of defining the problem, formulation of a research problem, errors in selecting research problem, technique involved in defining the problem, Report and paper writing.

Unit II Statistical analysis

Statistical analysis, Measures of central tendency and dispersion, mean, median, mode, range, mean and standard deviations, computing correlation in variables, linear and non-linear regression.

Unit III Probability and Probability distributions

Probability: classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes 'Theorem and independence. Probability distributions: binomial, poison, geometric, negative binomial uniform exponential, normal and log normal distribution.

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quintiles, Markov inequality, correlation and regression, independence of random variables.

Unit IV Sampling & Distributions

The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, ChiSquare, t and F distributions, problems. Hypothesis Testing: Basic ideas of testing hypothesis, null and alternative hypotheses, the critical and acceptance regions, two types of error, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications. Software and Tools to be learnt: Statistical packages like SPSS and R.

Unit V Simulation and Soft Computing Techniques

Introduction to soft computing, Artificial neural network, Genetic algorithm, Fuzzy logic and their applications, Tools of soft computing, Need for simulation, types of simulation, simulation language, fitting the problem to simulation study, simulation models, verification of simulation models, calibration and validation of models, Output analysis. Introduction to any one simulation tool e.g. MATLAB, NS2, ANSYS, Cadence etc. (Department Specific).

Text Book

1. R. Panneerselvam, " Research Methodologies," PHI.
2. C.R. Kothari: Research methodology, Methods and Techniques, New Age Publication.
3. S.M. Ross, A First Course in Probability, 8 th Edition, Prentice Hall.

Reference Books:

1. Best John V. and James V Kahn: Research in Education, Wiley eastern**.**
2. S.P. Sukhia, P.V. Mehrotra, and R.N. Mehrotra: Elements of Educational Research, PHI publication.
3. K. Setia: Methodology of Research Education, IEEE publication.
4. Jerry Banks, John S. Carson, Barry.L. Nelson David. M. Nicol, "Discrete-Event System Simulation", Prentice-Hall India.
5. V.K. Rohatgi, A.K. Md.E.Saleh," An Introduction to Probability and Statistics", Johm Willey.

SEMESTER II

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5EL01	Advance Concrete Technology	4	0	0	4	4
2	CE5CS01	Theory of Elasticity	4	0	0	4	4
3	CE5CS06	Design of concrete structures	4	0	4	8	6
4	CE5PC04	Minor Project-II	0	0	16	16	8
		Total	12	0	20	32	22

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CE5EL01	Advance Concrete Technology	4	0	0	4	4

Unit 1

Cement & its properties, Structure of Hydrated Cement paste, volume of hydrated product Rheology of Concrete, Properties of fresh concrete, Compaction of concrete, Curing of concrete, Maturity of concrete.

Unit 2

Chemical Admixtures:- Mechanism of chemical admixture, plasticizers & super Plasticizers, their effect on concrete property in fresh & hardened state, retarder, accelerator.

Mineral Admixtures:- Fly Ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state.

Unit 3

Properties of hardened concrete, strength characteristic, shrinkage, creep, permeability & durability of concrete, chemical attack, acid attack, efflorescence, IS 456-2000 requirement for durability .

Unit 4

Concrete at low & high temp., Under water concreting, shotcrete, air entrained concrete, self compacting concrete, high performance concrete, high Volume fly Ash concrete concept.

Unit 5

Mix design-factors affecting mix design, design of concrete mix by BIS method using IS 10262, Provisions in revised IS 10262-2004, Non destructive testing of concrete.

Reference Books

1. M.L. Gambir, Concrete Technology, Tata Mc. Graw Hill Book Co.
2. P. kumar Mehta & Paulo J.M., Monteiro, CONCRETE, Mc. Graw Hill Education (India) Pvt. Ltd.
3. A.M. Neville & J.J. Brooks, Concrete Technology, Pearson.
4. A.M. Nobille, Concrete Technology, ELBS London.
5. N. Krishna Raju, Concrete mix design, Sehgal Publication.
6. IS 10262-2004
7. M.S. Shetty, Concrte Technology, S. Chand.
8. A.R. Santhakumar, Concrete Technology, Oxford University Press.

9. J.Prasad, C.G. Nair, Non Destructive test and evaluation of materials, MC Graw Hill.

10. Peurifoy R.L., Construction planning Equipment & methods, Tata Mc. Graw Hill.

11. Aitcin PC, High performance Concreate, E. and FN London.

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CE5CS01	Theory of Elasticity	4	0	0	4	4

UNIT-I

Introduction: Stress & Strain: Plane Stress, Plane Strain, Analysis of stress and strain, Stress and Strain at a points, Generalized Hooke's Law, Compatibility equation, Differential equations of equilibrium, Relation of anisotropic materials, Linear elasticity, Relations of stress and strain, Boundary conditions, stress function.

UNIT-II

Rectangular Co-ordinates: Solutions of 2-D problems in Rectangular Co-ordinates by Polynomials, Airy's stress function, Saint-Venant's Principle, Determination of displacements, Bending of beams: Due to uniform load, simply supported, cantilever loaded at end, solution of 2-D problems in Fourier series.

UNIT-III

Polar Coordinates: General equations and 2-D problems in Polar coordinates, Stress Distribution and General solution of plates with circular holes and rotating circular disc, Strain components and stress distribution in polar co-ordinates, Pure bending of curved bars.

UNIT-IV

3-D Stress and Strain Analysis: Principal stress and strain, shearing stress and strains, Differential Equation's of equilibrium to determine displacement, compatibility conditions, Principle of virtual work - Strain energy, Principle of super position. Bending of Prismatic Bras: circular, rectangular cross-section

UNIT-V

Torsion: Rectangular bars, Prismatic bars in torsion, hollow thin walled sections in torsion, Torsion of Circular Shafts, membrane analogy, solution of torsion problems by energy method, torsion of rolled profile section, torsion of hollow shafts and thin tubes, torsion buckling and torsion flexural buckling.

Text Books:

1. Theory of Elasticity by Timoshenko, Mc-Graw hill Publications
2. "Applied Elasticity" by C. K. Wang, Mc Graw Hill
3. Theory of Elasticity by Sadhu singh, Khanna Publishers

References:

1. Theory of Elasticity by Y.C. Fung, Dover publications, New York
2. Advanced Mechanics of Materials by Arthur P. Boresi, John Willey publishers
3. Advanced Mechanics of solids by L.S.Srinath, Tata Mc-Graw Hill
4. Continuum Mechanics by P.N. ChandraMouli, Yes Dee Publishers

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
CE5CS06	Design of Concrete Structure	4	0	4	4	4

Unit- I

Loads on structures, reinforced concrete design of flat slabs, grid floors, deep beams,

Unit- II

Seismic analysis: Earthquake and wind effects on structures, Design of buildings: load bearing and framed structures, Design of foundations: Isolated sloped footing, Combined footing, Raft/Mat foundation

Unit-III

Design of ground and elevated water tanks, design of bridge decks.

Unit- IV

Pre-stressed concrete: Analysis and design of beam sections under flexure using limit state approach, anchorage zone and end block design, composite construction, introduction to statistically indeterminate pre-stressed concrete structures.

Unit- V

Silos and bunkers, Janseens and Airys theory, rectangular bunkers with sloping bottoms and with high side walls, battery of bunkers.

Proposed List of Practicals

1) Design of Flat slab.

2) Design of Grid slab.

3) Design of Silo.

4) Design of Rectangular Bunker.

5) Design of Intz Water Tank.

6) Design of on Ground Water Tank.

7) Design of Deck Type Bridge.

Reference Books:

1. Jaikrishna, Chandrasekaran, Elements of earthquake engineering.
2. Shah and Karve, Text book of reinforced concrete
3. Punmia, RCC designs
4. IS-456, IS -875, IS-1893.
5. Krishna Raju, Prestressed concrete.
6. Varghese, Advanced RC Designs, PHI
7. Everard, Theory and problems of RC design (Shaums Outline S), TMH

SEMESTER – III

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5CS05	Structural Dynamics	4	0	0	4	4
2	CE5EL03	Finite Element Method	4	0	0	4	4
3	CE5CS07	Structural Software Lab.	0	0	4	4	2
4	EN5HS02	Technical Paper writing	0	0	2	2	1
5	EN5MC01	Value and Ethics	2	0	0	2	0
6	CS5PC01	Dissertation Phase-I	0	0	0	20	10
		Total	10	0	6	36	21

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
CE5CS05	Structural Dynamics	4	0	0	4	4

Course Objectives: To impart knowledge on the fundamental of structural dynamics and their applications.

Course Outcomes: The learner will be able to understand the equation of motion, dynamics response of single, and multi degree-of freedom systems and basics of earthquake engineering.

UNIT - I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom – Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion. Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems -Harmonic excitation and periodic loadings-Dynamic magnification factor – Phase angle – Bandwidth. Difference between static loading and dynamic loading. Effects of damping and transmissibility.

UNIT - II

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretisation - Formulation of equations of motion by different methods –D'Alembert's principle, Principle of virtual work and Hamilton principle.

UNIT III

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. Idealisation of structure as single degree of freedom system.

UNIT – IV

Dynamics of Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Solutions of Eigen value problem for natural frequencies and mode shapes- Analysis of Dynamic response - Mode superposition procedure.

UNITV

ELEMENTS OF SEISMOLOGY: Elements of Engineering Seismology – Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters – Magnitude, intensity, focus, epicentre of earthquakes – Spectral Acceleration. Introduction to response spectrum analysis for peak responses.

TEXT BOOKS:

1. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi

2. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.

3. Earthquake Resistant design of Structures by Pankaj Agrawal and Manish Shrikhande.

REFERENCES:

1. Dynamics of Structures by Clough &Penzien, McGraw Hill, New York
2. Vibrations, Dynamics and Structural systems by Madhujit Mukhopadhyay, CRC press

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
CE5EL03	Finite Element Method	4	0	0	4	4

Course Objective:

To introduce the fundamentals of FEM, understand how it works and understand the capabilities of FEM.

Unit - I

Introduction - Background, General description of the method, Applicability and Description of Finite Element Method, Comparison with other methods.

Unit - II

Solution of Finite Element Method: Solution of Equilibrium Problems, Eigen value, problems, propagation problems, computer implementation of Gaussian eliminations, Choleski's decomposition.
Variational methods: calculus of variation, formulation by different approaches (displacement, potential energy the Rayleigh-Ritz and Galerkin methods.

Unit - III

General Procedure of Finite Element Method: Descretization of the domain, Various element shapes, finite element analysis of 1-D problems, Axisymmetric elements, plate bending elements, introduction to 3-D elements, shell elements, interface elements, boundary elements, infinite elements., node numbering technique, Interpolation Polynomials, their selection and derivation in terms of global and local coordinates, Convergence requirements. Direct and variational formulations of element stiffness and loads. Assemblage of elements, Boundary Conditions and Solution of overall problems.

Unit - IV
Isoparametric Element properties: Natural coordinates, interpolation functions Iso-parametric Formulation: Lagrange and Hermite interpolation functions, Numerical Integration. (1-D and 2-D), mesh refinement

Unit – V
Static Analysis: Formulation of equilibrium equation, bending of beams and plane frame analysis, Analysis of truss, Plane stress – plane strain - CST, LST & QST elements - solutions of problems,, Plates and Shells, Plate elements (Kirchoff theory, Mindlin plate element, triangular and rectangular plate elements, conforming and non-conforming elements, Shell elements (flat faced triangular and rectangular elements, degenerated shell elements).

Course Outcome:

The students are expected to be able to apply basics of FEM to solve 1D and 2D problems in solid mechanics and to write computer program based on finite element methods.

Text Books:

1. The Finite Element Method in Engineering- S.S. Rao, Butterworth-Heinemann;
2. Finite Element Analysis Theory and Programming- Krishnamoorthy, C.S, Tata McGraw-Hill Education
3. An Introduction to Finite Element Method- Reddy, J. N., McGraw-Hill Education

Reference Books:

1. Weaver, Johnson, Finite element and structural analysis
2. HC Martin, Matrix structural analysis
3. CF Abel, CS Desai, Finite element methods

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
CE5CS07	Structural Software Lab	0	0	4	4	2

Course Objective:

To familiarize the students on the software package (Staad Pro) for analysis and design of concrete and steel structures.

Learning Outcomes: The students will be able to:Analyze and interpret the results&Design the framed structures.

1. Introduction, Overview and the Environment of STAAD pro Package.

2. General Description, Type of structure, Unit systems, structure geometry and Co-ordinate systems, global co-ordinate system, Local co-ordinate systems, STAAD PRO -Commands- Using Edit Input-Command. Formats-Text Input.

3. STAAD PRE- Graphical Input Generation-Library- Geometry Generation – Dimensioning. STAAD POST– Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis &Design – Query reports.

4. LOAD – Member Load, Element Load, Joint Load, Floor Load, Self weight Command, Load case no, Load Combination .Load Generation for Wind Load, Seismic Load and Moving Load.

5. Analysis of 2D Truss

6. Analysis of Continuous Beams

7. Analysis of 2D and 3D Rigid Frames

8. Design of RC framed structures (Beams, columns, slabs, footings)

9. Design of Circular Water Tanks

10. Analysis and Design of steel structures (Beams, columns)

Subject Code	Subject Name	Hours per Week			Total	Total
		L	**T**	**P**	**Hr**	**Credit**
EN5HS02	Technical Paper Writing	0	0	0	2	1

- Report writing, various formats
- Plagiarism
- How to make a synopsis
- Reading techniques
- Making a hypothesis
- Writing abstract and Summary
- Paraphrasing
- Building thoughts
- Cauterization
- Formatting
- Oral presentation
- How to make good ppts
- Viva voce/ interviews
- Importance of syntax and semantics, Mechanics of writing, Proof reading

Recommended text:

1. C.R Kothari. *Research Methodology*. Sultan Chand & Sons, New Delhi,1990
2. Day R A. *How to Write and Publish a Scientific Paper*. Cambridge University Press, 1989.
3. Sharma RC and Krishna Mohan. *Business correspondence and report writing*. New Delhi: Tata Mc Graw Hill, 2016
4. Murphy Herta A, Herberrt W Hildebrandt, Jane P Thomas. *Effective Business Communication*. Tata Mc Graw Hill, 1997
5. Rizvi Ashraf. *Effective Technical Communication*. Tata Mc Graw Hill, 2014.
6. Koneru Aruna. Professional Communcation. Mc Graw Hill, 2015

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN5MC01	Human Values & Ethics	2	0	0	2	0

Unit I

Introduction: Definition of Ethics and Values, Character and Conduct, Nature and Scope of Ethics, Uses of Ethics, Self- realization and Harmony, Rules and Regulations, Rights and Duties, Good and Obligation, Integrity and Conscience.

Unit II

Obligation to Family: Trust and Respect, Codes of Conduct, Citizens Charter, Emotional Intelligence,

Liberty, Equality, and Fraternity, Civil Rights, Human Rights

Unit III

Individual and Society: Theories of Society, Social Relationships and Society, Empathy:

Compassion towards other being, Environmental Ethics and Nature

Unit IV

Western Ethics and Indian Ethics: Happiness and Prosperity, Four Cardinal Virtues, Lesson from Socrates, Lesson from Mahatma Gandhi, Society and Trusteeship, Indian Constitution, Fundamental Rights, Directive Principles of State Policy.

Unit V

Professional Ethics: Human Goals, Four Purusarthas, Ethics in Public Administration, Ethical Values and Management, Ethics and Civil Servants.

Reference Books:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
3. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
5. M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Humna Values), Eastern Economy Edition, Prentice Hall of India Ltd.
6. Ethics and Values, VANAPALLI VENKATA RAO.

SEMESTER-IV

Sr. No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CE5CS04	Advanced CAD Lab	0	0	4	4	2
2	CE5EL02	Pre-Stressed Design of Concrete Structures	4	0	0	4	4
3	EN5HS01	Entrepreneurship and Management	3	0	0	3	3
4	CS5PC02	Dissertation Phase-II	0	0	0	32	16
		Total	7	0	4	43	25

Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CE5CS04	Advanced CAD Lab	0	0	4	4	2

Unit 1

Introduction to Computer Aided Designing, Basics of scales, symbols and uses in drawing and drafting, Introduction to various available softwares of CAD.

Unit 2

Introduction to different commands : Mirror, Hatch, Array, Champher, Fillet, Tool Bars, Command Bar. Drawing of different geometrical shapes: Circle, rectangular beams, columns, slabs, hyperbola, ellipse.

Unit 3

Computer Aided drafting, 2-D drawings, Plan, elevation, Section, Views, Shadings of buildings and its elements.

Unit 4

Introduction to computer graphics, 3-D drawings and modeling software

Recommended software:

1. Software of Autodesk Auotcad.

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
CE5EL02	Pre-Stressed Design of Concrete Structures	4	0	0	4	4

1. INTRODUCTION:
Development of prestressed concrete –Advantages and Disadvantages of PSC over RCC –General principles of pre-stressing-pre tensioning and post tensioning –Materials used in PSC-high strength concrete –High tension steel-Losses of prestress.

2.**ANALYSIS**
Analysis of sections – Stress concept – Strength concept – Load balancing concept-Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections

3. DESIGN CONCEPTS
Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing– Applications

4. SHEAR, BOND, BEARING AND ANCHORAGE: Shear in PSC beams –Principal stresses –Conventional elastic design for shear-transfer of prestress in pretensioned members-transmission length –Bond stresses-bearing at anchorage –Anchorage zone stresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

5. CIRCULAR PRESTRESSING
Introduction –Circumferential prestressing Design of Prestressed concrete tanks –vertical prestressing in tanks-Dome prestressing.

TEXT BOOKS:

1. Prestressed Concrete by S. Krishna raju, TMH Pubilishers.
2. Prestressed Concrete by S. Ramamrutham, Dhanpati Rai Pubilicartions.
3. Prestressed concrete design by Praveen Nagarajan, Pearson Pubilications.

REFERENCE BOOKS:

1. T.Y.Lin, Design of Prestressed Concrete Structures, Asian Publishing house, Bombay,
2. Y.Guyon, Prestressed Concrete, Vol.I&II, Wiley and Sons, 1960.
3. F.Leohhardt, Prestressed concrete Design and construction, Wilhelm Ernst and shon, Berlin,

Course Code	Course Name	Hours Per Week			Total Hrs.	Total Credits
		L	T	P		
EN5HS01	Entrepreneurship and Management	3	0	0	3	3

Course Objective

1. To Institute Entrepreneurship Skills in the Student
2. To inculcate the spirit and perspective of entrepreneurship among students
3. To make the students to manage the business and organizations.
4. To enable the students to manage the business and organizations.
5. To use concepts of management organization structure dynamics effectively to achieve organization goals.

Course Outcome:

on successful completion of this course students will have a better understanding on required Entrepreneurship Skills to start a new venture also the importance of management in smooth conduction of business in an organization.

Course Contents:

Unit I – Introduction to Entrepreneurship

Definition and meaning, Concept and Need of Entrepreneurship ; Role of entrepreneurship in Economic Development, Factor Affecting Entrepreneurial Growth- Economic, Non- Economic Factors, Managerial Vs. Entrepreneurial approach, Entrepreneur Vs. Intrapreneur, Types of Entrepreneurs, Traits/Qualities of an Entrepreneurs, Characteristic of successful entrepreneurs, Entrepreneurship Process, Woman as Entrepreneurs, Ethics and Social Responsibilities, Entrepreneurial challenges.

Unit II- Creating and Starting the Venture

Business Plan – Meaning, Significance, contents, formulation and presentation of Business Plan implementing business plans. Marketing plan, financial plan and the organizational plan, Launching Formalities, Common errors in Business plan formulation.

Entrepreneurship and Management

Unit: III – Innovation and Entrepreneurship

Entrepreneurship and Innovation the Innovation Concept, importance of Innovation die Entrepreneurship, Source of Innovation for opportunities, The innovation Process, product life cycle, new product development process, Creativity and innovation in product modification/ development.

Unit: IV- Introduction to Management and Organization

Concept and differences between industry, commerce and business, Various types of ownership in the organization- Definition, Characteristics, Merits & Demerits, Single Ownership, Partnership, Cooperative Organization, Joint Stock Companies, Government Owned. Difference between Management and administration, Management as a science and as an art, different types of leadership models- Autocratic Leader, Democratic Leader, Free Rein Leader, Free Rein Leader, and Freelance Leader.

Unit: V- Function of Management

Planning: Definition, Types of Planning, Steps in planning process, Nature and Purpose of Organizing: Staffing, Line and staff Relationship, Line-Staff Conflict, Directing: definition and importance, Controlling: Concept and Process of Control, Control Techniques, Control as a Feedback System.

Text Books

1. Madhushree Nanda Agarawal, Fundamentals of Management, Pearson Education,
2. Harold koontz, O'Donnell and Heinz Weihrich, Essentials of Management, New Delhi, Tata Mc Graw Hill
3. Robbins , Management, 9th edition person Education
4. Stoner, Management, PHI Learning
5. Gupta C.B. and Khanks S.S., Entrepreneurship and small Business Management, Sultan Chand & Sons, New Delhi
6. Rajeev Roy, Entrepreneurship, Oxford University Press
7. Vasant Desai: Small scale Industries and Entrepreneurship, Himalaya publishing House

Reference Books

1. Gerene, Entrepreneurship3 rd edition cengage learning,
2. B.K. Mohanty fundamentals of Entrepreneurship PHI
3. Barringer, Entrepreneurship Pearson education
4. Desai Vasant, Dynamics of Entrepreneurship Development and Management, Himalaya Publishing House
5. David H Holt Entrepreneurship: New Venture Creation, PHI
6. Satyaraju & Parthsarthy, Management Text and Cases, PHI Learning
7. Kanishka Bedi, Management and Entrepreneurship 1st Edition 2009 oxford Higher Education