SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E-Civil Engineering

(Structural Engineering)

CURRICULUM and SYLLABI

[For students admitted in 2019-2020]

M.E / M.Tech Regulation 2019

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Civil Engineering
Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR101	Applied Mathematics	3	1	0	4
2	P19STR102	Theory of Elasticity and Plasticity	3	1	0	4
3	P19STR504	**Elective-**Stability of Structures	3	0	0	3
4	P19STR510	**Elective-**Advanced Design of Concrete Structures	3	0	0	3
5	P19GE101	Research Methodology and IPR	2	0	0	2
6	P19GE701	**Audit Course-**English for Research Paper Writing	2	0	0	0
Practical						
7	P19STR103	Structural Engineering Laboratory	0	0	4	2
					Total Credits	**18**

Approved by

Chairperson, Civil Engineering BOS
Dr.R.Malathy

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Civil, First Semester ME STR Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME II Semester under Regulations 2019
Civil Engineering
Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR201	Advanced Design of Concrete Structures	3	0	0	3
2	P19STR202	Advanced Design of Steel Structures	3	0	0	3
3	P19STR501	**Elective -** Prefabricated Structures	3	0	0	3
4	P19STR514	**Elective -** Formwork Engineering	3	0	0	3
5	P19GE702	**Audit Course**: Stress Management by Yoga	2	0	0	0
Practical						
6	P19STR203	Structural Software Application Laboratory	1	0	4	3
7	P19STR204	Mini Project	0	0	4	2
					Total Credits	**17**

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Civil Engineering
Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR301	Design of Steel Concrete Composite Structures	3	0	0	3
2	P19STR517	**Elective -** Design of Sub Structures	3	0	0	3
3	P19END601	**Open Elective**- Product Design and Manufacturing	3	0	0	3
Practical						
4	P19STR302	Technical Seminar	0	0	2	1
5	P19STR303	Practical Training	0	0	4	2
6	P19STR304	Project Phase – I	0	0	16	8
					Total Credits	**20**

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Civil Engineering

Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Practical						
1	P19STR401	Project Phase – II	0	0	28	14
					Total Credits	**14**

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Civil Engineering
Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR101	Applied Mathematics	3	1	0	4
2	P19STR102	Theory of Elasticity and Plasticity	3	1	0	4
3	P19STR504	**Elective-**Stability of Structures	3	0	0	3
4	P19STR510	**Elective-**Advanced Design of Concrete Structures	3	0	0	3
5	P19GE101	Research Methodology and IPR	2	0	0	2
6	P19GE701	**Audit Course-**English for Research Paper Writing	2	0	0	0
Practical						
7	P19STR103	Structural Engineering Laboratory	0	0	4	2
					Total Credits	**18**

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P19STR101	FINITE ELEMENT ANALYSIS	3 1 0 4

COURSE OUTCOMES

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

CO1 Discuss the displacement models to solve practical problems in Structural engineering.

CO2 Apply numerical techniques of finite element analysis to solve real time problems.

CO3 Manipulate the shape function and interpolation function to study structural behaviour.

CO4 Implement linear and quadratic elements in the finite element analysis of various types of structures.

CO5 Predict structural behaviour using strain displacement matrix and element stiffness matrix.

UNIT-I: INDRODUCTION **12**

Differential equilibrium equations - Strain displacement relation - Linear constitutive relation - Special cases - Principle of stationary potential energy - Application to finite element methods. Some numerical techniques in finite element analysis.

UNIT –II: DISPLACEMET MODELS **12**

Displacement models - Convergence requirements. Natural coordinate systems - Shape function. Interpolation function - Linear and quadratic elements - Lagrange and Serendipity elements - Strain displacement matrix - Element stiffness matrix and nodal load vector.

UNIT –III: ISOPARAMETRIC ELEMENTS **12**

Two dimensional isoparametric elements - Four noded quadrilateral elements - Triangular elements - Computation of stiffness matrix for isoparametric elements - Numerical integration (Gauss quadrature) - Convergence criteria for isoparametric elements.

UNIT –IV: APPLICATIONS OF FEM **12**

Assemblage of elements – Direct stiffness method - Special characteristics of stiffness matrix - Boundary condition and reaction - Gauss elimination and LDLT decomposition - Basic steps in finite element analysis.

UNIT –V: ANALYSIS OF STRUCTURES **12**

Analysis of framed Structures - 2D truss element - 2D beam element. Analysis of plate bending: Basic theory of plate bending - Displacement functions - plate bending Elements. Plane stress and plane strain analysis: Triangular elements - Rectangular elements.

Total:60 hrs.

REFERENCE BOOKS:

1. Bhavikatti.S.S, “Finite Element Analysis”, New Age International Publishers, 2015.
2. Chandrupatla, R.T. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, Prentice Hall of India, 2011.
3. Rao.S.S, “Finite Element Method in Engineering”, Butterworth – Heinmann, UK, 2008.
4. Logan D. L., A First Course in the Finite Element Method, Cengage Learning, 2015.
5. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons, 2011.

P19STR102	THEORY OF ELASTICITY AND PLASTICITY	3 1 0 4

COURSE OUTCOMES

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

CO1 Explain the concept of stress and strain and their relationships
CO2 Analyze the two dimensional problems in Cartesian and polar coordinates
CO3 Apply the concept of torsion to Prismatic bars of different sections
CO4 Solve simple problems of elasticity and plasticity understanding the basic concepts.
CO5 Apply numerical methods to solve continuum problems.

UNIT-I: ANALYSIS OF STRESS AND STRAIN IN CARTESIAN COORDINATES 12

Displacement, Analysis of stress (two and three dimension)- Body force, surface force - Uniform state of stress – Principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of strain (two and three dimension) Strain displacement relations - Compatibility equations - state of strain at a point – strain transformation - principal strain - principle of superposition. Stress-strain relations - generalized Hooke's law - Lame's constants, Boundary value problems

UNIT –II: TWO DIMENSIONAL PROBLEMS OF ELASTICITY IN CARTESIAN COORDINATES 12

Plane stress and Plane strain problems - Airy's stress function - Polynomials – Direct method of determining Airy's polynomial stress function - Solution of Biharmonic equation by fourier series - St. Venant principle.

UNIT –III: TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES 12

General equations in polar coordinates - Stress distribution symmetrical about an axis - Pure bending of curved bars - Strain components in polar coordinates - Displacements for symmetrical stress distribution - Rotating Disc - Bending of a curved bar by force at the end

UNIT –IV: TORSION OF PRISMATIC BARS 12

General solutions of the problem by displacement (St. Venant's warping function) and force (Prandtl's stress function) approaches - Membrane analogy-Torsion of shafts of circular and noncircular (elliptic, triangular and rectangular) cross sectional shapes. Torsion of hollow thin walled single and multicelled sections.

UNIT –V: PLASTIC DEFORMATION 12

Introduction to stress-strain curve - Ideal plastic body - Criterion of yielding - Rankine's theory - St.Venant's theory - Tresca's criterion - Beltramis theory - Von-mises criterion - Mohr's theory of yielding - yield surface – Plastic potential, Isotropic Hardening-Flow rule (plastic stress- strain relation) Prandtl Reuss equations - Plastic work - Plastic potential Nadai's sand heap analogy.

Total: 60 hrs.

REFERENCE BOOKS:

1. Sadhu Singh, Theory of Plasticity, Khanna Publishers, N.Delhi, 2008.
2. S. Timoshenko and J. N. Goodier, Theory of Elasticity, Mc Graw Hill Book Co., 2010.
3. RagabA.R., Bayoumi S.E., Engineering Solid Mechanics, CRC Press,1999
4. Computational Elasticity, AmeenM, Narosa, 2005.
5. Advanced Mechanics of Solids, Srinath L.S, Tata McGraw Hill, 2009.

P19STR103	STRUCTURAL ENGINEERING LABORATORY	0 0 4 2

COURSE OUTCOMES

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

CO1 Design high strength concrete and study the parameters affecting its performance

CO2 Conduct Non-Destructive tests on existing concrete structures

CO3 Apply Engineering principles to understand behaviour of structural elements

CONTENTS:- **60**

Study of stress-strain curve of high strength concrete

Correlation between cube strength, cylindrical strength, split tensile strength and modulus of rupture

Effect of cyclic loading on steel

Non-Destructive testing of existing concrete members

Behaviour of beams under flexure, shear and torsion

Model study on continuous beam with influence line coefficients

Total: 60 hrs.

REFERENCE BOOKS:

1. Properties of Concrete, Neville A.M, 5th Edition, Prentice Hall, 2013.

2. Concrete Technology, Shetty M.S., S.Chand and Co., 2008.

P19STR504	STABILITY OF STRUCTURES	3 0 0 3

COURSE OUTCOMES

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

CO1 Obtain the concept of structural stability of structures
CO2 Compare the method and analysis of structures
CO3 Design a beam column behaviour and torsional buckling in beams
CO4 Explain the buckling of portal frame with various modes
CO5 Describe the buckling plates with different approaches

UNIT – I: STABILITY OF COLUMNS **9**

Introduction-Methods of neutral equilibrium- Effective-length concept and design curve- Governing equation for columns- Eigen value problem-Elastic structural stability-Structural instability-Analytical methods for the stability analysis, equilibrium, imperfections and energy methods - Non-prismatic columns - Built up columns - Buckling modes effect of shear on buckling load - Large deflection theory

UNIT – II: METHODS OF ANALYSIS AND INELASTIC BUCKLING **9**

Approximate methods - Rayleigh and Galerkin methods - Numerical methods (New mark's Finite Difference and matrix methods) -Analysis of columns - Experimental study of column behaviour - South well plot - Column curves - Derivation of column design formula - Effective length of Columns - Inelastic behavior - Tangent modulus and Double modulus theory.

UNIT – III: BEAM COLUMNS **9**

Beam columns: Introduction-Behaviour, Stability analysis of beam column with single and several concentrated loads, distributed load and end couples. Beams: Torsional buckling-Combined Torsional and flexural buckling. Lateral buckling of beams, pure bending of simply supported and cantilever beams.

UNIT – IV: BUCKLING OF FRAMES **9**

Buckling of frames-Introduction-Modes of buckling-Critical load using various methods:- Neutral equilibrium-Slope-deflection equations-Matrix Analysis.

UNIT – V: BUCKLING OF PLATES **9**

Buckling of plates-Differential equation of plate buckling-Critical load on plates for various boundary conditions-Energy method-Finite difference method.

Total: 45 hrs.

REFERENCE BOOKS:

1. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall of India, 1990.
2. Ashwin Kumar, "Stability of Structures", Allied Publishers Ltd, New Delhi, 1998.
3. Gambhir, "Stability Analysis and Design of Structures", springer, New York, 2010.
4. Iyengar, N.G.R, "Structural Stability of Columns and Plates" East West Press Pvt Ltd, New Delhi, 1986.
5. Timoshenko, S.P, and Gere, J.M., "Theory of Elastic stability", McGraw-Hill Company, 2017.

P19STR510	ADVANCED CONCRETE TECHNOLOGY	3 0 0 3

COURSE OUTCOMES

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

CO1 discuss microstructure concrete and dimensional stability
CO2 prepare a mix design for the various mix proportions
CO3 enumerate the properties of ingredients used in concretes
CO4 explain the different types of special concrete and their applications in construction.
CO5 explain different types of non-destructive testing methods.

UNIT – I: CONCRETE CHARACTERISATION **9**

Microstructure of concrete: Aggregate phase, hydrated cement paste, interfacial transition zone. Strength: strength-porosity relationship, failure modes in concrete, factors affecting compressive strength, behavior of concrete under various stress states. Dimensional stability: Elastic behavior, drying shrinkage and creep, thermal shrinkage and thermal properties of concrete.

UNIT – II: PROPORTIONING CONCRETE MIXTURES **9**

Significance and objectives, general considerations, procedures, Methods of concrete mix design, design of high strength and high performance concrete using relevant codes. Testing and control of concrete quality: Methods and significance, accelerated strength testing, core tests and quality control charts.

UNIT – III: DURABILITY OF CONCRETE **9**

Water as an agent of deterioration: structure of water, permeability, causes of deterioration of concrete: surface wear, crystallization of salts in pores, frost action, effect of fire, sulfate attack, alkali aggregate reaction, and corrosion of embedded steel in concrete: Mechanism-control, development of holistic model of concrete deterioration, concrete in the marine environment. Methods of providing durable concrete, short-term tests to assess long-term behaviour.

UNIT – IV: SPECIAL TYPES OF CONCRETE **9**

Roller compacted concrete-self compacted concrete-shrinkage compensation concrete, pervious concrete-concrete containing polymers-heavy weight concrete for radiation shielding-high performance concrete, high strength concrete, shotcrete, fibre reinforced concrete- bacterial concrete-Mass concrete – their materials, mix proportions, properties, applications and limitations.

UNIT – V: NON-DESTRUCTIVE METHODS **9**

Surface hardness methods, Penetration resistance techniques, pull out tests, maturity method, stress wave propagation methods, electrical methods, electrochemical methods, electromagnetic methods, Tomography of reinforced concrete.

Total: 45 hrs.

REFERENCE BOOKS:

1. .Kumar Mehta, Paulo J.M Monteiro., Concrete Microstructure,properties and Materials,McGraw Hill Education(India) Pvt Ltd, New Delhi,2014
2. Job Thomas, "Concrete Technology", Cengage Learning India, 2015
3. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2011..
4. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010.
5. Neville, A.M., Properties of Concrete, Prentice Hall, 2013, London.
6. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2008.
7. IS 10262

P19GE101 RESEARCH METHODOLOGY AND IPR 2 0 0 2

COURSE OUTCOMES

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

1. Review the literature of the research problem
2. Choose appropriate data collection and sampling method according to the research problem.
3. Interpret the results of research and communicate effectively with their peers
4. Explain the Importance of intellectual property rights
5. Evaluate trade mark, develop and register patents

UNIT 1 INTRODUCTION TO RESEARCH METHODS 6

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design , Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules,

UNIT 2 SAMPLING DESIGN AND HYPOTHESIS TESTING 6

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques - Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), concerning variance – one tailed Chi-square test.

UNIT 3 INTERPRETATION AND REPORT WRITING 6

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

UNIT 4 INTRODUCTION TO INTELLECTUAL PROPERTY 6

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.

UNIT 5 TRADE MARKS, COPY RIGHTS AND PATENTS 6

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims –trademark Litigations- International trademark law

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

THEORY: 30 Hours TUTORIAL: - PRACTICAL: - TOTAL: 30 Hours

TEXT BOOKS

1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques ,4th Edition, New Age International Publishers, 2019.
2. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets”, Delmar Cengage Learning, 4th Edition, 2012.
3. Prabuddha Ganguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, Tata Mc Graw Hill Education, 1st Edition, 2008.

REFERENCE BOOKS

1. Panneerselvam, R., Research Methodology, Second Edition, Prentice-Hall of India, New Delhi, 2013.
2. Ranjith Kumar, Research Methodology – A step by step Guide for Begineers, 4th edition, Sage publisher, 2014.
3. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1st Edition, 2016.
4. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1st Edition, 2012.
5. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1st Edition, 2017.
6. M.Ashok Kumar and Mohd.Iqbal Ali :"Intellectual Property Rights" Serials Pub

P19GE701 **English for Research Paper Writing**

2 0 0 0

Course Outcomes:

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

- Demonstrate research writing skills both for research articles and thesis
- Frame suitable title and captions as sub-headings for articles and thesis
- Write each section in a research paper and thesis coherently
- Use language appropriately and proficiently for effective written communication
- Exhibit professional proof-reading skills to make the writing error free

Unit – I **6**

Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness

Unit – II **6**

Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections

of a paper/ abstract.

Unit- III **6**

Key skills to frame a title, to draft an abstract, to give an introduction

Unit – IV **6**

Skills required to organise review of literature, methods, results, discussion and conclusions

Unit – V **6**

Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing.

Text Books:

1.Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2.HighmanN , Handbook of Writing for the Mathematical Sciences, SIAM.Highman's book, 1998.
3. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
4.Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books)

Total: 30 hours

REFERENCES

Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006

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S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR201	Advanced Design of Concrete Structures	3	0	0	3
2	P19STR202	Advanced Design of Steel Structures	3	0	0	3
3	P19STR501	**Elective -** Prefabricated Structures	3	0	0	3
4	P19STR514	**Elective -** Formwork Engineering	3	0	0	3
5	P19GE702	**Audit Course**: Stress Management by Yoga	2	0	0	0
Practical						
6	P19STR203	Structural Software Application Laboratory	1	0	4	3
7	P19STR204	Mini Project	0	0	4	2
					Total Credits	**17**

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P19STR201	Advanced Design of Concrete Structures	3 0 0 3

COURSE OUTCOMES

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

CO1. Describe the design philosophy of Concrete Structures
CO2. Design the columns, walls, corbels, deep beams and grid floors
CO3. Design the flat slabs by yield line approach
CO4. Discuss the inelastic behaviour of concrete beams and columns
CO5. Deliberate the detailing for ductility of beams, columns and frames

UNIT-I: INTRODUCTION **9 Hrs.**

Calculation of deflection and crack width according to IS Code. Construction of Interaction curve for compression member with axial force and bending – Design of slender column. Behaviour of beams for flexure, shear and torsion.

UNIT –II: DESIGN OF SPECIAL REINFORCED CONCRETE ELEMENTS **9 Hrs.**

Design of Reinforced Concrete walls, Design of shear wall, – Strut and tie method of analysis for corbels and deep beams, Design of corbels, deep beams and grid floors.

UNIT –III: FLAT SLABS AND YIELD LINE APPROACH **9 Hrs.**

Design of flat slabs according to IS method - Design of spandrel beams - Yield line analysis and design of square, rectangular, triangular and circular slabs with various boundary conditions. Hillerborg's strip method.

UNIT –IV: INELASTIC BEHAVIOUR OF CONCRETE BEAMS AND COLUMNS **9 Hrs.**

Inelastic behaviour of concrete beams by Baker's method, moment – rotation - curvature characteristics. Limit analysis – Conditions for moment redistribution - Stress-Strain behaviour of confined and unconfined columns.

UNIT –V: DUCTILE DETAILING **9 Hrs.**

Concept of Ductility – Design and detailing of beams, columns for ductility - Design of cast-in-situ joints in frames – Determination of ductility factor for singly and doubly reinforced beams.

Total: 45 hrs.

REFERENCE BOOKS:

1. Gambhir.M. L., "Design of Reinforced Concrete Structures", Prentice Hall of India, 2012.
2. Purushothaman, P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill, 1984
3. Unnikrishna Pillai and Devdas Menon "Reinforced Concrete Design', Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2009.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2005.
5. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, 2007.

P19STR202	Advanced Design of Steel Structures	3 0 0 3

COURSE OUTCOMES

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

CO1. Explain and design the different types of steel connections
CO2. Analysis and design various components of industrial structures.
CO3. Design the steel members subjected to combined forces.
CO4. Design steel chimney subjected to wind loads.
CO5. Evaluate the behaviour and design of light gauge elements.

UNIT-I: DESIGN OF CONNECTIONS **9 Hrs.**

Introduction- Classification of connections. Bolted and Welded connections: Basic concepts- Beam-to-Beam connections. Beam-Column connection: Unstiffened and Stiffened seated Connections-Moment Resistant Connections.

UNIT –II: ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS **9 Hrs.**

Industrial building-Planning-Structural framing-Elements of industrial building- Analysis and design of trusses-Design of Purlins, Gable column and Gable wind girder-Introduction to pre-engineered building. Design and detailing for earthquake and wind loads. Design consideration for durability.

UNIT –III: DESIGN OF COMBAINED FORCES **9 Hrs.**

Design of members subjected to combined forces: Beam-Column-Crane Gantry Girders –Design of simple bases, Gusseted bases and Moment Resisting Base Plates

UNIT –IV: DESIGN OF STEEL CHIMNEY **9 Hrs.**

Introduction to chimneys -Types-Dimensions of steel stacks-Components: Lining- Breech openings and access ladder-Loading and load combinations-Design considerations-Design of self supporting and guyed steel chimney.

UNIT –V: DESIGN OF LIGHT GAUGE STEEL STRUCTURES **9 Hrs.**

Light gauge steel section: Introduction-Applications-Advantages-Behaviour-Forms-Edge and Intermediate stiffener-Stiffened, unstiffened and multiple stiffened element-Flat-width ratio-Effective width for load and deflection determination-Analysis and design of compression and flexural members.

Total: 45 hrs.

REFERENCE BOOKS:

1. Subramanian N, “Design of Steel Structures”, Oxford University Press, New Delhi 2011.
2. Duggal S.K, “Design of Steel Structures”, Tata McGraw-Hill Education, 2009.
3. Shiyekar M.R, “Limit State Design in Structural Steel”, Prentice Hall of India Pvt. Ltd, 2017.
4. Punmia B.C., Comprehensive Design of Steel Structures, Lakshmi Publications, New Delhi, 2000.
5. Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, 2000.
6. Bhavikatti.S.S, “Deign of Steel structures”, I.K. International publishing house, New Delhi, 2009.

P19STR203	Structural Software Application Laboratory	1 0 4 3

COURSE OUTCOMES

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

CO1. Analysis and design of steel roof trusses by softwares

CO2. Analysis and design of Reinforced Concrete frames by softwares

CO3. Analysis of various members by Finite Element Analysis softwares

Contents **45 Hrs.**

1. Analysis and design of 2D and 3D Steel roof trusses for static, wind and seismic forces.
2. Analysis and design of 2D and 3D Reinforced Concrete rigid frames for static, wind and seismic forces.
3. Finite Element modeling, analysis and design of Reinforced Concrete and Steel Elements.

Total: 45 hrs.

References:-

1. Laboratory manuals prepared by Civil Engineering Department, Sona College of Technology, Salem.
2. Unnikrishna Pillai and Devdas Menon "Reinforced Concrete Design', Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2009.
3. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi 2011
4. Prof. S.K. Bhattacharyya and Dr. D. Maity "Finite Element Analysis" NPTEL Web course, IIT Kharagpur.

P19STR204	Mini Project	0 0 4 2

COURSE OUTCOMES

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

CO1. Identify structural engineering problems reviewing available literature.

CO2. Study different techniques used to analyze complex structural systems.

CO3. Work on the solutions given and present solution by using his/her technique applying engineering principles.

Syllabus Contents: **30 Hrs.**

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

Total: 30 hrs.

P19STR501	PREFABRICATED STRUCTURES	3 0 0 3

COURSE OUTCOMES

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

CO1 Explain the principles and concepts of Prefabricated Structures.
CO2 Describe prefabricated elements along with their structural connections.
CO3 Summarize the production techniques of prefabricated elements.
CO4 Elucidate the hoisting techniques adopted in prefabrication construction.
CO5 Discuss the applications of prefabrication in construction field.

UNIT-I: GENERAL PRINCIPLES OF FABRICATION **9 Hrs.**

Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication - Economy of prefabrication – Modular coordination – Standardization– Disuniting of structures –Handling and erection stresses.

UNIT–II: PREFABRICATED ELEMENTS **9 Hrs.**

Roof and floor panels – wall panels – shear walls - columns – Joints for different structural connections – Effective sealing of joints for water proofing – Provisions for non-structural fastenings –Expansion joints in pre-cast construction

UNIT–III: PRODUCTION TECHNOLOGY **9 Hrs.**

Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening.

UNIT–IV: HOISTING TECHNOLOGY **9 Hrs.**

Equipment for hoisting and erection – Elimination of erection stresses – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads – Lifting with external pre-stressing.

UNIT–V: APPLICATIONS **9 Hrs.**

Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames – Single storeyed buildings – slabs, beams and columns - water tanks

Total: 45 hrs.

REFERENCE BOOKS:

1. I. T. Koncz, Manual of Precast Concrete Construction, Vol. I, II, III & IV, Berlin, 1971
2. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York, 1998
3. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009
5.Kims S. Elliot, Precast Concrete Structures, CRC Press, Taylor & Francis, 2017
6. IS15916:2011, Building design and erection using prefabricated concrete. BIS, India, 2011.

P19STR514	Formwork Engineering	3 0 0 3

COURSE OUTCOMES

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

CO1 Describe the materials and behavior of formwork
CO2 Design of foundation, wall and column formwork
CO3 Design the formwork for beam, slab, bridges and special structures
CO4 Design of Flying Formwork slipform techniques
CO5 Design of formwork for supports – Scaffolds and precast concrete

UNIT-I: INTRODUCTION **9 Hrs.**

Introduction-Formwork as a temporary structure-requirements for Formwork-selection of Formwork-Classification of Formwork- Formwork Materials-Timber-Plywood-Steel-Aluminium Form-Plastic Forms-other Material-Form Coating and Mould Linings-Form Anchors-Tie System-Spreaders, Spacers-Form Linings Materials.

UNIT –II: FORMWORK DESIGN CONCEPTS & FOUNDATION FORMWORK **9 Hrs.**

Loads on Formwork-Dead or Permanent Loads-Imposed Loads-Environmental Loads-Design Basis (Assumption Made in Formwork Design)-Estimating Permissible Stress-Maximum Bending Moment, Shear Force, and Deflection-Formwork for Foundation-Conventional Formwork for Foundation-Foundation Formwork (All Steel)-Foundation Formwork Design-Illustration on Foundation Wall Design.

UNIT –III: WALL & COLUMN FORMWORK **9 Hrs.**

Wall Formwork - Conventional Wall Formwork-Proprietary Wall Formwork System - Large Area Wall Forms-Climbing Formwork Wall Formwork - Climbing Formwork - Different types of Climbing formwork – Doka climbing Formwork - Wall Form Design - Illustration of Wall Formwork Design Using Plywood and H-16 Beams - Column Formwork - Conventional Column Formwork - Proprietary Column Formwork - Column Formwork System - Doka form work system - PERI Column Formwork - Disposable Column Formwork - All Metal Column Formwork-Achieving Formwork Economy in Column Construction-Design For Column Formwork-Illustration of Column Formwork Design-Example.

UNIT –IV: SLAB AND BEAM FORMWORK **9 Hrs.**

Traditional Slab and Beam Formwork-Slab and Beam Formwork Solutions offered by L&T - Beam and Slab Formwork Solution by PERI and Mivan - achieving Economy In Slab Construction - Design of Slab and Beam Construction - Illustration of Slab and Beam Formwork Design - Illustration of Proprietary Slab Formworkb-Formwork Arrangement for Caissons - Formwork For Piers And Pier Caps-Bridge Superstructures - Formwork for Bridge Railing / Parapets / Edge Beams - Cases Temporary Support Structures of Bridges.

UNIT –V: FLYING FORMWORK **9 Hrs.**

Some Examples of Flying Formwork - Flying Formwork Cycle - Advantages and Limitation of Flying Formwork -Design Issues In Flying Forms - Safety Issues in Flying Forms - Table Forms - Tunnel Formwork System - Column Mounted Shoring System - Gang Forms – Slipform - Vertical Slipform - Horizontal Slipform -Types of Slipform - Functions of Varies Slipform Components - Assembly, Sliding and Dismantling of Slipform - Slipform Design Issues - Some Cases in Slipform - Safety Operation during Slipform Erection - Productivity Issues in Slipform Construction. Failure of formworks.

Total: 45 hrs.

REFERENCE BOOKS:

1. Kumar Neeraj Jha, "Formwork for concrete structures" Tata Mcgraw Hill Education Private Limited New Delhi – 2012
2. Peurifoy R.L., Oberlender G.D., " Formwork For Concrete Structures", McGraw Hill, New York, 1996

P19GE702 **Stress Management by Yoga**

2 0 0 0

Course Outcomes:

At the end of completion of this course, students will be able to

1. Develop physical and mental health thus improving social health
2. Increase immunity power of the body and prevent diseases
3. Acceleratememory power
4. Achieve the set goal with confidence and determination
5. Improve stability of mind, pleasing personality and work with awakened wisdom

UNIT – I **6**

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do`s and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga- Nadisuthi, Practice and Spinal Sclearance Practice-Regularization of breathing techniques and its effects-Practice and kapalapathy practice.

UNIT – II **6**

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice- Body relaxation practice and its benefits- Raja Yoga- 1.Agna –explanation and practice- Activation of Pituitary- Raja Yoga-2. Santhi Yoga-Practice-Balancing of physical and mental power.

UNIT – III **6**

Raja Yoga-3.Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theory- Kayakalpa – practice-Yogic exercise to improve physical and mental health and practice-Asanas –explanation-Practice-benefits

UNIT –IV **6**

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana,chakrasana, viruchasanaetc-Stress management with Yoga-Role of women and Yoga
Equality, nonviolence, Humanity,Self- control- Food and yoga Aware of self-destructive habits
Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice

UNIT – V **6**

Moralisation of Desire & practice- Punctuality-Love-Kindness-CompassionEradication ofworries-Practice - Personality development, positive thinking-Good characters to lead a moral life
How to clear the polluted mind- Benefits of blessing- Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

Total : 30 hours

Reference Books

1. 'Yogic Asanas for Group Tarining-Part-I" Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Civil Engineering
Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P19STR301	Design of Steel Concrete Composite Structures	3	0	0	3
2	P19STR517	**Elective -** Design of Sub Structures	3	0	0	3
3	P19END601	**Open Elective**- Product Design and Manufacturing	3	0	0	3
Practical						
4	P19STR302	Technical Seminar	0	0	2	1
5	P19STR303	Practical Training	0	0	4	2
6	P19STR304	Project Phase – I	0	0	16	8
					Total Credits	**20**

Approved by

Chairperson, Civil Engineering BOS
Dr.R.Malathy

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Civil, Third Semester ME STR Students and Staff, COE

P19CEM301	Advanced Construction Techniques	L T P C 3 0 0 3

COURSE OUTCOMES

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

CO1To understand the various processes involved in sub-structure construction.
CO2 To understand the various processes involved in super-structure construction.
CO3 To understand the construction techniques carried in bridges, tunneling.
CO4 To understand the construction process of special structures and offshore structures.
CO5 To know about the rehabilitation techniques carried out for a structure.

UNIT-I: SUB STRUCTURE CONSTRUCTION 9 Hrs

Box Jacking: Need – elements – concept – precautions – advantages. Pipe jacking: Technique – factors – applications – advantages. Diaphragm walls – methods – sheet piles – applications – advantages. Piling techniques: Classifications – factors. Well and caisson: Types – sinking method –precautions. Coffer dam: Purpose – types – techniques. Cable anchoring – screw anchor – necessity- applications. Grouting: Need – materials – techniques – applications – guniting and shotcreting. Well points - dewatering – techniques.

UNIT –II: TALL STRUCTURES CONSTRUCTION 9 Hrs

Concrete in tall buildings – types of concrete pumps – factors – blockage – causes - clearing –safety. Slip form techniques: Vertical - chimney – horizontal – concrete paving methods. Suspended form work: Purpose – methods – advantages - erection techniques. Prestressing techniques – insitu prestressing in high rise structures.

UNIT –III: LARGE SPAN STRUCTURES CONSTRUCTION 9 Hrs

Tunneling: Purpose – aspects – shafts – mucking – construction techniques – advantages – trenchless technology. Bow string bridges: Systems – arrangements – advantages. Suspension and cable stayed bridges: Parallel – radial patterns – concept. Domes: Types – structural framing – erection methods. Aerial transportations – components – advantages – applications.

UNIT –IV: SPECIAL STRUCTURE CONSTRUCTION 9 Hrs

Lattice tower: Definition – techniques. Rigging of transmission line structures: Definition –precaution – stages involved. Advanced construction techniques in offshore construction practice: Various operations – under water concrete - vacuum dewatering of concrete flooring. Articulated structure – definition – mechanism.

UNIT –V: REPAIR AND STRENGTHENING TECHNIQUES 9 Hrs

Mud Jacking: Techniques – behavior of slab – advantages. Micro piles: Uses – stages – applications-benefits. Shallow profile pipeline laying –procedure – specifications – sub aqueous pipe lines –laying methods. Sheet piles protection techniques. Water proofing: Need – above and below ground. Under pinning: Need – methods. Demolition and dismantling: Principles – methods – modern demolition techniques – controlled demolition – mechanical method – hydro demolition – advantages – sequence of demolition – beams – columns – walls – general sequence.

Total: 45 hrs.

REFERENCE BOOKS:

1. Sankar, S.K.& Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.
2. Gahlot .P.S & Sanjay Sharma,"Building repair and maintenance management "CBS Publications.2006.
3. Brown.R, "Practical Foundation Engineering Hand Book", Mcgraw Hill Publications, 2005.
4. Patrick Powers .J, "Construction Dewatering: New Methods and Applications" John Wiley & Sons, 2002.

P19CEM517	Quality control and quality assurance in construction	L T P C 3 0 0 3

COURSE OUTCOMES

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

CO1To understand the elements of quality planning and the implication
CO2 To study the various quality policy adopted in construction industries
CO3To become aware of objectives and advantage of quality assurance
CO4To be exposed to means of quality control
CO5To study the relationship between quality and safety management

UNIT-I: QUALITY MANAGEMENT SYSTEMS **9 Hrs**

Types of organizations-Inspection. control and enforcement -Quality Management Systems and method - Responsibilities and authorities In quality assurances and quality Control- Architects, engineers, contractors, and special consultants, Quality circle.

UNIT –II: QUALITY POLICY **9 Hrs**

Quality policy -Objectives and methods In Construction Industry -Consumers satisfaction, Economics- Time of Completion -Statistical tolerance -Taguchi's concept of quality -Codes and Standards - Documents -Contract and construction programming -Inspection procedures -Processes and products - Total QA I QC programme and cost implication.

UNIT –III: QUALITY OBJECTIVES **9 Hrs**

Objectives -Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC -Different aspects of quality - Appraisals, Factors Influencing construction quality.

UNIT –IV: FAILURE ASPECTS **9 Hrs**

Critical, major failure aspects and failure mode analysis -Stability methods and tools, optimum design – Reliability testing- reliability coefficient and reliability prediction - Selection of new materials -Influence of drawings detailing, specification, standardization -Bid preparation- Reliability Based Design.

UNIT –V: CONSTRUCTION ACTIVITY **9 Hrs**

Construction activity, environmental safety. Social and environmental factors- Natural causes and speed of Construction -Life cycle costing- Reliability and Probabilistic methods-Value engineering and value analysis.

Total: 45 hrs.

REFERENCE BOOKS:

1. James, J.O Brian, "Construction Inspection Handbook -Quality Assurance and:Quality Control", Van Nostrand, New York, 2009.
2. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
3. Hutchins.G, ISO 9000, Viva Books. New Delhi 2003.
4. Clarkson H. Oglesby, "Productivity Improvement in Construction", McGraw-Hill, 2009.
5. John L. Ashford, "The Management of Quality in Construction", E & F.N, Spon. New York, 2009.

P19CEM302	Technical Seminar	0 0 2 1

COURSE OUTCOMES

The students will be trained to face an audience and to tackle any problem during group discussion in the Interviews

Syllabus

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to construction engineering and management and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

P19CEM303	Practical Training	0 0 4 2

COURSE OUTCOMES

To train the students in the field work so as to have a firsthand knowledge of practical problems related to Construction Management in carrying out engineering tasks.

To develop skills in facing and solving the problems experiencing in the field.

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

Syllabus

The students individually undertake training in reputed engineering companies doing construction during the summer vacation for a specified duration of four weeks. 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.

Total: 30 hrs.

P19CEM304	Project Phase - I	0 0 16 8

Course Outcomes

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.

Sylaabus

The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical 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.

OPEN ELECTIVE

Civil

P19CEM601	DISASTER MITIGATION AND MANAGEMENT	3 0 0 3

COURSE OUTCOMES

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

- CO1 Identify the types of hazards, vulnerability and micro zonation
- CO2 Explain the causes and effects of disasters
- CO3. Discuss the preparedness and forecasting the disasters
- CO4 Explain various post disaster activities
- CO5 Discuss the disaster management solutions from case studies

Unit 1 INTRODUCTION **9 Hrs.**

.Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: causes and effects – measurements - earthquake zones India – vulnerability and micro zonation;- volcanic hazards

Unit –II CAUSES AND EFFECTS **9 Hrs.**

Landslides : Causes and effects – landslide prone zones in India –Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Tsunami –Soil Erosion-Drought :Characteristics-Occurrence – Preventive measures

Unit –III PREPAREDNESS AND FORECASTING **9 Hrs.**

Emerging approaches in Disaster Management- Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/forecasting& warning- Preparing disaster preparedness plan- Land use zoning- Disaster resistant house construction- Population reduction in vulnerable areas- Awareness

Unit –IV POST DISASTER ACTIVITIES **9 Hrs.**

Emergency Stage - Rescue training for search & operation at national & regional level-Immediate relief-Assessment surveys- Post Disaster stage-Rehabilitation- Political Administrative Aspect- Social Aspect-Economic Aspect- Environmental Aspect- Mitigation - Role of Media - Monitoring Management-Preventive Measures- A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster& Disaster in Hills with particular reference to India -Ecological planning for sustainability & sustainable development in India-Sustainable rural development

Unit –V CASE STUDIES **9 Hrs.**

Soft Solutions for Disaster Management - Case studies - Earthquake, volcano and landslide - Flood prone area analysis and management – risk assessment – cyclones and floods - Drought and desertification

Total: 45 hrs.

Reference Books:

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
3. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi. 4. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Civil Engineering

Branch: Structural Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Practical						
1	P19STR401	Project Phase – II	0	0	28	14
					Total Credits	**14**

Approved by

Chairperson, Civil Engineering BOS
Dr.R.Malathy

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

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HOD/Civil, Fourth Semester ME STR Students and Staff, COE