SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E-Civil Engineering

(Structural Engineering)

CURRICULUM and SYLLABI

[For students admitted in 2022-2023]

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	Total Contact Hours
Theory							
1	P19STR101	Finite Element Analysis	3	1	0	4	60
2	P19STR102	Theory of Elasticity and Plasticity	3	1	0	4	60
3	P19STR510	**Professional Elective:** Advanced Concrete Technology	3	0	0	3	45
4	P19STR525	**Professional Elective:** Internet of Things of Civil Engineering	3	0	0	3	45
5	P19GE101	Research Methodology and IPR	2	0	0	2	30
6	P19GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	30
Practical							
7	P19STR103	Structural Engineering Laboratory	0	0	4	2	60
					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	Total Contact Hours
Theory							
1	P19STR201	Advanced Design of Concrete Structures	3	0	0	3	45
2	P19STR202	Advanced Design of Steel Structures	3	0	0	3	45
3	P19STR505	**Professional Elective:** Aseismic Design of Structures	3	0	0	3	45
4	P19STR517	**Professional Elective:** Design of sub structures	3	0	0	3	45
5	P19GE702	**Audit Course:** Stress Management by Yoga	2	0	0	0	30
Practical							
6	P19STR203	Structural Software Application Laboratory	1	0	4	3	75
7	P19STR204	Mini Project	0	0	4	2	60
					Total Credits	**17**	

Approved by

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

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M.E-CIVIL-STR
III

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	Total Contact Hours
Theory							
1	P19STR301	Design of Steel Concrete Composite Structures	3	0	0	3	45
2	P19STR516	**Professional Elective:** Design of Bridges	3	0	0	3	45
3	P19ISE601	**Open Elective:** Transport Safety	3	0	0	3	45
	P19MIT602	**Open Elective:** Machine Learning					
Practical							
4	P19STR302	Technical Seminar	0	0	2	1	30
5	P19STR303	Practical Training	0	0	4	2	60
6	P19STR304	Project Phase – I	0	0	16	8	240
					Total Credits	**20**	**465**

Approved by

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

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M.E-Civil
STR IV

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	P19STR401	Project Phase – II	0	0	28	14	420
					Total Credits	14	

Approved by

Chairperson, Civil Engineering BOS
Dr.R.Malathy

Member Secretary, Academic Council
Dr.R.Shivakumar 26/12/23

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

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

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	Total Contact Hours
Theory							
1	P19STR101	Finite Element Analysis	3	1	0	4	60
2	P19STR102	Theory of Elasticity and Plasticity	3	1	0	4	60
3	P19STR510	**Professional Elective:** Advanced Concrete Technology	3	0	0	3	45
4	P19STR525	**Professional Elective:** Internet of Things of Civil Engineering	3	0	0	3	45
5	P19GE101	Research Methodology and IPR	2	0	0	2	30
6	P19GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	30
Practical							
7	P19STR103	Structural Engineering Laboratory	0	0	4	2	60
					Total Credits	**18**	

Approved by

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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

COURSE CODE	COURSE NAME	L	T	P	C
P19STR101	FINITE ELEMENT ANALYSIS	3	1	0	4

Course Objective (s): The Purpose of learning this course is to:

- Understand the concepts of strain displacement relation and numerical techniques.
- Solve the problems in calculating shape function and formation displacement and stiffness matrix.
- Evaluate the problems on an iso-parametric element and dynamic Problems using the finite element method.
- Recognize the concept of FEM applications in engineering problems.
- Analyse two-dimensional truss and beam elements and to solve problems on rectangular and triangular elements.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Discuss the displacement models to solve practical problems in Structural engineering. (K3)
CO2	Apply numerical techniques of finite element analysis to solve real time problems. (K3)
CO3	Manipulate the shape function and interpolation function to study structural behaviour. (K4)
CO4	Implement linear and quadratic elements in the finite element analysis of various types of structures. (K2)
CO5	Predict structural behaviour using strain displacement matrix and element stiffness matrix. (K5)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	3	2	-	-	1	-	1	1
CO2	3	3	3	3	2	-	-	1	-	1	1
CO3	3	3	3	3	2	-	-	1	-	1	1
CO4	3	3	3	3	2	-	-	1	-	1	1
CO5	3	3	3	3	2	-	-	1	-	1	1
CO	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**-**	**1**	**1**

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial

UNIT-I	INDRODUCTION	12 Hrs.

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	DISPLACEMENT 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	APLLICATIONS 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 Hours

REFERENCES:

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",
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.

COURSE CODE	COURSE NAME	L	T	P	C
P19STR102	THEORY OF ELASTICITY AND PLASTICITY	3	1	0	4

Course Objective (s): The Purpose of learning this course is to:

- Understand the concepts of stresses, strains and stress-strain relationships, basic theory of elasticity and plasticity
- Expose students to two-dimensional problems in Cartesian coordinates
- Understand the problem formulations and solution techniques
- Familiarize students with the principle of torsion of prismatic bars of non-circular sections.
- Expose the students to elastoplastic problems involving plastic deformation of beams and bars.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Explain the concept of stress and strain and their relationships (k2)
CO2	Analyze the two-dimensional problems in Cartesian and polar coordinates (K4)
CO3	Apply the concept of torsion to Prismatic bars of different sections (k3)
CO4	Solve simple problems of elasticity and plasticity understanding the basic concepts. (k4)
CO5	Apply numerical methods to solve continuum problems. (k5)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	2	2	1	-	2	2	1	1
CO2	3	3	2	2	2	1	-	2	2	1	1
CO3	3	3	3	3	2	1	-	2	3	2	1
CO4	3	3	3	3	2	1	-	2	3	2	1
CO5	3	3	3	3	2	1	-	2	3	3	1
CO	**3**	**3**	**2.6**	**2.6**	**2**	**1**		**2**	**2.6**	**1.8**	**1**

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

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

Displacement, Analysis of stress (two and three dimensions)- Body force, surface force - Uniform state of stress – Principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of strain (two and three dimensions) 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	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 – Beltrami's 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 Hours

REFERENCES:

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.

COURSE CODE	COURSE NAME	L	T	P	C
P19STR103	STRUCTURAL ENGINEERING LABORATORY	0	0	4	2

Course Objective (s): The Purpose of learning this course is to:

- Practice the design of high strength concrete
- Gain the knowledge to conduct various Non-destructive tests
- Practice various engineering principles to understand the behavior of structures

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Design high strength concrete and study the parameters affecting its performance (k4)
CO2	Conduct Non-Destructive tests on existing concrete structures (k5)
CO3	Apply Engineering principles to understand behaviour of structural elements (k5)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	3	3	2	1	2	2	3	1
CO2	3	2	1	3	3	2	1	3	3	3	1
CO3	3	3	1	3	3	2	1	1	1	3	1
CO	**3.0**	**2.3**	**1.0**	**3.0**	**3.0**	**2.0**	**1.0**	**2.0**	**2.0**	**3.0**	**1.0**

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

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**

REFERENCES:

1. Properties of Concrete, Neville A.M, 5th Edition, Prentice Hall, 2013.
2. Concrete Technology, Shetty M.S., S.Chand and Co., 2008.

COURSE CODE	COURSE NAME	L	T	P	C
P19STR510	ADVANCED CONCRETE TECHNOLOGY	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:

- Analyse the characterisation of concrete matrix with influencing factors like strength and behaviour
- Signify the various method of mix proportions
- Evaluate and study of the factors to affecting the durability of concrete
- Apply the special concrete with specified quality and study the limitations
- Evaluate the Concrete properties based on Non destructive methods

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Discuss microstructure concrete and dimensional stability (K4)
CO2	Prepare a mix design for the various concrete grades (K3)
CO3	Enumerate the properties of ingredients considered for durability of concretes (K4)
CO4	Explain the different types of special concrete and their applications in construction (K3)
CO5	Explain different types of non-destructive testing methods (K4)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	2	1	3	1	1	--	1	3	2	2
CO2	1	2	1	3	1	1	--	1	3	2	2
CO3	1	2	1	3	1	1	--	1	3	2	2
CO4	1	2	1	3	1	1	--	1	3	2	2
CO5	1	2	1	3	1	1	--	1	3	2	2
CO	1	2	1	3	1	1	--	1	3	2	2

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	CONCRETE CHARACTERISATION	9 Hours

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 Hours

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 Hours

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 Hours

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 Hours
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: 45Hrs.

REFERENCES:-

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 10262:2019, Concrete Mix Proportioning – Guidelines (Second Revision), Bureau of Indian Standars, New Delhi.2019

COURSE CODE	COURSE NAME	L	T	P	C
P19STR525	Internet of Things of Civil Engineering	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:

1. Understand the basic components in the architecture of IoT.
2. Enable to know the basic concept of WoT.
3. Understand the working principle of the Sensors used in IoT.
4. Acquire the knowledge in Application of IoT in Smart Cities.
5. Understand the role of IoT in Environmental monitoring.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Explain the basic concept and pillars of IoT**(K1)**
CO2	Demonstrate the pillars and the architecture of the webof things**(K2)**
CO3	Apply the suitability of IoT sensors for various applications in Civil Engineering**(K3)**
CO4	Understand the IoT tools for smart city applications**(K4)**
CO5	Monitor the environment using IoT architecture and related concepts**(K5)**

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	3		2	3	2	2	1	2	2	3
CO2	2	2	1	2	3	2	2	2	2	2	3
CO3	1	2	1	2	3	2	2	2	2	2	3
CO4	1	1	1	2	3	2	2	2	2	2	3
CO5	1	1	1	2	3	2	2	2	2	2	3
CO	**1**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	**INTRODUCTION**	**10 Hours**

Definition and functional Requirements-Motivation-Architecture-Web3.0 View of IoT-Ubiquitous IoTapplictions-Four pillars of IoT-DNA of IoT-The Toolkit approach for End-user participation in the Internet of Things .Middleware for IoT: Overview-Communication middleware for IoT-IoT Information Security

UNIT-II	**WEB OF THINGS**	**10 Hours**

Web of things versus Internet of things-Two pillars of the web-Architecture Standardization for WoT--Unified Multitier WoTArchitecture.Cloud of Things:Grid/SOA and cloud computing –Mobile Cloud computing-The cloud of things.

UNIT-III	**IOT SENSORS**	**9 Hours**

Introduction –Detectable phenomena-conversion methods-commonly measured quantiuties-Physiocal Principles-Selection of sensor-Need for sensor –role of sensor. Types of sensor: Requirements, Advantages, disadvantages and application-Pressures sensor-Temperature sensor-Humidity sensor-chemical sensor-Accelerometer and gyroscope

UNIT-IV	**SMART CITY APPLICATION**	**8 Hours**

Smart transportation –Intelligent parking-Autonomous Vehicle network. Smart buildings –Energy aware-inter building Navigation. Environmental sensing-Sustainable cities-City insights. Health monitoring of structures-Case studies

UNIT-V	**ENVIRONMENTAL MONITORING**	**8 Hours**

Water management –Process –application.Airpollution-Methods-advantages.Water monitoring-quality standards.Indication of calamities-alert systems-applications.Smart irrigation-case study.Micro climate monitoring.

TOTAL: 45 Hours

REFERENCES:	
1.	The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012
2.	Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) – Springer – 2011
3.	The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012
4.	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

CIVIL ENGINEERING

M. E. / STRUCTURAL ENGINEERING

SEMESTER – I	NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	C
P19STR506		2	1	0	3

COURSE OUTCOMES

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

1. find the numerical solution of algebraic and transcendental equations.
2. solve the linear system of equations by direct and indirect methods.
3. find the interpolation and polynomial approximation for the given data.
4. find the numerical solution of ordinary differential equations.
5. find the numerical solution of partial differential equations by finite difference method.

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11
CO1	3	3	3	3	3		2				
CO2	3	3	3	3	3		2				
CO3	3	3	3	3	3		2				
CO4	3	3	3	3	3		2				
CO5	3	3	3	3	3		2				

UNIT – I ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **9**

Bisection method – Regula-Falsi method – Fixed point iteration method – Newton Raphson method.

UNIT – II LINEAR SYSTEM OF EQUATIONS AND EIGEN VALUE PROBLEMS **9**

Gauss elimination method – Gauss-Jordan method – Gauss-Jacobi method – Gauss-Seidel method – Eigen values of a matrix by Power method.

UNIT – III INTERPOLATION AND APPROXIMATION **9**

Newton's forward and backward difference formulae – Newton's divided difference interpolation – Lagrange's interpolation – inverse Lagrange's interpolation.

UNIT – IV ORDINARY DIFFERENTIAL EQUATIONS 9

Solution of first and second order ordinary differential equations – Taylor series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method.

UNIT – V PARTIAL DIFFERENTIAL EQUATIONS 9

Classification of linear second order partial differential equations – Solution of parabolic partial differential equations by Bender – Schmidt explicit and Crank-Nicolson implicit methods – Solution of hyperbolic partial differential equations by explicit method – Solution of two dimensional Laplace's and Poisson's partial differential equations on rectangular domain.

Theory: **30 Hours** Tutorial: **15 Hours** Total: **45 Hours**

TEXT BOOK:

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall India Publishers, 5th Edition, 2012.

REFERENCE BOOKS:

1. K. E. Atkinson, "An Introduction to Numerical Analysis", Wiley Publishers, 2nd Edition, 1989.
2. F. Scheid, "Theory and Problems of Numerical Analysis", Mc Graw Hill Publishers, 2nd Edition, 1988.
3. S. R. K. Iyengar, R. K. Jain and M. K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th Edition, 2012.
4. R. L. Burden and J. D. Faires, "Numerical Analysis", Cengage Publishers, 9th Edition, 2012.

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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

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO12	PSO1	PSO2
CO1	3	3	3	3	2						3	3	3
CO2	3	3	3	3	2						3	3	3
CO3	3	3	3	3	2						3	3	3
CO4	3	3	3	3	2						3	3	3
CO5	3	3	3	3	2			3			3	3	3

UNIT I 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 II 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 III 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 IV 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.

16-09-2022

Dr. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM-636 005

UNIT V 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

16-09-2022

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SONA COLLEGE OF TECHNOLOGY
SALEM-636 005

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. Highman N , 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)

REFERENCES

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

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

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	Total Contact Hours
Theory							
1	P19STR201	Advanced Design of Concrete Structures	3	0	0	3	45
2	P19STR202	Advanced Design of Steel Structures	3	0	0	3	45
3	P19STR505	**Professional Elective:** Aseismic Design of Structures	3	0	0	3	45
4	P19STR517	**Professional Elective:** Design of sub structures	3	0	0	3	45
5	P19GE702	**Audit Course:** Stress Management by Yoga	2	0	0	0	30
Practical							
6	P19STR203	Structural Software Application Laboratory	1	0	4	3	75
7	P19STR204	Mini Project	0	0	4	2	60
					Total Credits	**17**	

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, Second Semester ME STR Students and Staff, COE

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: 75 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: 60 hrs.

P19STR505	Aseismic Design of Structures	3 0 0 3

COURSE OUTCOMES

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

CO1 Identify the causes and effects of earthquake and describe the terms related to earthquake.

CO2 Define the basic concepts of elements of vibration and behavior of structures under cyclic loading.

CO3 Practice the codal provisions for design and detailing of earthquake resistant structures.

CO4 Formulate the design principles for Non-engineered buildings and design provisions for bridges and dams.

CO5 Categorize the new concepts on different types of base isolation techniques.

UNIT- I: ELEMENTS OF SEISMOLOGY **9**

Elements of Engineering Seismology, Characteristics of Earthquakes, History, Seismic Susceptibility of Indian Subcontinent, Performance of structures during past earthquakes, Lessons learnt from past earthquakes.

UNIT – II: THEORY OF VIBRATIONS **9**

Theory of vibrations ,Building Systems , Rigid Frames, Braced Frames, Shear Walls, Behavior of RC, Steel and Prestressed concrete elements under cyclic loading ,Soil liquefaction and prevention methods

UNIT – III: CODAL PROVISIONS FOR DESIGN & DETAILING **9**

Concept of Earthquake Resistant Design, Response Spectrum ,Design Spectrum Provisions of Seismic Code IS 1893 (Part I) – 2002 ,Structural Configuration , 3 D computer analysis of building (Theory) ,Design and Detailing of Frames, Shear Walls and Framed Walls ,Provisions of IS-13920.

UNIT – IV: NON ENGINEERED BUILDINGS **9**

Design of Non Engineered construction, strengthening of buildings, Design Provisions for Bridges and Dams.

UNIT – V: BASE ISOLATION TECHNIQUES **9**

Modern Concepts –Base Isolation, Adoptive systems and Case studies.

Total: 45 hrs.

REFERENCE BOOKS:

1. Shashikant K.Duggal, Earthquake resistant design of structures, Oxford higher education, 2016
2. Pankaj Agarwal & Manish Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning Pvt Ltd, New Delhi, 2008.
3. Damodarasamy S.R,"Basics of Structural Dynamics and Aseismic Design", PHI Learning Pvt Ltd, New Delhi, 2009.
4. Anil K Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2001.
5. Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition,1993.
6. IS 1896:2016 Criteria for Earthquake Resistant Design of Structures, BIS, NewDelhi.
7. IS 13920:2016 Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice, BIS, NewDelhi.

P19STR517	Design of Substructures	3 0 0 3

COURSE OUTCOMES

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

CO1. Describe the basic requirements of foundations and design the shallow foundations
CO2. Design of pile foundations
CO3. Design of well foundations
CO4. Design of machine foundations
CO5. Design of foundations on expansive soil

UNIT-I: SHALLOW FOUNDATIONS **9 Hrs.**

Soil investigation – Basic requirements of foundation – Types and selection of foundations. Bearing capacity of soil - plate load test – Design of reinforced concrete isolated, strip, combined and strap footings – mat foundation.

UNIT –II: PILE FOUNDATIONS **9 Hrs.**

Introduction – Types of pile foundations – load carrying capacity - pile load test – structural design of straight piles –configuration of piles- different shapes of piles cap – structural design of pile cap.

UNIT –III: WELL FOUNDATIONS **9 Hrs.**

Types of well foundation – Grip length – load carrying capacity – construction of wells – Failures and Remedies – Design of well foundation – Lateral stability.

UNIT –IV: MACHINE FOUNDATIONS **9 Hrs.**

Introduction – Types of machine foundation – Basic principles of design of machine foundation – Dynamic properties of soil – vibration analysis of machine foundation – Design of foundation for Reciprocating machines and Impact machines – Reinforcement and construction details – vibration isolation.

UNIT –V: SPECIAL FOUNDATIONS **9 Hrs.**

Foundation on expansive soils – choice of foundation – under-reamed pile foundation. Foundation for concrete Towers, chimneys – Design of anchors- Reinforced earth retailing walls.

Total: 45 hrs.

REFERENCE BOOKS:

1. Bowles .J.E., "Foundation Analysis and Design", McGraw Hill Publishing co., New York, 1997.
2. Swamy Saran, Analysis and Design of substructures, Oxford and IBH Publishing Co. Pvt. Ltd., 2006.
3. Tomlinson.M.J, "Foundation Design and Construction", Longman, Sixth Edition, New Delhi, 1995.
4. Varghese.P.C, "Design of Reinforced Concrete Foundations" – PHI learning private limited, New Delhi – 2009.

P19GE702 **Stress Management by Yoga**

2000

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. Accelerate memory 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- Nadi suthi, 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, viruchasana etc-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-Compassion Eradication of worries-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.

Reference Books

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

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

M.E-CIVIL-STR
III

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	Total Contact Hours
Theory							
1	P19STR301	Design of Steel Concrete Composite Structures	3	0	0	3	45
2	P19STR516	**Professional Elective:** Design of Bridges	3	0	0	3	45
3	P19ISE601	**Open Elective:** Transport Safety	3	0	0	3	45
	P19MIT602	**Open Elective:** Machine Learning					
Practical							
4	P19STR302	Technical Seminar	0	0	2	1	30
5	P19STR303	Practical Training	0	0	4	2	60
6	P19STR304	Project Phase – I	0	0	16	8	240
					Total Credits	**20**	**465**

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

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005.
DEPARTMENT OF CIVIL ENGINEERING
M.E STRUCTURAL ENGINEERING (Full Time)
CURRICULUM for REGULATION R2019

SEMESTER – III						
S.No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**
1	P19STR301	Design of Steel Concrete Composite Structures	3	0	0	3
2	P19STR516	**Professional Elective:** Design of Bridges	3	0	0	3
3		***Open Elective*:**	3	0	0	3
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

COURSE CODE	COURSE NAME	L	T	P	C
P19STR301	Design of Steel-Concrete Composite Structures	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:

- Understand the steel - concrete composite construction and Construction issues in design.
- Design of various composite member
- Design of various connectors
- Understand the design concepts and behaviour of box girder bridges
- Understand the various behaviour of steel - concrete composite structures through case studies

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Understand the steel-concrete composite actions (K1)
CO2	Design of composite members (K3)
CO3	Design of connections in composite structures (K3)
CO4	Behaviour of box girder bridges (K4)
CO5	Seismic behaviour of composite structures (K5)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	3	2	1	2	2	2	2
CO2	3	3	3	3	3	2	1	2	2	2	2
CO3	3	3	3	3	3	2	1	2	2	2	2
CO4	3	3	3	3	3	2	1	2	2	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2
CO (Avg)	3	3	3	3	3	2	1	2	2	2	2

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	INTRODUCTION	9 Hrs.

Introduction to steel - concrete composite construction – Codes – Composite action – Serviceability and Construction issues in design.

UNIT-II	DESIGN OF COMPOSITE MEMBERS	9 Hrs.

Design of composite beams, slabs, columns, beam – columns - Design of composite trusses.

UNIT-III	DESIGN OF CONNECTIONS	9 Hrs.

Shear connectors – Types – Design of connections in composite structures – Design of shear connectors – Partial shear interaction.

UNIT-IV	COMPOSITE BOX GIRDER BRIDGES	9 Hrs.

Introduction - behaviour of box girder bridges - design concepts

UNIT-V	CASE STUDIES	9 Hrs.

Case studies on steel - concrete composite construction in buildings - seismic behaviour of composite structures.

TOTAL: 45 Hours

REFERENCES:

1.	Johnson R.P., "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol.I, Blackwell Scientific Publications, 2004.
2.	Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Pergamon press, Oxford, 1995.
3.	Owens.G.W and Knowles.P, "Steel Designers Manual", Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 1992.

Sona College of Technology APPROVED Board of Studies Civil Engineering Chairperson

COURSE CODE	COURSE NAME	L T P C
P19STR516	Design of Bridges	3 0 0 3

Course Objective (s): The Purpose of learning this course is to:

- Knowing the loading standards of various types of bridges
- Practice with design principles of long span RC Bridges
- Familiarize the Pre-stressed concrete bridge designs
- Understand the dynamic effects of steel bridges
- Recognize the design concept of bearings and foundation of bridges

COURSE OUTCOMES

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

CO1. Discuss about types, loading condition of bridges. Analysis and design of short span RC bridges
CO2. Design of long span RC bridges
CO3. Design of Pre-stressed concrete bridges
CO4. Design of steel bridges
CO5. Design of bearings and foundations

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO-PO Mapping:-

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	2	1	2	1	1	2	2
CO2	2	2	3	2	2	1	1	1	2	1	1
CO3	2	2	3	2	2	2	2	1	2	1	1
CO4	2	2	2	2	2	1	1	1	2	2	1
CO5	2	2	2	2	2	1	2	1	2	1	1
CO (Avg)	2.2	1.8	2.4	2	2	1.2	1.6	1	1.2	1.6	1.2

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I: GENERAL INTRODUCTION AND SHORT SPAN RC BRIDGES **9 Hrs.**

Types of bridges and loading standards - Choice of type - I.R.C. specifications for road bridges – Design of RCC solid slab bridges - analysis and design of slab culverts, Tee beam and slab bridges.

UNIT –II: LONG SPAN RC BRIDGES **9 Hrs.**

Design principles of continuous girder bridges, box girder bridges, and balanced cantilever bridges – Arch bridges – Box culverts – Segmental bridges.

UNIT –III: PRESTRESSED CONCRETE BRIDGES **9 Hrs.**

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT –IV: STEEL BRIDGES **9 Hrs.**

General – Railway loadings – dynamic effect – Railway culvert with steel beams – Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

UNIT –V: BEARINGS AND SUBSTRUCTURES **9 Hrs.**

Different types of bearings – Design of bearings – Design of piers and abutments of different types – Types of bridge foundations – Design of foundations.

Total: 45 hrs.

REFERENCE BOOKS:

1. Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2017.
2. Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 2017.
3. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008.
4. Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.

Sona College of Technology
APPROVED
Board of Studies
Civil Engineering
Chairperson
Autonomous

COURSE CODE	COURSE NAME	L	T	P	C
P19STR302	Technical Seminar	0	0	2	1

Course Objective (s): The Purpose of learning this course is to:

- Improve the presentation skill and answer the questions in a brief manner within the stipulated time

Course Outcome (s) (COs): At the end of this course, the students will be able to:

- Know the way of presentation about their understanding/concepts in a clear manner (K2)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO	3	3	3	3	3	3	1	2	2	3	2

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

TOTAL: 30 Hours

The students will work for two hours per week guided by a group of staff members. They will be asked to give a presentation on any topic of their choice related to Structural Engineering and to engage in discussion with the audience. A brief copy of their presentation 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 defend their presentation. Evaluation will be based on the technical presentation and the report and also on the interaction shown during the seminar.

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COURSE CODE	COURSE NAME	L	T	P	C
P19STR303	Practical Training	0	0	4	2

Course Objective (s): The Purpose of learning this course is to:

- Trained in tackling a practical field/industry-orientated problem related to Structural Engineering.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

- Develop skills in facing and solving the field problems (K5)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO	3	3	3	3	3	3	1	2	2	3	2

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

TOTAL: 60 Hours

The students individually undertake training in reputed Industries during the summer vacation for a specified period of four weeks. At the end of the 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.

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COURSE CODE	COURSE NAME	L	T	P	C
P19STR304	Project Phase – I	0	0	16	8

Course Objective (s): The Purpose of learning this course is to:

- Express his/her findings in the project in sequenced manner and defend their ideas

Course Outcome (s) (COs): At the end of this course, the students will be able to:

- 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.

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO	3	3	3	3	3	3	1	2	2	3	2

Correlation Level: 1: Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

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

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Course Code : P19ISE601

Course Name : TRANSPORT SAFETY

Lecture	-	3 Hrs/Week	Internal Marks	50
Tutorial	-	0 Hrs/Week	External Marks	50
Practical	-		Credits	3

Pre-requisites subject: Nil

Upon completion of this course the students will be able to

Course Outcomes

C01 explain the dangers of transporting hazardous goods and the safe procedures to be followed during transit.

C02 Determine the main factors contribute to the safety in road transport and implement appropriate measures to prevent accidents.

C03 know the methods of selecting and training drivers and teach them the safe procedures to be followed.

C04 Analyze the construction features of road and rails which contribute the accidents and design appropriate traffic management.

C05 implement the methods of keeping repair shop and off road vehicle safe and the wafer ways of servicing the vehicles.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)

COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	-	-	-	1	3	3	3	2	2	3	3	2	2
CO – 2	3	2	2	1	3	3	3	3	2	2	-	2	2	3
CO – 3	2	3	2	3	3	3	3	3	3	3	3	2	2	3
CO – 4	2	1	3	3	3	3	2	3	1	2	-	2	3	3
CO - 5	1	3	3	3	-	3	-	3	3	3	2	3	2	2

UNIT I TRANSPORTATION OF HAZARDOUS GOODS **L 9 T 0**

Transport emergency card (TREM) – driver training-parking of tankers on the highways-speed of the vehicle – warning symbols – design of the tanker lorries -static electricity-responsibilities of driver – inspection and maintenance of vehicles-check list- loading and decanting procedures – communication.

UNIT II ROAD TRANSPORT **L 9 T 0**

Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance check lists-motor vehicles act – motor vehicle insurance and surveys – modern sensor devices.

UNIT III DRIVER AND SAFETY **L 9 T 0**

Driver safety programme – selection of drivers – driver training-tacho-graph-driving test-driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act- driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes

UNIT IV ROAD SAFETY **L 9 T 0**

Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.- factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds-Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver. Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.

UNIT V SHOP FLOOR AND REPAIR SHOP SAFETY **L 9 T 0**

Transport precautions-safety on manual, mechanical handling equipment operations-safe driving movement of cranes-conveyors etc., servicing and maintenance equipment-grease rack operation wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment.

TOTAL NUMBER OF PERIODS= 45

Content beyond syllabus

- Aviation safety
- Maritime safety
- Railway safety
- Traffic management
- Safety management systems

Learning Resources

TEXT BOOKS:

1. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.
2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.

REFERENCES

1. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
2. Motor Vehicles Act, 1988, Government of India.
3. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
5. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"

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P19MIT602 **MACHINE LEARNING** **3 0 0 3**

PREAMBLE

Machine learning is a rapidly evolving field of study that focuses on developing algorithms and models capable of learning from data and making predictions or decisions without being explicitly programmed. The power of machine learning lies in its ability to uncover patterns, relationships, and insights from large and complex datasets. By analyzing and extracting valuable information from data, machine learning algorithms can make predictions, classify data, detect anomalies, recommend actions, and automate decision-making processes.

Machine learning is an exciting and rapidly expanding field that leverages the power of data and algorithms to make predictions and automate decision-making. Python's versatility and rich ecosystem of libraries make it an ideal language for developing and deploying machine learning models. By mastering machine learning techniques, you can unlock the potential of data and contribute to advancements in various industries.

COURSE OUTCOMES

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

1. Explain the concepts of different types of learning and apply linear regression
2. Summarize the concepts of logistic regression and implement the same with python
3. Explain and apply the concepts of Neural networks and support vector machines
4. Evaluate the hypothesis based on factors like bias and variance
5. Explain the concepts of clustering, dimensionality reduction and anomaly detection.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1				1	1		1	2	2
CO2	3	3	3	3	3				1	1		1	2	2
CO3	3	3	3	3	3				1	1		1	2	2
CO4	3	3	3	1	1				1	1		1	2	2
CO5	3	3	1	1	1				1	1		1	2	2

UNIT I INTRODUCTION AND LINEAR REGRESSION 9

Introduction to Artificial Intelligence - What is machine learning? – Supervised Learning – unsupervised learning – Linear Regression – cost function – gradient descent algorithm – normal equation - Gradient descent for multiple variables – feature scaling – learning rate – polynomial regression – normal equation

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UNIT II LOGISTIC REGRESSION 9

Hypothesis representation – decision boundary – nonlinear decision boundaries – cost function – gradient descent – advanced optimizations – multi class classification problems – **Regularization** - Problem of overfitting – cost function optimization for regularization – regularized linear regression – regularization with normal equation - regularized logistic regression

UNIT III NEURAL NETWORKS AND SUPPORT VECTOR MACHINES 9

Overview and summary – neurons and brain – model representation – artificial neural networks representation – example – multiclass classification – cost function – back propagation algorithm – gradient checking – random initialization – Support vector machines – optimization objective – cost function – large margin intuition – decision boundary – kernels – adapting to nonlinear classifiers - implementation

UNIT IV ADVICE FOR APPLYING MACHINE LEARNING 9

Debugging a learning algorithm – evaluating a hypothesis – model selection and training, validation test sets – bias Vs variance – regularization and bias/variance – learning curves machine learning system design

UNIT V OTHER TOPICS 9

Unsupervised learning – k-means algorithm – optimization objective – choosing number of clusters - Dimensionality reduction – principle component analysis - Anomaly detection – algorithm – developing and evaluating the algorithm – anomaly detection Vs supervised algorithm -Case study – recommender system – collaborative filtering - Large scale machine learning – online learning – map reduce and parallelism.

Total: 45 hours

REFERENCES

1. Stanford's machine learning course presented by Professor Andrew Ng – online resource - http://www.holehouse.org/mlclass/
2. James, G., Witten, D., Hastie, T., Tibshirani, R, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
3. Tom M. Mitchell, "Machine Learning", 1st edition, McGraw Hill Education, 2017.
4. Ethem Alpaydın, "Introduction to Machine Learning", The MIT Press, 2nd edition, 2013.
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
6. Sebastianraschka, "Python Machine Learning", Packt Publishing Ltd., 2017.

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M.E-Civil
STR IV

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	P19STR401	Project Phase – II	0	0	28	14	420
					Total Credits	14	

Approved by

Chairperson, Civil Engineering BOS
Dr.R.Malathy

Member Secretary, Academic Council
Dr.R.Shivakumar 26/12/23

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

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