SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E- Structural Engineering

(Dept of Civil Engineering)

CURRICULUM and SYLLABI

[For students admitted in 2025-2026]

PG Regulations 2023

Approved by BOS and Academic Council meetings

ME-STR I

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)
Branch: Structural Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23MAT101C	Numerical Methods for Structural Engineering	2	1	0	0	3	FC	45	TT
2.	P23STR101	Theory of Elasticity and Plasticity	3	0	0	0	3	PC	45	T
3.	P23STR102	Experimental Techniques and Instrumentation	3	0	2	0	4	PC	75	TL
4.	P23CEM501	**Elective:** Advanced Concrete Technology	3	0	0	0	3	PE	45	T
5.	P23STR519	**Elective:** Internet of Things for Civil Engineers	3	0	0	0	3	PE	45	T
6.	P23GE101	Research Methodology and IPR	3	0	0	0	3	PC	45	T
7.	P23GE701	English for Research Paper Writing	2	0	0	0	0	AC	30	T
Practical courses										
8.	P23STR103	Advanced Construction Engineering Laboratory	0	0	4	0	2	PC	60	L
							Total Credits		21	

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P-project.

Approved By

Chairperson – Civil BoS	**Member Secretary/ Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
Dr.R.Malathy	**Dr.R.Shivakumar**	**Dr.J.Akilandeswari**	**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 M.E/M.Tech. Semester II under Regulations 2023 (CBCS)

Branch: Structural Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
		Theory courses								
1.	P23STR201	Finite Element Analysis	3	0	0	0	3	PC	45	T
2.	P23STR202	Advanced Design of Concrete Structures	3	0	0	2	4	PC	75	TP
3.	P23STR203	Advanced Design of Steel Structures	3	0	0	0	3	PC	45	T
4.	P23STR504	**Elective**: Design of Bridges	3	0	0	0	3	PE	45	T
5.	P23STR509	**Elective**: Prefabricated Structures	3	0	0	0	3	PE	45	T
6.	P23GE702	**Audit Course**: Stress Management by Yoga	2	0	0	0	0	AC	30	T
		Practical courses								
7.	P23STR204	Structural Design Studio Laboratory	0	0	4	0	2	PC	60	L
8.	P23STR205	Technical Seminar	0	0	2	0	1	PC	30	L
		Total Credits					**19**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P-Project

Approved By

Chairperson – Civil Engineering, BoS	**Member Secretary, Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
Dr.R.Malathy	**Dr.R.Shivakumar**	**Dr.J.Akilandeswari**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Civil, Second Semester STR Students and Staff, COE

ME-STR I

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)
Branch: Structural Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23MAT101C	Numerical Methods for Structural Engineering	2	1	0	0	3	FC	45	TT
2.	P23STR101	Theory of Elasticity and Plasticity	3	0	0	0	3	PC	45	T
3.	P23STR102	Experimental Techniques and Instrumentation	3	0	2	0	4	PC	75	TL
4.	P23CEM501	**Elective:** Advanced Concrete Technology	3	0	0	0	3	PE	45	T
5.	P23STR519	**Elective:** Internet of Things for Civil Engineers	3	0	0	0	3	PE	45	T
6.	P23GE101	Research Methodology and IPR	3	0	0	0	3	PC	45	T
7.	P23GE701	English for Research Paper Writing	2	0	0	0	0	AC	30	T
Practical courses										
8.	P23STR103	Advanced Construction Engineering Laboratory	0	0	4	0	2	PC	60	L
							Total Credits			
							21			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P-project.

Approved By

Chairperson – Civil BoS	**Member Secretary/ Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
Dr.R.Malathy	**Dr.R.Shivakumar**	**Dr.J.Akilandeswari**	**Dr.S.R.R.Senthil Kumar**

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

CIVIL ENGINEERING						
M. E. / STRUCTURAL ENGINEERING						
SEMESTER - I	NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	J	C
P23MAT101C		2	1	0	0	3

Course Outcomes

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

CO1:	find the numerical solution of algebraic and transcendental equations.
CO2:	solve the linear system of equations by direct and indirect methods.
CO3:	find the interpolation and polynomial approximation for the given data.
CO4:	find the numerical solution of ordinary differential equations.
CO5:	find the numerical solution of partial differential equations by finite difference method.

Pre-requisites:

- Basics of elementary algebra
- Basics of calculus
- Basics of numerical methods
- Basics of differential equations

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

Course assessment methods [Theory]

Direct		Indirect
CIE test I (10) (Theory) CIE test II (10) (Theory) CIE test III (10) (Theory) Assignment / Problem-solving / Seminar (10)	Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01	**ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**	**9 Hours**

Bisection method – Regular Falsi method – Fixed point iteration method – Newton Raphson method.

Unit 02	**LINEAR SYSTEM OF EQUATIONS AND EIGEN VALUE PROBLEMS**	**9 Hours**

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

Unit 03	**INTERPOLATION AND APPROXIMATION**	**9 Hours**

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

Unit 04	ORDINARY DIFFERENTIAL EQUATIONS	9 Hours
Solution of first order ordinary differential equations – Taylor series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method.		
Unit 05	**PARTIAL DIFFERENTIAL EQUATIONS**	**9 Hours**
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 two dimensional Laplace's and Poisson's partial differential equations on rectangular domain.		

Theory: 30 Hrs	Tutorial: - 15 Hrs	Practical:	Project:–	Total Hours: 45 Hrs

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.

M.E/M. TECH REGULATIONS 2023	HEAD OF THE DEPARTMENT OF MATHEMATICS
S&H BoS DATE:08-07-2023	

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P23STR101	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

At the end of the 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 coordinates
CO3	Solve two dimensional problems in Polar coordinates
CO4	Apply the concept of torsion to Prismatic bars of different sections
CO5	Solve problems with elasto-plastic properties

Pre-requisite:- Nil

CO-PO Mapping

(3/2/1 indicates the strength of the correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	3	3	3	3
CO3	3	2	3	3	2
CO4	3	2	2	3	2
CO5	3	3	2	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10) Assignment / Problem solving / Seminar (10)	Total CIE: **40 marks** Semester End Examination: **60 marks**	Course end survey

UNIT-I: ANALYSIS OF STRESS AND STRAIN IN CARTESIAN COORDINATES — **9 Hours**

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 — **9 Hours**

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 — **9 Hours**

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 — **9 Hours**

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: PLASTICITY				**9 Hours**
Physical Assumptions – Yield Criteria – Failure Theories –Thick Cylinder – Plastic Stress Strain Relationship - Bending and Torsion in Elasto-Plastic Materials -Strain hardening Materials				
Theory: 45 Hrs.	**Tutorial: –**	**Practical: –**	**Project: –**	**Total Hours: 45 Hrs.**

REFERENCE BOOKS:

1.	Sadhu Singh, Theory of Plasticity, Khanna Publishers, New Delhi, 2008.
2.	S. Timoshenko and J. N. Goodier, Theory of Elasticity, Mc Graw Hill Book Co., Newyork . 2017.
3.	RagabA.R., Bayoumi S.E., Engineering Solid Mechanics, CRC Press, New York, 2007
4.	Chandramouli, Theory of Elasticity, Mc Graw Hill, Publishers, New York, 2007.
5.	Advanced Mechanics of Solids, Srinath L.S, Tata McGraw Hill, New Delhi, 2009.

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P23STR102	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L	T	P	J	C
		3	0	2	0	4

COURSE OUTCOMES

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

CO1	Demonstrate strain measuring equipments.
CO2	Discuss various vibration measuring equipments.
CO3	Choose various data indicating and recording instrument
CO4	Outline the concept of photoelasicity
CO5	Apply suitable non-destructive testing methods

Pre-requisite:- Nil

CO-PO Mapping

(3/2/1 indicates the strength of the correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	2	3	3	2
CO3	3	2	3	3	2
CO4	3	2	3	3	2
CO5	3	2	2	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10) - Theory CIE test II (10) - Theory CIE test III (10) - Theory CIE test IV (10) - Laboratory Assignment/Quiz/Seminar/mini project (10)	Total CIE: **50 marks** Semester End Examination: **50 marks** **[SEE: Theory (35 marks), Lab (15 marks)]**	Course end survey

UNIT-I: FORCE AND STRAIN MEASUREMENTS — **9 Hours**

Basic Concept – Measurements of displacement, strain pressure, force, torque etc, Strain gauges (Mechanical, Electrical, Acoustical etc) – Strain gauge circuits - Potentiometer and wheat stone bridge – Rosette analysis. Hydraulic Jack, Load cell, and Proving Ring.

UNIT –II: VIBRATION MEASUREMENTS — **9 Hours**

Liner Variable Differential Transducers (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs.

UNIT –III: DATA ACQUISITION SYSTEMS — **9 Hours**

Indicating and recording devices - Static and dynamic data recording –Data acquisition and processing systems – Cathode Ray Oscilloscope – XY Plotter – Chart plotters – Digital data acquisition systems.

UNIT –IV: PHOTO ELASTICITY — **9 Hours**

Photo elasticity – Optics of photoelasticity, modal analysis – Polariscope: Circular and plane polariscope – Isoclinics and Isochromatics - Methods of stress separation

UNIT –V: NON-DESTRUCTIVE TESTING METHODS — **9 Hours**

Ultrasonic testing principles and application – Rebound Hammer – Holography – Use of laser for structural

testing – Advanced NDT methods – Ultrasonic pulse echo, impact echo, impulse radar techniques, GECOR, Ground penetrating radar (GPR).

Total Theory Hours = 45 Hours.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of a metallic bar by Strain gauge meter, Determination of Rigidity modulus of a metallic wire by Strain gauge meter
2. Determination of Ultrasonic velocity in liquids by Ultrasonic Interferometer
3. Model study on continuous beam with influence line
4. Determination of metal thickness – Fringes approach, Resistivity measurements
5. Calibration of Proving Ring and LVDT

Total Practical Hours = 30 Hours.

Theory: 45 Hrs.	Tutorial: –	Practical: 30 Hrs.	Project: –	Total Hours: 75 Hrs.

REFERENCE BOOKS:

1.	Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi,2009
2.	Ganesan, T.P, "Modal Analysis of Structures:, University Press, 2000.
3.	Rangan C S., "Instrumentation – Devices and Systems", Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2007
4.	Dally J W and Riley W.F, "Experimental stress Analysis", McGraw-Hill, Inc. NewYork, 2007
5.	Charles J Hellier, Handbook of Non destructive Evaluation, Second Edition, Mc graw Hill Education, 2013.

P23CEM 501	ADVANCED CONCRETE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

At the end of the 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.

Pre-requisite:- Concrete Technology

CO-PO Mapping

(3/2/1 indicates the strength of the correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	2	1
CO2	2	2	2	2	2
CO3	3	2	3	3	1
CO4	3	2	3	2	2
CO5	2	2	2	2	2

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10) Assignment / Problem solving / Seminar (10)	Total CIE: **40 marks** Semester End Examination: **60 marks**	Course end survey

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 – maturity of Concret

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

Significance and objectives, general considerations, procedures, Methods of concrete mix design IS & ACI Method, design of high strength concrete, High performance concrete, and Self Compacting Concrete using relevant codes. Testing and control of concrete quality: Methods and significance, accelerated strength testing, core tests and quality control charts – sampling and acceptance criteria.

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

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**

Self-compacted concrete-Self curing concrete-shrinkage compensation concrete, pervious concrete-concrete containing polymers-Geopolymer concrete-heavy weight concrete for radiation shielding-high performance

concrete, high strength concrete, shotcrete, fibre reinforced concrete - Roller compacted concrete - bacterial concrete-Mass concrete – 3D Printing Concrete– their materials, mix proportions, properties, applications and limitations.				
UNIT –V: NON-DESTRUCTIVE TESTING				**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-Rebound hammer – Ultra sonic pulse velocity meter – Cover meter – Rebar locator				
Theory: 45 Hrs.	**Tutorial: --**	**Practical: --**	**Project: --**	**Total Hours: 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. Nayak, N.V, Jain. A.K., "Hand book on Advanced Concrete Technology", Alpha Science, New Delhi, 2012.
5. Neville, A.M., Properties of Concrete, Prentice Hall, London, 2013.
6. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2008.

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P23STR519	INTERNET OF THINGS FOR CIVIL ENGINEERS	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

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

CO1	Understand the architecture of Internet of Things.
CO2	Know the basic concept of Web of Things.
CO3	Identify the sensors for various applications in the IoT.
CO4	Application of IoT in Smart Cities.
CO5	Discuss the role of IoT in Environmental monitoring.

Pre-requisite:- Nil

CO-PO Mapping

(3/2/1 indicates the strength of the correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	-	-	2	2
CO2	2	1	3	2	2
CO3	2	-	-	3	2
CO4	3	2	3	2	2
CO5	3	3	-	2	2

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10) Assignment / Problem solving / Seminar (10)	Total CIE: **40 marks** Semester End Examination: **60 marks**	Course end survey

UNIT-I: INTRODUCTION — **9 Hours**

Definition and functional Requirements-Motivation-Architecture-Web3.0 View of IoT-Ubiquitous IoT applications-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: IOT ENABLING TECHNOLOGY — **9 Hours**

Wireless sensor network – cloud computing – big data analysis-communication protocol-embedded system. IoT levels. Web of things versus Internet of things-Two pillars of the web-Architecture standardization foe WoT. The cloud of things.

UNIT –III: IOT SENSORS — **9 Hours**

Introduction –Detectable phenomena-conversion methods-commonly measured quantities-Physical 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 — **9 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: STRUCTURAL AND ENVIRONMENTAL MONITORING — **9 Hours**

Structural health monitoring – components of structural health monitoring – Application of IoT in Structural health

monitoring – case study. Water management –Process –application. Air pollution-Methods-advantages. Water monitoring-quality standards. Indication of calamities-alert systems-applications. Smart irrigation-case study. Micro climate monitoring. Room automation using IOT – Hands on Training				
Theory: 45 Hrs.	**Tutorial: –**	**Practical: –**	**Project: –**	**Total Hours: 45 Hrs.**
REFERENCE BOOKS:				
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			

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P23GE101 **RESEARCH METHODOLOGY AND IPR** **3 0 0 0 3**
(Common to all M.E /M.Tech Programmes)

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 the strength of correlation) 3-Strong, 2-Medium, 1-Weak COs Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)					
COs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	3	3	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) (Theory) CIE test II (10) (Theory) CIE test III (10) (Theory)	Assignment / Problem –Solving /Seminar (10) Total CIE: **40 Marks** Semester End Examination : **60 Marks**	Course end survey

UNIT I INTRODUCTION TO RESEARCH METHODS **9**

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 **9**

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 II INTERPRETATION AND REPORT WRITING **9**

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 **9**

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

UNIT V TRADE MARKS, COPY RIGHTS AND PATENTS 9

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

Lecture: 45, Tutorial: 0, Total: 45 Hours

TEXT BOOKS

1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques An Edition, New Age International Publishers, 2019.
2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning, 4" Edition, 2012.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata Mc Graw Hill Education, 1" 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, 4" edition, Sage publisher, 2014.
3. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1" Edition, 2016.
4. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1" Edition, 2012.
5. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1" Edition, 2017.
6. M.Ashok Kumar and Mohd. Iqbal Ali :"Intellectual Property Rights" Serials Pub

S. Padma 4.8.23

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE.
Sona College of Technology
Salem-636 005. Tamil Nadu.

P23GE701	English for Research Paper Writing	L	T	P	J	C
		2	0	0	0	0

Course Outcomes

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

CO1:	Demonstrate research writing skills both for research articles and thesis
CO2:	Frame suitable title and captions as sub-headings for articles and thesis
CO3:	Write each section in a research paper and thesis coherently
CO4:	Use language appropriately and proficiently for effective written communication
CO5:	Exhibit professional proof-reading skills to make the writing error free

Course Assessment methods

Direct		Indirect
CIE test I (30) CIE test II (30) CIE test III (40)	Total CIE: 100 marks Semester End Examination: NIL	Course end survey

Unit 01:	**6 Hours**
Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness	
Unit 02:	**6 Hours**
Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections of a paper/ abstract.	
Unit 03:	**6 Hours**
Key skills to frame a title, to draft an abstract, to give an introduction	
Unit 04:	**6 Hours**
Skills required to organise review of literature, methods, results, discussion and conclusions	
Unit 05:	**6 Hours**
Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing	

Theory: 30 Hrs	Tutorial: --	Practical: --	Project:--	Total Hours: 30 Hrs

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

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

HOD
Dr. M.RENUGA,
Professor & Head,
Department of Humanities & Languages,
Sona College of Technology,
SALEM - 6

P23STR103	ADVANCED CONSTRUCTION ENGINEERING LABORATORY	L	T	P	J	C
		0	0	4	0	2

COURSE OUTCOMES

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

CO1	Design high strength concrete and study the parameter affecting its performance
CO2	Apply experimental techniques to evaluate the structural behavior of reinforced concrete and steel members under various loading conditions
CO3	Conduct Non-Destructive tests on existing concrete structures and apply engineering principles to understand behaviour of structural elements

Pre-requisite:- Nil

CO-PO Mapping

(3/2/1 indicates the strength of the correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1

Course Assessment methods

Direct		Indirect
CIE test I (20) Quiz I (5) CIE test II (20) Quiz I (5) RTPS (10)	Total CIE: **60 marks** Semester End Examination: **40 marks**	Course end survey

LIST OF EXPERIMENTS

1. Determine the mix design for high strength concrete.
2. Determine the modulus of elasticity of concrete using cylindrical specimen.
3. Correlation between cube strength, cylindrical strength, split tensile strength and modulus of rupture
4. Flexural behavior of RC beams
5. Flexural behavior of steel beams
6. Analyze the behavior of reinforced concrete columns subjected to axial load
7. Determine the compressive strength of concrete by conducting a Rebound hammer test.
8. Assess the quality of concrete by conducting ultrasonic pulse velocity test.
9. Behaviour of beams under flexure, shear, and torsion
10. Determine the durability of concrete specimens using RCPT

Theory: –	Tutorial: –	Practical: 60 Hrs.	Project: –	Total Hours: 60 Hrs.

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

Sona College of Technology, Salem

(An Autonomous Institution)

Courses of Study for M.E/M.Tech. Semester II under Regulations 2023 (CBCS)

Branch: Structural Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
		Theory courses								
1.	P23STR201	Finite Element Analysis	3	0	0	0	3	PC	45	T
2.	P23STR202	Advanced Design of Concrete Structures	3	0	0	2	4	PC	75	TP
3.	P23STR203	Advanced Design of Steel Structures	3	0	0	0	3	PC	45	T
4.	P23STR504	**Elective**: Design of Bridges	3	0	0	0	3	PE	45	T
5.	P23STR509	**Elective**: Prefabricated Structures	3	0	0	0	3	PE	45	T
6.	P23GE702	**Audit Course**: Stress Management by Yoga	2	0	0	0	0	AC	30	T
		Practical courses								
7.	P23STR204	Structural Design Studio Laboratory	0	0	4	0	2	PC	60	L
8.	P23STR205	Technical Seminar	0	0	2	0	1	PC	30	L
		Total Credits					**19**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P-Project

Approved By

Chairperson – Civil Engineering, BoS	**Member Secretary, Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
Dr.R.Malathy	**Dr.R.Shivakumar**	**Dr.J.Akilandeswari**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Civil, Second Semester STR Students and Staff, COE

P23STR201	FINITE ELEMENT ANALYSIS	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

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

CO1	Explain the fundamental governing equations of elasticity (differential equilibrium, strain-displacement, constitutive relations) and formulate the Principle of Stationary Potential Energy
CO2	Construct the shape functions, strain-displacement matrices, and stiffness matrices for basic linear and quadratic finite elements in natural coordinate systems
CO3	Implement the isoparametric formulation to compute the stiffness matrix for 2D quadrilateral and triangular elements using numerical integration
CO4	Analyze determinate and indeterminate trusses, beams, and plane frames by assembling global stiffness matrices, applying boundary conditions, and solving for displacements and internal forces
CO5	Compare the finite element formulations and results for thin plates, thick plates, skew plates, and shells

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	1	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	1	3	3	3
CO5	3	1	3	3	3

Course Assessment Methods

Direct		Indirect
CIE Test I (10) CIE Test II (10) CIE Test III (10)	Assignment /Seminar/Problem solving (10) Total CIE: **40 marks** Semester End Examination: **60 marks**	Course End Survey

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

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	9 Hrs.
Two dimensional iso-parametric elements - Four noded quadrilateral elements - Triangular elements - Computation of stiffness matrix for iso-parametric elements - Numerical integration (Gauss quadrature) - Convergence criteria for iso-parametric elements.	
UNIT –IV: ANALYSIS OF STRUCTURES	**9 Hrs.**
Stiffness of Truss Members-Analysis of Truss-Stiffness of Beam Members-Finite Element Analysis of Continuous Beam-Plane Frame Analysis	
UNIT –V: APPLICATION OF FEM	**9 Hrs.**
Introduction to Plate Bending Problems - Finite Element Analysis of Thin & Thick Plates - Finite Element Analysis of Thick Plate - Finite Element Analysis of Skew Plate -Introduction to Finite Strip Method - Finite Element Analysis of Shell.	

Theory: 45 Hrs.	Tutorial: -	Practical: -	Project: -	Total Hours: 45 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. Krishnamoorthy. C.S., "Finite Element Analysis theory and programming" Tata McGraw Hill Pvt.Ltd., NewDelhi, 2013.
4. Rajasekararan.S, "Finite Element Analysis in Engineering Design" S.Chand Pubilshers, New Delhi, 2008
5. Rao.S.S, "Finite Element Method in Engineering", Butterworth – Heinmann, UK, 2008.
6. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons, 2011.

P23STR202	ADVANCED DESIGN OF CONCRETE STRUCTURES	L	T	P	J	C
		3	0	0	2	4

COURSE OUTCOMES

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

CO1	Analyze and design reinforced concrete structural members and evaluating the behaviour of reinforced concrete beams under flexure, shear, and torsion in compliance with codal provisions.
CO2	Design the columns, walls, corbels, deep beams and grid floors Design reinforced concrete walls, shear walls, corbels, deep beams, and grid floors using codal provisions to ensure structural safety, stability, and serviceability
CO3	Design flat slabs and various types of slabs under different boundary conditions using the IS code provisions, yield line theory, and Hillerborg's strip method.
CO4	Discuss the inelastic behaviour of reinforced concrete beams and columns, including moment–rotation–curvature characteristics and evaluate the stress–strain behaviour of confined and unconfined reinforced concrete columns.
CO5	Design reinforced concrete beams, columns, and cast-in-situ joints with adequate ductility to ensure safe and ductile structural performance.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	3
CO2	2	2	2	3	3
CO3	2	2	2	3	3
CO4	2	2	3	3	3
CO5	2	2	3	3	3

Course Assessment Methods

Direct		Indirect
CIE Test I (10) - Theory CIE Test II (10) - Theory CIE Test III (10) – Theory CIE Test IV (10) – Project	Assignment /Quiz/Seminar (10) Total CIE: **50 marks** Semester End Examination: **50 marks** [SEE- Theory 35 marks, Project:15 marks]	Course End Survey

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 - 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.	

Theory: 45 Hrs.	Tutorial: -	Practical: -	Project: 30 Hrs.	Total Hours: 75 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.

Sona College of Tech. APPROVED Board of Studies Civil Engineering Chairperson Autonomous

P23STR203	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

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

CO1	Analyse and design bolted and welded steel connections for beam–beam and beam–column joints, including unstiffened, stiffened, and moment-resisting connections.
CO2	Analyse and design industrial steel buildings by evaluating trusses, purlins, gable columns, and wind girders considering wind, earthquake, durability, and pre-engineered building concepts.
CO3	Design steel members subjected to combined forces, including beam-columns, crane gantry girders, and base plates, ensuring safety and serviceability.
CO4	Analyse and design self-supporting and guyed steel chimneys based on load combinations, stability, and codal requirements.
CO5	Analyse and design light gauge steel members using effective width concepts for compression and flexural behaviour under strength and serviceability limits.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	3
CO2	2	2	3	3	3
CO3	2	2	3	3	3
CO4	2	2	3	3	3
CO5	2	2	3	3	3

Course Assessment Methods

Direct		Indirect
CIE Test I (10) CIE Test II (10) CIE Test III (10)	Assignment /Seminar/Problem solving (10) Total CIE: **40 marks** Semester End Examination: **60 marks**	Course End Survey

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.	

Theory: 45 Hrs.	Tutorial: -	Practical: -	Project: -	Total Hours: 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.

P23STR504	DESIGN OF BRIDGES	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

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

CO1	Apply IRC specifications to analyze and design short-span reinforced concrete slab, culvert, and tee-beam bridges, and demonstrate basic proficiency in bridge analysis software.
CO2	Analyze different bridge systems including continuous girder, box girder, balanced cantilever, arch, and segmental bridges, based on structural behavior and design principles.
CO3	Design prestressed concrete bridge girders by evaluating prestressing forces, stress checks and short- and long-term deflection behavior.
CO4	Analyze steel bridge systems subjected to railway loading for different structural steel systems with appropriate consideration of dynamic effects and stiffening requirements.
CO5	Design bridge bearings, piers, abutments, and foundations by assessing load transfer mechanisms, soil conditions, and serviceability requirements.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Assessment Methods

Direct		Indirect
CIE Test I (10) CIE Test II (10) CIE Test III (10)	Assignment /Seminar/Problem solving (10) Total CIE: **40 marks** Semester End Examination: **60 marks**	Course End Survey

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. Introduction of software for bridges (SAP, MIDAS)

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.	

Theory: 45 Hrs.	Tutorial: -	Practical: -	Project: -	Total Hours: 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, 2004.
5. IRC 112: 2020, Code of Practice for Concrete Road Bridges (Sec-1), Indian Road Congress, New Delhi
6. IRC 6: 2017, Code of Practice for Concrete Road Bridges (Sec-2), Indian Road Congress, New Delhi

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

P23STR509	PREFABRICATED STRUCTURES	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

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

CO1	Analyze and compare prefabricated and monolithic construction systems, classify types of prefabrication, and handling and erection stresses in prefabricated construction practices.
CO2	Apply the principles of design, detailing, and construction of precast structural elements and their joints in precast construction systems
CO3	Analyze and select appropriate production setups and manufacturing methods for precast construction, dimensional tolerances of precast elements, and apply techniques for quality-controlled production
CO4	Select, and apply appropriate equipment and techniques for hoisting and erection of structural members to ensure safe and efficient construction practices.
CO5	Design and detail precast concrete structural units for industrial and factory buildings in accordance with relevant design codes and practical construction requirements.

CO-PO Mapping

(3/2/1 indicates the strength of correlation) 3- Strong, 2-Medium, 1-Weak.

COs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	2	1	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Assessment Method

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10) Assignment /Problem-solving / Seminar (10)	Total CIE: **40 marks** Semester End Examination: **60 marks**	Course End Survey

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	

Theory: 45 Hrs.	Tutorial: -	Practical: -	Project: -	Total Hours: 45 Hrs.

REFERENCE BOOKS:

1. T. Koncz, Manual of Precast Concrete Construction, Vol. I, II, III & IV, Berlin, 2012
2. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, , New York, 2008
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.

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

P23GE702	Stress Management by Yoga	L	T	P	J	C
		2	0	0	0	0

Course Outcomes

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

CO1:	Develop physical and mental health thus improving social health
CO2:	Increase immunity power of the body and prevent diseases
CO3:	Accelerate memory power
CO4:	Achieve the set goal with confidence and determination
CO5:	Improve stability of mind, pleasing personality and work with awakened wisdom

Course Assessment methods

Direct		Indirect
CIE test I (30) CIE test II (30) CIE test III (40)	Total CIE: 100 marks Semester End Examination: NIL	Course end survey

Unit 01: **6 Hours**

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 02: **6 Hours**

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 03: **6 Hours**

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 04: **6 Hours**

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 05: **6 Hours**

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.

Theory: 30 Hrs	Tutorial: --	Practical: --	Project:--	Total Hours: 30 Hrs

REFERENCES

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

HOD
Dr. M.RENUGA,
Professor & Head,
Department of Humanities & Languages,
Sona College of Technology,
SALEM - 636 005

P23STR204	STRUCTURAL DESIGN STUDIO LABORATORY	L	T	P	J	C
		0	0	4	0	2

COURSE OUTCOMES

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

CO1	Understand the requirements of a structure and model it accordingly using computer software
CO2	Analyze the structure for various loads and load combinations according to the relevant IS codes
CO3	Design and detail structures using computer software/tools and check the correctness using manual approximate methods

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	2	2	3	3
CO3	3	2	2	3	3

Course Assessment Methods

Direct		Indirect
CIE Test I (20) Quiz 1 (5) CIE Test II (20) Quiz 2 (5)	RTPS (10) Total CIE: **60 marks** Semester End Examination: **40 marks**	Course End Survey

1. Structural Dynamics

Dynamics of a three storied building frame subjected to harmonic, base motion, Dynamics of a one storied building frame with planar asymmetry subjected to harmonic base motions, Dynamics of a four storied building frame with and without an open ground floor, Dynamics of one-span and two-span beams.

2. Finite Element Analysis

Use of finite element software to analyze bar, beam, frame and plane stress and plain strain problems.

3. Geotechnical Engineering

Site investigation for shallow foundation, Analysis of typical bore hole data, identification and characterization of soil.

Theory: -	Tutorial: -	Practical: 60 Hrs./	Project: -	Total Hours: 60 Hrs.

REFERENCE BOOKS:

1. Laboratory manuals prepared by Civil Engineering Department, Sona College of Technology, Salem.
2. Pillai U., and Menon D., "Reinforced Concrete Design", Fourth Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2021.
3. Neville A.M., Properties of Concrete, Prentice Hall, 2013, London.
4. Shetty M.S., Concrete Technology, S. Chand, and Company Ltd. Delhi, 2019.

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

P23STR205	TECHNICAL SEMINAR	L	T	P	J	C
		0	0	2	0	1

COURSE OUTCOMES

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

CO1	Collect an innovative / novelty topic related to the desirable area.
CO2	Present their understandings from the research studies in an effective manner.
CO3	Demonstrate the ability to defend technical content with logical reasoning, respond to questions confidently, and exhibit professional interaction during their presentations.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-weak

COs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	2	2
CO2	2	2	2	1	1
CO3	2	2	1	1	2

Course Assessment Methods

Direct		Indirect
Review I (10 marks) Review II (20 marks) Review III (20 marks) Final Presentation (50 marks)	Total CIE: **100 marks** Semester End Examination: -	Course End Survey

The students will work for two hours per week guided by a group of staff members. They will be asked to give three presentations 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, also on the interaction shown during the seminar.

Review-I, II and III will consist of a panel constituted by the Head of the Department. Final Presentation will consist of a panel constituted by the Office of Controller of Examination consisting of one coordinator and one internal member from the Department.

Theory: -	Tutorial: -	Practical: 30 Hrs.	Project: -	Total Hours: 30 Hrs.

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