SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E- Structural Engineering

(Dept of Civil Engineering)

CURRICULUM and SYLLABI

[For students admitted in 2023-2024]

PG Regulations 2023

Approved by BOS and Academic Council meetings

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

Approved By

Chairperson - 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

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Sona College of Technology, Salem

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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.	P23STR505	**Elective**: Formwork Engineering	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

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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

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Chairperson - BoS	Member Secretary, Academic Council	Dean-Academics	Chairperson, Academic Council & Principal
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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 – regula-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.

Dr. S. JAYABHARATHI ASSOCIATE PROFESSOR & HEAD DEPARTMENT OF MATHEMATICS, SONA COLLEGE OF TECHNOLOGY, SALEM-636 005. Tamilnadu. Ph: 0427 - 4099999.	Dr. M.RENUGA, Professor & Head, Department of Humanities & Langu... Sona College of Technology, SALEM - 636 005.
HoD / Mathematics	BoS – Chairperson / Science and Humanities

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 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.**

REFERENCES

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, Newyork, 2007
4.	Chandramouli, Theory of Elasticity, Mc Graw Hill, Publishers, Newyork, 2007
5.	Advanced Mechanics of Solids, Srinath L.S, Tata McGraw Hill, New Delhi, 2009.

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 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: 30Hours.

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

REFERENCES

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 Nondestructive Evaluation, Second Edition, Mc graw Hill Education, 2013.

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P23CEM501	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 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 Concrete

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**

M.E Structural Engineering PG Regulations 2023

self compacted concrete-Self curing concrete-shrinkage compensation concrete, pervious concrete-concrete containing polymers-Geo-polymer 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.**

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.	Nayak, N.V, Jain, A.K., "Handbook 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 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

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

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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	Conduct Non-Destructive tests on existing concrete structures and apply engineering principles to understand behaviour of structural elements
CO3	Gain practical knowledge of non-destructive testing and learn to calibrate and use proving rings and LVDTs

Pre-requisite:- Nil

CO/PO 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	2	3	3
CO2	3	1	2	2	1
CO3	2	1	2	3	2

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

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. Determine the influence of cyclic load on steel beam.
5. Determine the compressive strength of concrete by conducting a Rebound hammer test.
6. Determine the compressive strength of concrete by conducting a Ultra Sonic Pulse Velocity test
7. Assess the quality of concrete by conducting ultrasonic pulse velocity test.
8. Behaviour of beams under flexure, shear, and torsion
9. Determine the durability (Water absorption/Permeability/RCPT)of concrete Specimen

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

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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

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.	P23STR505	**Elective**: Formwork Engineering	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

Approved By

Chairperson - 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	3	0	0	0	3

COURSE OUTCOMES

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

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

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	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1
CO4	2	2	1	1	1
CO5	2	2	1	1	1

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 **9Hrs.**

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 **9Hrs.**

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 **9Hrs.**

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: ANALYSIS OF STRUCTURES **9Hrs.**

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 **9Hrs.**

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.ChandPubilshers, New Delhi, 2008
5. Rao.S.S, "Finite Element Method in Engineering", Butterworth – Heinmann, UK, 2008.
6. 5. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons, 2011.

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P23STR202	ADVANCED DESIGN OF CONCRETE STRUCTURES	3	0	0	2	4

COURSE OUTCOMES

Upon completion of this 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

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	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1
CO4	2	2	1	1	1
CO5	2	2	1	1	1

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 - 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 - curvaturecharacteristics. 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.

P23STR203	ADVANCED DESIGN OF STEEL STRUCTURES	3	0	0	0	3

COURSE OUTCOMES

Upon completion of this 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.

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	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1
CO4	2	2	1	1	1
CO5	2	2	1	1	1

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	3	0	0	0	3

3COURSE OUTCOMES

Upon completion of this 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

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	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1
CO4	2	2	1	1	1
CO5	2	2	1	1	1

Course Assessment methods

Direct		Direct
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. andJayaram.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

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P23STR505	FORMWORK ENGINEERING	3	0	0	0	3

COURSE OUTCOMES

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

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

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	1	1	1
CO2	2	2	1	1	1
CO3	2	2	1	1	1
CO4	2	2	1	1	1
CO5	2	2	1	1	1

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.**

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

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

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

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

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

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

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

UNIT –V: FLYING FORMWORK **9 Hrs.**

Some Examples of Flying Formwork-Flying Formwork Cycle-Advantages And Limitation of Flying Formwork-Design Issues in Flying Forms-Safety Issues in Flying Forms-Table Forms-Tunnel Formwork System-Column Mounted Shoring

System-Gang Forms-Slipform-Vertical Slipform-Horizontal Slipform-Types of Slipform-Functions of Varies Slipform Components-Assembly, Sliding And Dismantling of Slip form – Slip form Design Issues-Some Cases in Slip form - Safety Operation during Slip form Erection-Productivity Issues in Slip form Construction. Failure of formworks.				
Theory: 45 Hrs	**Tutorial: –**	**Practical: –**	**Project: –**	**Total Hours: 45 Hrs.**
REFERENCE BOOKS:				
1. Kumar NeerajJha, "Formwork for concrete structures", Tata Mcgraw Hill Education Private Limited New Delhi – 2012				
2. JanarthanSha&S.K.Sinha, " Modern Practices in Formwork for Civil Engineering Construction Works, University Science Press, New Delhi, 2014				
3. Oberlender. D, Robert L. Peurifoy, "Formwork for Concrete Structures", McGraw Hill Publishers, NewYork, 2010				

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P23STR204	STRUCTURAL DESIGN STUDIO LABORATORY	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	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
CO4	2	2	1	1	1
CO5	2	2	1	1	1

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 (ETABS)

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 (ABAQUS)

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

3. Geotechnical Engineering (PLAXIS)

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 APPROVED Board of Studies Civil Engineering Chairperson Autonomous

P23STR205	TECHNICAL SEMINAR	0	0	2	0	1

COURSE OUTCOMES

At the end of the course, the students 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	Trained to face an audience and to solve any critical problem during their Interview

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	1	2	2
CO2	2	2	2	1	1
CO3	2	2	1	1	2

Course Assessment methods

Direct		Indirect
Presentation I (30 marks) Presentation II (35 marks) Presentation III (35 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. The students will be evaluated through a viva-voce examination by a team of internal faculty members assigned by HoD for each presentation of the student.

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

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.