# SONA COLLEGE OF TECHNOLOGY, SALEM-5

**(An Autonomous Institution)**

## M.E- Structural Engineering

**(Dept of Civil Engineering)**

## CURRICULUM and SYLLABI

**[For students admitted in 2024-2025]**

## 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** |

Copy to:-

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

ME-STR
II

**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. | P23STR522 | *Elective: Special Concrete* | 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

M.E-STR III

**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester III 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. | P23STR301 | Application of BIM in Structural Engineering | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 2. | P23STR502 | **Elective:** Computer Aided Analysis and Design | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 3. | P23STR511 | **Elective:** Design of Steel Concrete Composite Structures | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| **Practical courses** | | | | | | | | | | |
| 4. | P23STR302 | Practical Training | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| 5. | P23STR303 | Project Work-I | 0 | 0 | 0 | 16 | 8 | PC | 240 | P |
| | | | | | | | **Total Credits** | **20** | | |

*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, Third Semester ME STR Students and Staff, COE

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

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Practical courses** | | | | | | | | | | |
| 1. | P23STR401 | Project Work – II | 0 | 0 | 0 | 28 | 14 | PC | 420 | P |
| | | **Total Credits** | | | | | **14** | | | |

*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, Fourth Semester ME STR Students and Staff, COE

**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** |

Copy to:-

HOD/ Civil, First Semester 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)<br>CIE test II (10) (Theory)<br>CIE test III (10) (Theory)<br>Assignment / Problem- solving / Seminar (10) | Total CIE: 40 marks<br>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<br>ASSOCIATE PROFESSOR & HEAD<br>DEPARTMENT OF MATHEMATICS,<br>SONA COLLEGE OF TECHNOLOGY,<br>SALEM-636 005. Tamilnadu.<br>Ph: 0427 - 4099999. | Dr. M.RENUGA,<br>Professor & Head,<br>Department of Humanities & Langu...<br>Sona College of Technology,<br>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)<br>CIE test II (10)<br>CIE test III (10)<br>Assignment / Problem- solving / Seminar (10) | Total CIE: **40 marks**<br>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. | Ragab A.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. |


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

| 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<br>CIE test II (10) - Theory<br>CIE test III (10) - Theory<br>CIE test IV (10) – Laboratory<br>Assignment /Quiz/Seminar/mini project (10) | Total CIE: **50 marks**<br>Semester End Examination: **50 marks**<br>**[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.


Sona College of Technology APPROVED Board of Studies Civil Engineering Chairperson ...nomous

| 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)<br>CIE test II (10)<br>CIE test III (10)<br>Assignment / Problem- solving / Seminar (10) | Total CIE: **40 marks**<br>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**

| |
|---|
| 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. |


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

| 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)<br>CIE test II (10)<br>CIE test III (10)<br>Assignment / Problem- solving / Seminar (10) | Total CIE: **40 marks**<br>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 |


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

| 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)<br>Quiz 1 (5)<br>CIE test II (20)<br>Quiz 2 (5)<br>RTPS (10) | Total CIE: **60 marks**<br>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. |
|---|---|---|---|---|

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

**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)<br>CIE test II (10) (Theory)<br>CIE test III (10) (Theory) | Assignment / Problem –Solving /Seminar (10)<br>Total CIE: **40 Marks**<br>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)<br>CIE test II (30)<br>CIE test III (40) | Total CIE: 100 marks<br>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

ME-STR
II

**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. | P23STR522 | *Elective: Special Concrete* | 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 | 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)<br>CIE Test II (10)<br>CIE Test III (10) | Assignment /Seminar/Problem solving (10)<br>Total CIE: **40 marks**<br>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.Chand Pubilshers, 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.

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

| 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 | 1 | 2 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 2 | 1 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 3 | 3 | 3 |

**Course Assessment Methods**

| Direct | | Indirect |
|---|---|---|
| CIE Test I (10) - Theory<br>CIE Test II (10) - Theory<br>CIE Test III (10) – Theory<br>CIE Test IV (10) – Project | Assignment /Quiz/Seminar (10)<br>Total CIE: **50 marks**<br>Semester End Examination: **50 marks**<br>[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 - 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.

| 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 | 1 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 3 | 3 | 3 |
| CO3 | 2 | 1 | 3 | 3 | 3 |
| CO4 | 2 | 1 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 3 | 3 | 3 |

**Course Assessment Methods**

| Direct | | Indirect |
|---|---|---|
| CIE Test I (10)<br>CIE Test II (10)<br>CIE Test III (10) | Assignment /Seminar/Problem solving (10)<br>Total CIE: **40 marks**<br>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.


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

| 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 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 2 | 3 | 3 |
| CO3 | 2 | 1 | 2 | 3 | 3 |
| CO4 | 2 | 1 | 2 | 3 | 3 |
| CO5 | 2 | 1 | 2 | 3 | 3 |

**Course Assessment Methods**

| Direct | | Indirect |
|---|---|---|
| CIE Test I (10)<br>CIE Test II (10)<br>CIE Test III (10) | Assignment /Seminar/Problem solving (10)<br>Total CIE: **40 marks**<br>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

| P23STR522 | SPECIAL CONCRETE | 3 | 0 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Understand the Fundamental Properties of Concrete |
| CO2 | Analyze and Apply Concrete Mix Design Principles |
| CO3 | Examine High-Performance and Specialty Concrete. |
| CO4 | Evaluate Advanced Cementitious Composites |
| CO5 | Explore Innovative and Sustainable Concrete Technologies |

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

| CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 |

**Course Assessment Methods**

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

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

Concrete-A composite material-Basic properties of fresh concrete and hardened concrete- Concrete mix proportions: Analysis and adjustments- Pores and porosity in concrete – Admixtures in concrete – Chemical admixtures: Water reducers, Set controllers, Standards on chemical admixture & Air entraining agents Understanding concrete rheology, Viscosity modifying agents, Shrinkage reducing admixtures & Other speciality admixtures: Mineral Admixtures: Introduction, classification and pozzolanic activity, Fly ash, Silica fume, GGBFS, Metakaolin and LC3

| UNIT –II: | HIGH STRENGTH CONCRETE | 9 Hrs. |
|---|---|---|

Introduction, classification, properties, strength and durability, mix proportioning and problems. High STRENGTH concrete: Ultra high strength concrete, reactor powder concrete, Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

| UNIT –III: | FERRO CEMENT | 9 Hrs. |
|---|---|---|

Ferro cement: Ferrocement materials, mechanical properties, cracking of ferrocement, strength and behaviour in tension, compression and flexure, Design of ferrocement in tension, ferrocement constructions, durability, and applications.

| UNIT –IV: | FIBRE REINFORCED CONCRETE | 9 Hrs. |
|---|---|---|

Fibre materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.

| UNIT –V: | OTHER CONCRETES | 9 Hrs. |
|---|---|---|

constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete, Self-Compacting Concrete, self-curing concrete, bacterial concrete, Light weight concrete, mass concrete, micro concrete, Expansive concrete, roller compacted concrete, concrete using recycled aggregate and Nano technology in concrete, Concrete for 3D printing.

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

**REFERENCE BOOKS:**


1. Neville A.M, "Properties of Concrete" Pearson Education Asia, 2000
2. P. Kumar Mehta, Paul J.N. Monterio, CONCRETE:Microstructure, Properties and Materials", Tata McGraw Hill
3. A.R.Santhakumar, (2007) "Concrete Technology"-Oxford University Press, New Delhi, 2007
4. Gambhir "Concrete Technology" TMH
5. Short A and Kinniburgh.W, "Light Weight Concrete"- Asia Publishing House, 1963
6. Aitcin P.C. "High Performance Concrete" E and FN, Spon London 1998

| 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 | 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)<br>Quiz 1 (5)<br>CIE Test II (20)<br>Quiz 2 (5) | RTPS (10)<br>Total CIE: **60 marks**<br>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 APPROVED Board of Studies Civil Engineering Chairperson Autonomous

| P23STR205 | TECHNICAL SEMINAR | 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 | 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 | 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)<br>Review II (20 marks)<br>Review III (20 marks)<br>Final Presentation: 50 Marks | Total CIE: **100 marks**<br>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 a 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

| 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)<br>CIE test II (30)<br>CIE test III (40) | Total CIE: 100 marks<br>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

M.E-STR
III

**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester III 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. | P23STR301 | Application of BIM in Structural Engineering | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 2. | P23STR502 | **Elective:** Computer Aided Analysis and Design | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 3. | P23STR511 | **Elective:** Design of Steel Concrete Composite Structures | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| **Practical courses** | | | | | | | | | | |
| 4. | P23STR302 | Practical Training | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| 5. | P23STR303 | Project Work-I | 0 | 0 | 0 | 16 | 8 | PC | 240 | P |
| | | | | | | | **Total Credits** | **20** | | |

*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, Third Semester ME STR Students and Staff, COE

| P23STR301 | APPLICATION OF BIM IN STRUCTURAL ENGINEERING | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 2 | 4 |

**Course Outcomes**

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

| | |
|---|---|
| CO1: | Understand BIM and its importance in current scenario in development of infrastructure |
| CO2: | Create the model according to level of development required. |
| CO3: | Construct the workflow for 3D model creation and perform clash deduction. |
| CO4: | Outline the process to collaborate the models and extract schedules and quantities. |
| CO5: | Assess and detail the structural model as required by the building lifecycle. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| CO1 | 1 | 3 | 1 | 1 | 1 |
| CO2 | 1 | 3 | 1 | 2 | 2 |
| CO3 | 1 | 3 | 2 | 2 | 2 |
| CO4 | 1 | 3 | 2 | 2 | 2 |
| CO5 | 1 | 3 | 2 | 2 | 2 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (10)-Theory<br>CIE test II (10)- Theory<br>CIE test III (10)- Theory<br>CIE test IV (10)-Project<br>Assignment/Quiz/Seminar (10) | Total CIE: **50 marks**<br>Semester End Examination: **50 marks**<br>[SEE: Theory (35marks),Project (15 marks)] | Course end survey |

**Unit 01: BIM BASICS & CONCEPTS** — **9 Hours**

BIM Concepts & Basics – Terms and Definitions - 2D CAD v. 3D Modeling v. BIM - New and Old Practices - - Object Based Modeling- Parametric Modeling - Modelling Development & Project Phases - Model types - Design Modeling - Documentation Modeling - Construction Modeling - Coordination Modeling - Uses of models

**Unit 02: BIM PROJECT PHASES** — **9 Hours**

Types - Modeling & Project Phases - Level of Development (LOD) & Object Data Level – Visualization – Data extraction – Simulation and analysis – Documentation – Role of Architect – Engineers – Essentials of Model creation – Phases of model development

**Unit 03: BIM MODEL WORKFLOW** — **9 Hours**

Model Extraction – 3D model – Modeling requirements – checking – Model quality – Complete data on buildings – Clash detection – configurations – materials – Location – Space compliance – Responsibilities of Engineer - ISO 19650

**Unit 04: BIM COLLOBORATION AND COORDINATION** — **9 Hours**

Essentials and benefits of Intelligent 3D modelling – automated schedules and quantities- digital exchange model - Project Life Cycle BIM Model - Graphic/Visual coordination – digital file exchanges and Import file formats

Software - Pre-design and planning Phase - Designers view - Architectural Design - Structural Design - Parametric Design - MEP Design -Electrical Design - Sustainability - Hydraulic Design - Estimating/QS - Checking & Co-ordination - Environmental - Obstacles for BIM

| Unit 05: BIM IN STRUCTURAL ENGINEERING | | | | 9 Hours |
|---|---|---|---|---|
| Introduction to Structural modelling - Create concrete and steel structural models – Beam, column, floors, foundations, and other elements – Create and edit steel connections – set visibility and detail to models. | | | | |
| **Theory: 45 Hrs** | **Tutorial: --** | **Practical: --** | **Project: 30Hrs.** | **Total Hours: 75 Hrs** |

**REFERENCE BOOKS:-**


1. ISO 19650 - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling, 2018
2. Paul Teicholz, Rafael Sacks, Ghang Lee, Charles Eastman, BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, Wiley & Sons, 2018
3. Dana K. Smith, Building Information Modeling: A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers, Wiley Publishers, 2019
4. Mervyn Richards, Building Information Management: A Standard Framework and Guide to BS 1192, British Standards Institution, 2010


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

| P23STR502 | COMPUTER AIDED ANALYSIS AND DESIGN | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

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

| | |
|---|---|
| **CO1:** | Understand the basics of graphic primitives and drafting. |
| **CO2:** | Analysis the structural elements by software approaches. |
| **CO3:** | Design the steel and Reinforced concrete elements. |
| **CO4:** | Understand the optimization techniques. |
| **CO5:** | Apply the inference mechanism and algorithm. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| CO1 | 2 | 3 | 2 | 2 | 3 |
| CO2 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 2 | 3 | 2 | 2 | 3 |

**Course Assessment methods**

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

**Unit 01: COMPUTER MODELLING** — **9 Hours**

Graphic primitives – Transformations – Basics of 2D drafting – Modelling of curves and surfaces – Wire frame modelling –Solid Modelling -Graphic standards - Drafting Software packages

**Unit 02: STRUCTURAL ANALYSIS** — **9 Hours**

Computer method of structural analysis – Simulation and Analysis of steel sections I, channel and Angle –PEB Elements – RCC and Composite members - Nonlinear Analysis through software packages.

**Unit 03: STRUCTURAL DESIGN** — **9 Hours**

Computer Aided Design of Steel and RC structural elements – Detailing of reinforcement – Detailed Drawing

**Unit 04: APPLICATION** — **9 Hours**

Applications Introduction to Optimisation – Simple Genetic Algorithm. Introduction to computer aided design softwares – Use of excel sheets

**Unit 05: INTRODUCTION TO R** — **9 Hours**

Data Science - Big Data and Data Science hype – Datafication – Statistical Inference - Intro to R - overview of R - elements and data structures - Sessions and Functions - Variables, Data Types - Vectors, Scalars - Data Frames – Lists – Classes - Data input/output - Data storage formats - Subsetting objects - Vectorization

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

**REFERENCE BOOKS:-**


1. Krishnamoorthy C.S and Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 1991.
2. GrooverM.P.and Zimmers E.W. Jr.," CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, New Delhi, 1993.
3. Rao. S.S., "Optimisation Theory and Applications ", Wiley Eastern Limited, New Delhi, 2009.
4. Richard Forsyth (Ed.), "Expert System Principles and Case Studies", Chapman and Hall, 1996.
5. Shah V.L. "Computer Aided Design in Reinforced Concrete", [illegible], 2014.


Sona College of Technology * Autonomous * Civil Engineering Chairperson

| P23STR511 | DESIGN OF STEEL CONCRETE COMPOSITE 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:** | Illustrate the behaviour of composite structures |
| **CO2:** | Design various composite structural elements such as beams, columns, floors, slabs and concrete filled steel tubes. |
| **CO3:** | Analyse the connection behaviour and design |
| **CO4:** | Assess the behaviour of box girder bridges and design concepts of the same |
| **CO5:** | Evaluate the concepts of various structural elements and design concepts through case studies |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |

**Course Assessment methods**

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

**Unit 01: INTRODUCTION** — **9 Hours**

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

**Unit 02: DESIGN OF CONNECTIONS** — **9 Hours**

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

**Unit 03: DESIGN OF COMPOSITE MEMBERS** — **9 Hours**

Design of composite beams, slabs, columns, beam-column joints - Design of composite trusses.

**Unit 04: COMPOSITE BOX GIRDER BRIDGES** — **9 Hours**

Introduction - behaviour of box girder bridges - design concepts

**Unit 05: CASE STUDIES** — **9 Hours**

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

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

**REFERENCE BOOKS:-**


1. Johnson R.P., "Composite Structures of Steel and Concrete", Blackwell Scientific Publications, UK 2008.
2. Oehers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental Behaviour", Permagon Press, Oxford, 2006.
3. Course material of workshop on "Steel Concrete Composite st… by Anna University, 2007.
4. INSDAG Materials, Volume I and II. 2000.


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

| P23STR302 | PRACTICAL TRAINING | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 4 | 2 |

**Course Outcomes**

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

| | |
|---|---|
| **CO1:** | Train the students in the field work so as to have a first-hand knowledge in practical Situation. |
| **CO2:** | Develop skills in facing and solving the field problems |
| **CO3:** | Tackling a practical field/industry orientated problem related to Structural Engineering. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| Review I- 5 Marks<br>Review II – 10 Marks<br>Review III – 15 Marks<br>Final Project Report – 10 Marks | Total Internal Marks: **40 marks**<br>Semester End Examination: **60 marks** | Course end survey |

The students individually undertake training in reputed design / construction industries during the summer vacation for a specified period of four weeks. At the end of the training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. Three internal reviews shall be done by a committee duly appointed by the HoD. Students shall submit a report on the work done during the course duration. The final viva-voce shall be conducted by a committee duly appointed by the office of CoE which consist of a person from the related Industry, two faculty members (i) from the same department (ii) from another related department. The evaluation is 100% internal

**Total hours: 60 hrs.**

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

| P23STR303 | PROJECT WORK - I | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 16 | 8 |

**Course Outcomes**

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

| | |
|---|---|
| CO1: | Procure the necessary sources/materials for their experimental/analytical work |
| CO2: | Conduct the preliminary investigation for optimize the proportions/section |
| CO3: | Disseminate a clear idea of their work and carry out the remaining work in phase II in a systematic way. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 | CO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| Review I- 5 Marks<br>Review II – 10 Marks<br>Review III – 15 Marks<br>Final Project Report – 10 Marks | Total Internal Marks: **40 marks**<br>Semester End Examination: **60 marks** | Course end survey |

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

**Total hours: 240 hrs.**

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

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

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Practical courses** | | | | | | | | | | |
| 1. | P23STR401 | Project Work – II | 0 | 0 | 0 | 28 | 14 | PC | 420 | P |
| | | | | | | **Total Credits** | **14** | | | |

*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, Fourth Semester ME STR Students and Staff, COE

| P23STR401 | PROJECT WORK-II | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 28 | 14 |

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Apply approved research methodologies to systematically carry out project work using advanced research techniques.(K3) |
| CO2 | Demonstrate proficiency in the structured execution and monitoring of the research plan to achieve defined objectives.(K3) |
| CO3 | Prepare a comprehensive, well-structured, and professionally written project report documenting the research methodology, analysis, results, and conclusions.(K4) |

Pre-requisite: Project work-I

**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 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 2 |

**Course Assessment Methods**

| Direct | | Indirect |
|---|---|---|
| Review I – 5 Marks<br>Review II – 10 Marks<br>Review III – 15 Marks<br>Final Project Report – 10 Marks | Total CIE: 40 Marks<br>Semester End Examination (60) | Course end survey |

**Project work Instructions:** The student should continue their project work – I on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

| Theory: - | Tutorial: - | Practical: - | Project: 420 | Total Hours: 420 Hrs. |
|---|---|---|---|---|