# SONA COLLEGE OF TECHNOLOGY, SALEM-5

**(An Autonomous Institution)**

## M.E- Construction Engineering and Management

**(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: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1. | P23MAT101E | Statistical Methods for Engineers | 2 | 1 | 0 | 0 | 3 | FC | 45 | TT |
| 2. | P23CEM101 | Construction Planning Scheduling and Control | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3. | P23CEM102 | Quality Control and Quality Assurance in Construction | 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. | P23CEM103 | 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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M.E - CEM
II

**Sona College of Technology, Salem**

**(An Autonomous Institution)**

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

**Branch: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Theory courses** | | | | | | | | |
| 1. | P23CEM201 | Advanced Construction Techniques | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2. | P23CEM202 | Resource Management and Control in Construction | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 3. | P23CEM203 | Construction Equipment and Management | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4. | P23CEM509 | ***Elective:*** Contract Laws and Regulation | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 5. | P23 STR522 | ***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. | P23CEM204 | Construction Management Studio Laboratory | 0 | 0 | 4 | 0 | 2 | PC | 60 | L |
| 8. | P23CEM205 | 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** |

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M.E-CEM
III

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

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| Theory courses | | | | | | | | | | |
| 1. | P23CEM301 | Application of BIM in Construction Management | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 2. | P23CEM513 | **Elective:** Modern Construction Materials | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 3. | P23CEM516 | **Elective:** Materials Management | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| Practical courses | | | | | | | | | | |
| 4. | P23CEM302 | Practical Training | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| 5. | P23CEM303 | 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 |
|---|---|---|---|
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**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester IV under Regulations 2023 (CBCS)**
**Branch: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Practical courses** | | | | | | | | | | |
| 1. | P23CEM401 | 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**

| | | | |
|---|---|---|---|
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| **Dr.R.Malathy** | **Dr.R.Shivakumar** | **Dr.J.Akilandeswari** | **Dr.S.R.R.Senthil Kumar** |

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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: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1. | P23MAT101E | Statistical Methods for Engineers | 2 | 1 | 0 | 0 | 3 | FC | 45 | TT |
| 2. | P23CEM101 | Construction Planning Scheduling and Control | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3. | P23CEM102 | Quality Control and Quality Assurance in Construction | 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. | P23CEM103 | 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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| CIVIL ENGINEERING | | | | | | |
|---|---|---|---|---|---|---|
| M. E. / CONSTRUCTION ENGINEERING AND MANAGEMENT | | | | | | |
| SEMESTER - I | STATISTICAL METHODS FOR ENGINEERS | L | T | P | J | C |
| P23MAT101E | | 2 | 1 | 0 | 0 | 3 |

**Course Outcomes**

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

| | |
|---|---|
| **CO1:** | apply the concepts of random variable, moments, moment generating function and its properties to solve the problems and apply the standard distributions to appropriate problems. |
| **CO2:** | test the attributes and variables of large and small samples. |
| **CO3:** | apply the concepts of multiple and partial correlation, plane of regression and multiple and partial regression to solve the related problems. |
| **CO4:** | analyse the variances of several variable while applying standard designs like completely randomized design and randomized block design. |
| **CO5:** | apply the multivariate density concept and its properties to analyze the principal components. |

**Pre-requisites:**

- Basics of calculus
- Basics of statistics
- Basics of geometry
- Basics of probability

**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 | PROBABILITY AND RANDOM VARIABLE | 9 Hours |
|---|---|---|
| Discrete and continuous random variables, moments, moment generating function and their properties, binomial, Poisson and normal distributions. | | |
| **Unit 02** | **TESTING OF HYPOTHESIS** | **9 Hours** |
| Tests based on normal, t, $\chi^2$ and F distributions for testing means, variances and proportions – Analysis of $r \times c$ tables – goodness of fit. | | |

| | | |
|---|---|---|
| Unit 03 | MULTIPLE AND PARTIAL CORRELATION AND MULTIPLE AND PARTIAL REGRESSION | 9 Hours |
| Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations. | | |
| Unit 04 | DESIGN OF EXPERIMENTS | 9 Hours |
| Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design. | | |
| Unit 05 | MULTIVARIATE ANALYSIS | 9 Hours |
| Random vectors and matrices – mean vectors and covariance matrices – multivariate normal density and its properties – principal components: population components from standardized variables. | | |

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

**TEXT BOOK:**


1. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons Publishers, 11th Edition (Reprint), 2019.


**REFERENCE BOOKS:**


1. J. L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury Publishers, 5th Edition, 2002.
2. R. A. Johnson and C. B. Gupta, "Miller and Freund's, Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2018.
3. R. A. Johnson and D. W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Publishers, 6th Edition, 2007.
4. S. Ross, "A first course in probability", Pearson Publishers, 9th Edition, 2019.


| | |
|---|---|
| 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 & Languages<br>Sona College of Technology,<br>SALEM - 636 005. |
| HoD / Mathematics | BoS – Chairperson / Science and Humanities |

| P23CEM101 | CONSTRUCTION PLANNING SCHEDULING AND CONTROL | 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 | Summarize the importance of planning. |
| CO2 | Determine the project time and cost. |
| CO3 | Know the time cost trade off, simulation and scheduling process. |
| CO4 | Recognize the need of cost control. |
| CO5 | Illustrate the database models and its applications in construction projects |

**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 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 1 |
| CO3 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 1 | 3 | 2 |
| CO5 | 2 | 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: CONSTRUCTION PLANNING** — **9 Hours**

Introduction to Construction Projects - Project Categories - Project Participants - Project Life Cycle – Planning – Role of Planning Department in Construction- objectives – principles - stages of planning –Defining work task and precedence relationships among activities- Estimating durations and resources requirements- Coding system

**UNIT –II:PROJECT SCHEDULING:** — **9 Hours**

Construction scheduling - Work Breakdown Structure - Project Cost and Time Estimation - Bar Chart - Milestone Chart - CPM - PERT -RPM - LOB - Software's in construction scheduling.

**UNIT –III:SCHEDULING WITH RESOURCE CONSTRAINTS** — **9 Hours**

Scheduling with Resource Constraints and Precedence – Use of Advanced Scheduling Techniques – Scheduling with Uncertain Durations – Calculations for Monte Carlo Schedule Simulation – Crashing and Time/Cost Tradeoffs – Improving the Scheduling Process.

**UNIT –IV: COST CONTROL** — **9 Hours**

Monitoring and control of construction projects – quality control- importance-objectives – methods - cost control – objectives – control systems – direct and indirect cost control – project budgetary control – Project risk analysis and mitigation.

**UNIT –V:ORGANIZING AND USE OF PROJECT INFORMATION** — **9 Hours**

Types of project information- accuracy – use of information – computerized information – uses – database – database models- relational model- centralized model- applications.

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

**REFERENCES**


| | |
|---|---|
| 1. | Sengupta and Guha, "Construction Management and Planning", 1st Edition, Tata McGraw Hill Publication, 2015. |
| 2. | Chitkara K.K., "Construction Project Management Planning Scheduling and Controlling", 18th Reprint, Tata McGraw Hill, 2017. |
| 3. | Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 2017. |
| 4. | Dr. Seetharaman S., "Construction Engineering and Management", 2nd Edition, Umesh Publications, 2017. |
| 5. | Saleh A. Mubarak ., "Construction Project Scheduling and Control" 4th Edition, Wiley Publication, 2019. |


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

| P23CEM102 | QUALITY CONTROL AND QUALITY ASSURANCE IN CONSTRUCTION | 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 | Apply quality control aspects in planning and management. |
| CO2 | study the various quality policy adopted in construction industries |
| CO3 | Know the concept of objectives and advantage of quality assurance |
| CO4 | be exposed to means of quality control |
| CO5 | Understand the concept and importance of maintenance |

**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 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 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) – 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: QUALITY MANAGEMENT SYSTEMS** — **9 Hours**

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

**UNIT –II:QUALITY POLICY** — **9 Hours**

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

**UNIT –III:QUALITY ASSURANCE** — **9 Hours**

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

**UNIT –IV: FACTORS OF CONSTRUCTION QUALITY** — **9 Hours**

Appraisals - Critical, Major Failure Aspects and Failure Mode Analysis - Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction.

**UNIT –V:MAINTENANCE MANAGEMENT** — **9 Hours**

| |
|---|
| Introduction- objectives- need of maintenance – maintenance management- Planning systems for maintenance –Building Maintenance/ Facilities Management - Scheduled and contingency maintenance - case study. |
| **Total Theory Hours: 45 Hours.** |
| **LIST OF EXPERIMENTS** |
| 1. To plot X - bar charts and process capability analysis for the given data<br>2. To plot C-chart using given experimental setup for the given data<br>3. Asses on how the inspection should be made to a building,<br>4. Statistical quality control applied to business strategy (SIX SIGMA)<br>5. Assessing on how the quality has an impact on various aspects can be examined.<br>6. Determination of reliability testing of materials for a project.<br>7. Examine and prepare a report on how the maintenance is important for the building |
| **Total Practical Hours: 30Hours.** |

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

**REFERENCES**


| | |
|---|---|
| 1. | James, J.O Brian, "Construction Inspection Handbook -Quality Assurance and: Quality Control", Van Nostrand, New York, 2012. |
| 2. | Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2017. |
| 3. | John L. Ashford, "The Management of Quality in Construction", E & F.N, Spon. New York, 2009. |
| 4. | Clarkson H. Oglesby, "Productivity Improvement in Construction", McGraw-Hill, 2009. |
| 5. | Steven McCabe, "Quality Improvement Techniques in Construction", Addison Wesley Longman Ltd, England, 2016. |


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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)<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 Sience, NewDelhi, 2012
5. Neville, A.M., Properties of Concrete, Prentice Hall, 2013, London.
6. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2008.


| 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) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | 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 * Autonomous * APPROVED Board of Studies Civil Engineering Chairperson

| P23CEM103 | 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.



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Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

**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.
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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

M.E - CEM
II

**Sona College of Technology, Salem**

**(An Autonomous Institution)**

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

**Branch: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Theory courses** | | | | | | | | |
| 1. | P23CEM201 | Advanced Construction Techniques | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2. | P23CEM202 | Resource Management and Control in Construction | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 3. | P23CEM203 | Construction Equipment and Management | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4. | P23CEM509 | ***Elective:*** Contract Laws and Regulation | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 5. | P23 STR522 | ***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. | P23CEM204 | Construction Management Studio Laboratory | 0 | 0 | 4 | 0 | 2 | PC | 60 | L |
| 8. | P23CEM205 | 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 CEM Students and Staff, COE

| P23CEM201 | ADVANCED CONSRUCTION TECHNIQUES | 3 | 0 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|

**COURSE OUTCOMES**

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

| | |
|---|---|
| CO1 | Assess advanced substructure construction techniques to determine their suitability for various conditions |
| CO2 | Implement innovative superstructure construction strategies for complex structures |
| CO3 | Design and execute advanced and innovative construction methods for specialized structures |
| CO4 | Evaluate the rehabilitation and strengthening techniques for structural sustainability |
| CO5 | Formulate a strategic demolition using a sustainable demolition techniques. |

**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 | 3 | 2 | 3 | 3 |
| CO2 | 2 | 3 | 2 | 3 | 3 |
| CO3 | 2 | 3 | 2 | 3 | 3 |
| CO4 | 2 | 3 | 2 | 3 | 3 |
| CO5 | 2 | 3 | 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: SUBSTRUCTURE CONSTRUCTION** **9Hrs.**

Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement – Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

**UNIT –II: SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS** **9 Hrs.**

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- Aerial transporting – Handling and erecting lightweight components on tall structures.

**UNIT –III: CONSTRUCTION OF SPECIAL STRUCTURES** **9Hrs.**

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, and sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

**UNIT –IV:REHABILITATION AND STRENGTHENING TECHNIQUES** **9Hrs.**

Seismic retrofitting - Strengthening of beams, columns, slab and masonry wall - Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

**UNIT –V:DEMOLITION** **9 Hrs.**

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

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

**REFERENCE BOOKS:**


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




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| P23CEM202 | RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION | 3 | 0 | 0 | 2 | 4 |
|---|---|---|---|---|---|---|

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Explain resource identification, personnel planning, material management, labor scheduling, and cost control. |
| CO2 | Analyze labour management strategies and resource utilization techniques. |
| CO3 | Determine the appropriate time of purchase, sources, transportation, and selection of equipment based on cost and time optimization. |
| CO4 | Evaluate time and cost management techniques to improve project efficiency. |
| CO5 | Develop resource levelling, smoothing, loading, and value management strategies using computational tools. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 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: RESOURCE PLANNING** **9 Hrs.**

Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.

**UNIT –II: LABOUR MANAGEMENT** **9 Hrs.**

Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour- Productivity analysis for labour.

**UNIT –III: MATERIALS AND EQUIPMENT MANAGEMENT** **9 Hrs.**

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution.
Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.

**UNIT –IV: TIME AND COST MANAGEMENT** **9 Hrs.**

Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control-Fast track construction.

**UNIT –V: RESOURCE ALLOCATION CONCEPTS** **9 Hrs.**

Time-cost trade off, Computer application – Resource levelling, resource smoothing resource list, resource allocation, Resource loading, Cumulative cost –Value Management.

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

**REFERENCE BOOKS:**


1. S. Keoki Sears, Glenn A. Sears, Richard H. Clough, Jerald L. Rounds, Robert O. Segner "Construction Project Management", 6th Edition, John Wiley & Sons Inc., New Jersey, 2015.
2. K. K. Chitkara., "Construction Project Management Planning, Scheduling and Controlling", 4th edition, Tata McGraw-Hill Education, 2019.
3. Harvey, A. Levine, "Project Management using Micro Computers", Obsome McGraw Hill C.A. Publishing Co., Inc. 2008.
4. Andrew Whyte, "Integrated Design and Cost Management for Civil Engineers", CRC Press, 2014
5. https://nptel.ac.in/courses/105105161/


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| P23CEM203 | CONSTRUCTION EQUIPMENT AND MANAGEMENT | 3 | 0 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Understand the functions of equipment operations. |
| CO2 | Understand the functions of various earthwork equipment selections. |
| CO3 | understand the construction methods involved in sub structure and super structure construction |
| CO4 | interpret a suitable equipment for concreting works |
| CO5 | understand the various equipment management techniques |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 2 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 |
| 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: CONSTRUCTION EQUIPMENT SELECTION** **9Hrs.**

Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.

**UNIT –II: EQUIPMENT FOR EARTHWORK** **9 Hrs.**

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment

**UNIT –III: OTHER CONSTRUCTION EQUIPMENT** **9Hrs.**

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.

**UNIT –IV: ASPHALT AND CONCRETING EQUIPMENT** **9Hrs.**

Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.

**UNIT –V:CONSTRUCTION EQUIPMENT MANAGEMENT** **9 Hrs.**

Identification – Planning - Equipment Management in Projects - Maintenance Management –Replacement – Equipment Productivity Analysis-Cost Control of Equipment – Depreciation Analysis – Safety Management

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

**REFERENCE BOOKS:**


1. Peurifoy R.L., "Construction Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2018.
2. Sharma S.C., "Construction Equipment and Management", 5th Edition, Khanna Publishers, New Delhi, 2019..
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2010.


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| P23CEM509 | CONTRACT LAWS AND REGULATIONS | 3 | 0 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Analyze the functions and elements of contracts in engineering, understand their significance in project execution, and evaluate the different types of contracts used in the construction industry. |
| CO2 | Critically assess the tendering process, including the preparation, evaluation, and analysis of technical and financial aspects of tender documents. |
| CO3 | Evaluate the role of arbitrators in resolving disputes within construction contracts, understanding their appointment, duties, and powers, andsynthesize strategies to manage potential violations and contract breaches effectively. |
| CO4 | Apply tax regulations and contractual clauses in construction projects, and assess the legal requirements for local government approvals. |
| CO5 | Interpret and assess various labor laws applicable to the construction industry, ensuring compliance with legal regulations related to worker compensation, minimum wages, child labor, industrial disputes, and maternity benefits. |

**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 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 1 | 2 | 3 | 3 |
| CO4 | 2 | 1 | 2 | 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: CONTRACT AGREEMENTS** **9 Hrs**

Functions of Contracts in engineering- Introduction to Contract agreements, Terms involved in Contract agreements - Elements of Contracts - Types of Contracts – Standard Contract Document - Conditions of Contract-Law of Torts.

**UNIT –II: TENDERING CONCEPTS** **9 Hrs**

Tendering Process - tender documents – requirements for tendering –Methods of inviting tenders-Evaluation of Tender from Technical, financial aspects – Two Cover System- Preparation of the Documentation- FIDIC conditions of contract

**UNIT –III: APPOINTMENT OF ARBITRATOR** **9 Hrs**

Earnest Money Deposit (EMD) – Security deposits - Arbitrator- appointment of arbitrator-power and duties of arbitrator – dispute review board- Violations – Certificates, Forms, and Schedules – Extension of time and extended stay-Case study.

**UNIT –IV: TYPES OF TAX INVOLVED IN CONSTRUCTION** **9 Hrs**

Potential Contractual Problems – price variation clause – fine and Liquidated Damages – insurance income tax – sales tax – VAT – Legal requirements of planning –Local government approval-Case study.

**UNIT –V: LABOUR LAWS** **9 Hrs**

Indian Contracts Act - Labour laws – workmen compensation act – minimum wages Act – Child labour Act- Industrial dispute Act- Maternity benefit Act – Domestic emerging on misconduct.

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

**REFERENCE BOOKS:**

1. Jimmie Hinze, "Construction Contracts", McGraw Hill, 2010.
2. Joseph T. Bockrath, "Contracts, the Legal Environment for Engineers and Architects", McGraw Hill, 2010
3. John G. Betty., "Engineering Contracts", McGraw Hill, 2003.
4. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", 4th edition, LexisNexis Butterworths India, 2000
5. Saleh A. Mubarak ., "Construction Project Scheduling and Control" 4th Edition, Wiley Publication, 2019
6. 5. http://nptel.ac.in/courses/105105108

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"
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




Civil Engineering Chairperson

| P23CEM204 | CONSTRUCTION MANAGEMENT STUDIO LABORATORY | 0 | 0 | 4 | 0 | 2 |
|---|---|---|---|---|---|---|

***COURSE OUTCOMES***

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

| | |
|---|---|
| CO1 | Prepare quantity take-off and delivery of bid for construction projects. |
| CO2 | Prepare track project report using management software. |
| CO3 | Develop project schedules, monitor the progress of construction activities, and evaluate associated risk factors |

**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**

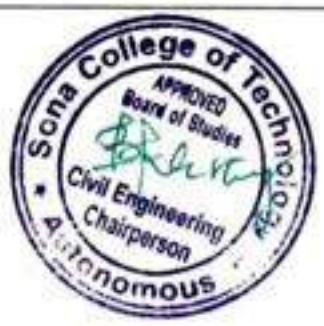
| Direct | | Indirect |
|---|---|---|
| CIE Test I (20)<br>Quiz 1 (5)<br>CIE Test II (20)<br>Quiz 2 (5) | RTPS (10)<br>Total CIE: **60 marks**<br>Semester End Examination: **40 marks** | Course End Survey |

1. Design of a simple equipment information system for a construction project.
2. Quantity take-off, Preparation and delivery of the bid or proposal of an engineering construction project.
3. Scheduling of a small construction project scheduling systems including reports and tracking.
4. Simulation models for project risk analysis.
5. Resource allocation for construction project and levelling of the resources.
6. Monitoring of the construction project, tracking and taking reports

| 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. Carl S Chattfield and Timothy D Johnson, "Microsoft Project 2016 Step by Step", 1st Edition, Pearson Publication, 2016.
3. Daniel L. Williams, Elaine Britt Krazer, "Oracle Primavera P6 Version 8: Project and Portfolio Management", 1st Edition, Packt Publishing Ltd., 2012.



| P23CEM205 | 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 Construction Engineering and Management 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. |
|---|---|---|---|---|

| 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.

**Sona College of Technology, Salem**

**(An Autonomous Institution)**

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

**Branch: Construction Engineering and Management**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Theory courses** | | | | | | | | | | |
| 1. | P23CEM301 | Application of BIM in Construction Management | 3 | 0 | 0 | 2 | 4 | PC | 75 | TP |
| 2. | P23CEM513 | **Elective:** Modern Construction Materials | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 3. | P23CEM516 | **Elective:** Materials Management | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| **Practical courses** | | | | | | | | | | |
| 4. | P23CEM302 | Practical Training | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| 5. | P23CEM303 | 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 CEM Students and Staff, COE

| P23CEM301 | APPLICATION OF BIM IN CONSTRUCTION MANAGEMENT | 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:** | Prepare the schedules, planning and quantity take-off for the BIM model as required. |

**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 | 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 CONSTRUCTION ENGINEERING AND MANAGEMENT** | | | | **9 Hours** |
| Overview of BIM uses for construction management - BIM tools and new workflows of construction planning & management Model-based quantity-take-off and cost estimating - Scheduling and planning with 4D BIM - Construction safety planning using BIM | | | | |
| **Theory: 45 Hrs** | **Tutorial: --** | **Practical: --** | **Project:30 Hrs.** | **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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| P23CEM513 | MODERN CONSTRUCTION MATERIALS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

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

| | |
|---|---|
| **CO1:** | To study the properties and applications of structural materials |
| **CO2:** | To understand the various concepts of non- structural materials. |
| **CO3:** | To study the concepts of composites on FRP |
| **CO4:** | To study the usage of special concretes on construction activities. |
| **CO5:** | To understand the concepts of smart and intelligent materials |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 1 | 3 | 3 |
| CO2 | 3 | 2 | 1 | 3 | 2 |
| CO3 | 3 | 1 | 1 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 1 | 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 01: STRUCTURAL MATERIALS** — **9 Hours**

Wood and Wood Product - Metals - Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminum and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.

**Unit 02: NON-STRUCTURAL MATERIALS** — **9 Hours**

Introduction of Non-Structural Materials and Criteria for Selection - Types and properties of Water Proofing Materials – Types of Non-weathering Materials and its uses – Types of Polymer floor Finishes - Paint - Tiles - Acoustic Treatment materials - Dry Walls - Anchors.

**Unit 03: COMPOSITE** — **9 Hours**

Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FR

**Unit 04: SPECIAL CONCRETES** — **9 Hours**

Concretes. Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

**Unit 05: SMART AND INTELLIGENT MATERIALS** — **9 Hours**

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials

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

**REFERENCE BOOKS:-**


1. R. K. Rajput, Engineering Materials, S. Chand & Company
2. Ganapathy, C., Modern Construction Materials, Eswar P
3. N.Subramanian ,"Building Materials Testing and Sust er Education, 2019..
4. http://nptel.ac.in/downloads/105106053


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| P23CEM516 | MATERIALS MANAGEMENT | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

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

| | |
|---|---|
| **CO1:** | Describe the different types of materials and its identification for its usage |
| **CO2:** | Discuss about the material organizing and purchasing |
| **CO3:** | Explicate the material supply and demand |
| **CO4:** | Expound the material storage management |
| **CO5:** | Deliberate the causes of wastage of materials |

**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)<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: MATERIAL CLASSIFICATION** — **9 Hours**

Material Classification- Organizing for materials management – basis for forming organizations – conventional and modern approaches to organizing materials management. Materials identification – classifying of materials – codification of materials – standardization – simplification and variety reduction of materials

**Unit 02: MATERIAL PURCHASING** — **9 Hours**

Material Purchasing– Planning Purchasing Materials – Norms of Vendor Rating – Cei Methodology – Material Selection and Development – Purchasing Procedures and Methods – Legal Aspects – Insurance of Materials.

**Unit 03: PROCUREMENT MANAGEMENT** — **9 Hours**

Supply Management – Sources of Supply – Out Sourcing Material Management- Procurement Organization - Procurement Planning - Functions of Material Management - Inventory Control.

**Unit 04: STORE MANAGEMENT** — **9 Hours**

Storing of Materials-Management of stores – location – different types of stores – methods of storing – safety and security of materials – stores equipment – materials handling equipment – factors affecting materials handling

**Unit 05: WASTE MANAGEMENT** — **9 Hours**

Scrap & Obsolete Materials-Management of surplus obsolete and scrap materials – reasons for accumulation of surplus obsolete and scrap materials – methods of disposal – regulations and procedures

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

**REFERENCES**


1. Datta .A.K, "Materials Management: Procedures, Text and Cases", PHI Learning Pvt. Ltd., 2004.
2. Arnold, "Introduction To Materials Management", Pearson Education India,2017
3. A.K.Chitale, R.C.Gupta , "Materials Management", Prentice hall India learning private limited, 2014.
4. Richard J. Tersine, "Modern Materials Management", John Ha[illegible] 2007
5. Gopalakrishnan ,P, "Handbook of Materials Management", PHI Learning Pvt. Ltd., 2015

| P23CEM302 | 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 Construction Engineering. |

**CO/PO, PSO Mapping**

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

| COs | Programme Outcomes (POs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 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**

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| P23CEM303 | 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) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| 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.**

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**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. |
|---|---|---|---|---|