DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

M.E. (CONSTRUCTION ENGINEERING AND MANAGEMENT)
(Full-Time) & (Part-Time)
(Choice Based Credit System)

CURRICULAM AND SYLLABI BASED ON R-2019

MEETING OF
BOARD OF STUDIES IN CIVIL AND STRUCTURAL ENGINEERING
HELD ON
09.11.2018
DEPARTMENT OF CIVIL & STRUCTURAL ENGINEERING

VISION

To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

MISSION

M1: To provide quality education and knowledge base to the students in structural engineering.
M2: To prepare the students as nationally competitive and trend setters for the future generation in the realm of technical education.
M3: To assimilate the available theories, explore new frontiers, to propound new theories which will result in improving the quality of the life of the student community.
M4: To develop personality of the students in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research.
M5: To provide service to the university, engineering profession, and the public through consultancy services.

M.E. (CONSTRUCTION ENGINEERING AND MANAGEMENT)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

<table>
<thead>
<tr>
<th>PEO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PEO1</td>
<td>To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the domain, feeding the needs of global expectations with professional competence.</td>
</tr>
<tr>
<td>PEO2</td>
<td>To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for professional jobs, research assignment or self-employment.</td>
</tr>
<tr>
<td>PEO3</td>
<td>To demonstrate their ability to deal effectively with ethical and professional issues, taking into account the broader societal implications.</td>
</tr>
<tr>
<td>PEO4</td>
<td>To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue higher studies.</td>
</tr>
</tbody>
</table>

M.E. (CONSTRUCTION ENGINEERING AND MANAGEMENT)

PROGRAMME OUTCOMES (POs)

<table>
<thead>
<tr>
<th>PO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td><strong>Engineering knowledge:</strong> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
<tr>
<td>PO2</td>
<td><strong>Problem analysis:</strong> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first</td>
</tr>
</tbody>
</table>
- **PO3** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

- **PO4** Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

- **PO5** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

- **PO6** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- **PO7** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- **PO8** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- **PO9** Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **PO10** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO11** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

- **PO12** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

<table>
<thead>
<tr>
<th>Mapping PO with PEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
</tr>
<tr>
<td>PEO1</td>
</tr>
<tr>
<td>PEO2</td>
</tr>
<tr>
<td>PEO3</td>
</tr>
<tr>
<td>PEO4</td>
</tr>
</tbody>
</table>
# M.E (CONSTRUCTION ENGINEERING AND MANAGEMENT) (FULL TIME)

## COURSES OF STUDY AND SCHEME OF EXAMINATIONS

### SEMESTER I

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CZCMPC11</td>
<td>PC - I</td>
<td>Construction Project Management</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CZCMPC12</td>
<td>PC - II</td>
<td>Quality control and Assurance in construction</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CZCMPE13</td>
<td>PE - I</td>
<td>Program Elective-I</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CZCMPE14</td>
<td>PE - II</td>
<td>Program Elective-II</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CZCMMC15</td>
<td>MC</td>
<td>Research methodology and IPR.</td>
<td>2</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>CZCMCP16</td>
<td>CP - I</td>
<td>Construction Project Management Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>CZCMCP17</td>
<td>CP-II</td>
<td>Advanced Concrete Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>CZCMAC18</td>
<td>Audit 1</td>
<td>Audit Course–1</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>205</td>
<td>495</td>
<td>700</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CZCMPC21</td>
<td>PC - III</td>
<td>Safety in Construction</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CZCMPC22</td>
<td>PC - IV</td>
<td>Construction Equipment and Management</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CZCMPE23</td>
<td>PE - III</td>
<td>Program Elective-III</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CZCMPE24</td>
<td>PE - IV</td>
<td>Program Elective-IV</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CZCMCP25</td>
<td>CP - III</td>
<td>Model Testing Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CZCMCP26</td>
<td>CP - IV</td>
<td>Numerical Analysis Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>CZCMTS27</td>
<td>TS</td>
<td>Industrial Training and Seminar/ Mini project</td>
<td>-</td>
<td>Tr</td>
<td>S</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>CZCMAC28</td>
<td>Audit 2</td>
<td>Audit Course– 2</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>220</td>
<td>480</td>
<td>700</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SEMESTER III

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CZCMPE31</td>
<td>PE - V</td>
<td>Program Elective- V</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CZCMOE32</td>
<td>OE</td>
<td>Open Elective</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CZCMPV33</td>
<td>PV-I</td>
<td>Project work and Viva-Voce Phase 1</td>
<td>-</td>
<td>Pr</td>
<td>S</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>90</td>
<td>210</td>
<td>300</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>CZCMPV41</td>
<td>PV-II</td>
<td>Project work and Viva-Voce Phase II</td>
<td>-</td>
<td>Pr</td>
<td>S</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:**
- **PC**: Program core
- **MC**: Mandatory learning Course
- **PE**: Program Elective
- **AC**: Audit Course
- **OE**: Open Elective
- **PV**: Project work and Viva voce
- **CP**: Core Practical
- **EC**: Branch code
- **TS**: Industrial Training and Seminar
- **CS**: ME Specialisation code

**Keys:**
- **L**: Lecture
- **P**: Practical
- **T**: Thesis
- **CA**: Continuous Assessment
- **FE**: Final Examination
## M.E (CONSTRUCTION ENGINEERING AND MANAGEMENT)  
(PART TIME)  
COURSES OF STUDY AND SCHEME OF EXAMINATIONS

### SEMESTER – I

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCM PC11</td>
<td>PC - I</td>
<td>Construction Project Management</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPC11</td>
</tr>
<tr>
<td>2</td>
<td>PCZCM PC12</td>
<td>PC - II</td>
<td>Quality control and Assurance in construction</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPC12</td>
</tr>
<tr>
<td>3</td>
<td>PCZCM MC13</td>
<td>MC</td>
<td>Research methodology and IPR.</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>2</td>
<td>CZCMMC15</td>
</tr>
<tr>
<td>4</td>
<td>PCZCM CP14</td>
<td>CP - I</td>
<td>Construction Project Management Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
<td>CZCMCP16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>115</td>
<td>285</td>
<td>400</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER – II

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCM PC21</td>
<td>PC - III</td>
<td>Safety in Construction</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPC21</td>
</tr>
<tr>
<td>2</td>
<td>PCZCM PC22</td>
<td>PC - IV</td>
<td>Construction Equipment and Management</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPC22</td>
</tr>
<tr>
<td>3</td>
<td>PCZCM PC23</td>
<td>CP - II</td>
<td>Advanced Concrete Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
<td>CZCMCP17</td>
</tr>
<tr>
<td>4</td>
<td>PCZCM CP24</td>
<td>CP-III</td>
<td>Model Testing Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
<td>CZCMCP25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>130</td>
<td>270</td>
<td>400</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SEMESTER – III

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in M.E. Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCM PE31</td>
<td>PE - I</td>
<td>Program Elective-I</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPE13</td>
</tr>
<tr>
<td>2</td>
<td>PCZCM PE32</td>
<td>PE - II</td>
<td>Program Elective-II</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPE14</td>
</tr>
<tr>
<td>3</td>
<td>PCZCM CP33</td>
<td>CP - IV</td>
<td>Numerical Analysis Lab</td>
<td></td>
<td></td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
<td>CZCMCP26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>90</td>
<td>210</td>
<td>300</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER – IV

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in M.E. Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCM PE41</td>
<td>PE - III</td>
<td>Program Elective-III</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPE23</td>
</tr>
<tr>
<td>2</td>
<td>PCZCM PE42</td>
<td>PE - IV</td>
<td>Program Elective-IV</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPE24</td>
</tr>
<tr>
<td>3</td>
<td>PCZCM TS43</td>
<td>TS</td>
<td>Industrial Training and Seminar/Mini project</td>
<td>Tr</td>
<td>S</td>
<td></td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
<td>CZCMTS27</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>90</td>
<td>210</td>
<td>300</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER – V

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in M.E. Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCM PE51</td>
<td>PE - V</td>
<td>Program Elective-V</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMPE31</td>
</tr>
<tr>
<td>2</td>
<td>PCZCM OE52</td>
<td>OE</td>
<td>Open Elective</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>3</td>
<td>CZCMOE32</td>
</tr>
<tr>
<td>3</td>
<td>PCZCM PV53</td>
<td>PV-1</td>
<td>Project work and Viva-Voce Phase 1</td>
<td>Pr</td>
<td>S</td>
<td></td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>10</td>
<td>CZCMPV33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>90</td>
<td>210</td>
<td>300</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SEMESTER – VI

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Category</th>
<th>Course Description</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
<th>Equivalent course code in M.E. Full time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PV61</td>
<td>PV-2</td>
<td>Project work and Viva-Voce Phase II</td>
<td>-</td>
<td>Pr</td>
<td>S</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>15</td>
<td>CZCMPV41</td>
</tr>
</tbody>
</table>

**Total** | 40 | 60 | 100 | 15 |

### LIST OF PROGRAM ELECTIVES (PE)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Program Electives</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCMPESC</td>
<td>Forensic Engineering and Retrofitting of Structures</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PCZCMPESC</td>
<td>System Integration in Construction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PCZCMPESC</td>
<td>Project Formulation and Appraisal</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PCZCMPESC</td>
<td>Contract Laws and Regulations</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PCZCMPESC</td>
<td>Construction Economics and Finance Management</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PCZCMPESC</td>
<td>Resource Management and Control in Construction</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PCZCMPESC</td>
<td>Construction Planning, Scheduling and Control</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>PCZCMPESC</td>
<td>Advanced topics in Acoustics, Lighting and Ventilation</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>PCZCMPESC</td>
<td>Information Technology for Construction Managers</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>PCZCMPESC</td>
<td>Construction Workplace and Employees Behaviour</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>PCZCMPESC</td>
<td>Advanced Concrete Technology</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>PCZCMPESC</td>
<td>Analytical and Numerical Methods for Construction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>PCZCMPESC</td>
<td>Computer Application in Construction Engineering and Planning</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>PCZCMPESC</td>
<td>Advanced Construction Methods for Special Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

### LIST OF OPEN ELECTIVES (OE)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Course Code</th>
<th>Open Electives</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCZCMOESC</td>
<td>Geographic Information System in Construction Engineering and Management</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PCZCMOESC</td>
<td>Shoring, Scaffolding and Formwork</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PCZCMOESC</td>
<td>Value Engineering and Valuation</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PCZCMOESC</td>
<td>Energy Conservation Techniques in building Construction</td>
<td>3</td>
</tr>
<tr>
<td>Sl.No</td>
<td>Course Code</td>
<td>Audit Courses</td>
<td>Credits</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>----------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>5</td>
<td>CZCMOESC</td>
<td>Composite Construction</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CZCMOESC</td>
<td>Advanced Construction Engineering Techniques</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>CZCMOESC</td>
<td>Prefabricated Structures</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>CZCMOESC</td>
<td>Public Health Engineering Structures</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>CZCMOESC</td>
<td>Research Methodology</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>CZCMOESC</td>
<td>Construction Personnel Management</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>CZCMOESC</td>
<td>Industries Organizational Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

### LIST OF AUDIT COURSES (AC)

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Course Code</th>
<th>Audit Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CZMACSC</td>
<td>English for Research paper writing</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CZMACSC</td>
<td>Disaster management</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CZMACSC</td>
<td>Sanskrit for Technical knowledge</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CZMACSC</td>
<td>Value education</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CZMACSC</td>
<td>Constitution of India</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CZMACSC</td>
<td>Pedagogy Studies</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CZMACSC</td>
<td>Stress Management by Yoga</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CZMACSC</td>
<td>Personality development through Life enlighten skills</td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES:
- To understand the concept of Project management planning on construction projects
- To manage the project team, defining roles and responsibilities and fixing scope of the project
- To know the time management of a construction project by proper scheduling using PERT, CPM, RPM, etc. Apply excel, MSP, PRIMAVERA, Construction manager and other softwares to solve construction problems.
- To learn about project controlling
- To study the site mobilization, material and labor management

Basics of Management
Introduction to construction industries, concepts and need of management in construction.
Modern scientific management, Management Functions, Management Styles.

Construction Project Planning
Project life cycle, identification, preparation, appraisal, detailed planning, implementation, Project delivery system, Leadership and motivation for the project team - effect of project risk on organization role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management, monitoring and control.

Project Scheduling
Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modelling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).

Project Controlling
Monitoring and Control, Crashing, Resource Levelling, Updating.

Construction Management

REFERENCES:
3. Charles Patrick, Construction Project Planning & Scheduling, Pearson, 2012

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Have an idea about the concept of Project management planning on construction projects
2. Understand the roles and responsibilities in project planning.
3. Find project duration and optimize the time and minimize the cost implement resource allocation and.
4. Understand the control techniques plan and implement
5. Know about site mobilization, material and labor management
<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

**CZCMPC12 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION**

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**
- To know the quality plan and performance factors influencing construction quality
- To provide a basic information about quality Management Guidelines
- To know the quality planning and taguchi’s concept-codes
- To examine the quality assurance, appraisals and quality control by reliability testing.
- To find out how the quality techniques can be improved.

**Introduction**
Definition-Concept of quality-meaning of quality-design-conformance-performance-dimensions-factors influencing construction quality.

**Quality Management**
Fundamentals of quality management—function-inspection, control and enforcement-quality management system and method-quality circle-total quality management-quality management guidelines-responsibilities and authority

**Quality Planning**
Quality policy, objectives and methods—consumers’ satisfaction-time completion—documents-process and products—quality cost—Taguchi’s concept-codes and standards

**Quality Control and Assurance**
Objectives of quality control—appraisals—needs and techniques of quality control—critical, major failure aspects-failure mode and effect analysis-statistical process control-quality systems-quality audit—responsibilities and authorities in quality control and assurance

**Quality Improvement Techniques**
Selection of new materials—influencing drawings, detailing, specification, standardization-bid preparation—construction activity, environmental safety, social and environmental factors-natural causes and speed of construction-life cycle costing—value engineering and value analysis.

**REFERENCES:**
4. *International Standards Organization—ISO 9001 and ISO 9004*

**COURSE OUTCOMES:**
- At the end of the course, Student will be able to
  1. Understand the concept of quality plan
  2. Learn about quality Management Guidelines
  3. Use taguchi’s concept-codes and standards
  4. Know quality assurance, appraisals and quality control by reliability testing
  5. Implement the quality improvement techniques
COURSE OBJECTIVES:

- To study the research problem and formulation.
- To Analyze the Plagiarism and Research ethics.
- To Know about Preparation of research proposal.
- To understand about Patenting.
- To learn about IPR.

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.


New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

COURSE OUTCOMES

At the end of the course, Student will be able to
1. Understand research problem formulation.
2. Analyze the Plagiarism and Research ethics.
3. Explain about Preparation of research proposal.
4. Learn about Patenting.
5. Understand IPR.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMCP16 | CONSTRUCTION PROJECT MANAGEMENT LABORATORY | L | T | P | C |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To study the quantity take off, preparation and delivery of the bid.
- To learn about the simple equipment information.
- To prepare proper scheduling for a small construction project using primavera.
- To prepare proper scheduling for a small construction project using tools like MS project.
- To analyse and study the project risk.

LIST OF EXPERIMENTS
1. Quantity take off, preparation and delivery of the bid or proposal of an Engineering construction project.
2. Design of a simple equipment information system of an Engineering construction project.
3. Scheduling of a small construction project using primavera Scheduling system including reports and tacking.
4. Scheduling of a small construction project using tools like MS project Scheduling system including reports and tacking.
5. Simulation models for project risk analysis.

REFERENCES:
5. Using PRIMAVERA and MS PROJECT software

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Know about the Preparation and delivery of the bid or proposal of an Engineering construction project.
2. Learn about the Design of a simple equipment information system.
3. Understand the Computer application of using primavera scheduling system including reports and tacking.
4. Understand the Computer application of using primavera Scheduling system including reports and tacking.
5. Analyse the models for projects risk.
Course Outcome | Mapping with Programme Outcomes
--- | ---
CO1 | ✓ ✓ ✓ ✓ ✓ ✓
CO2 | ✓ ✓ ✓ ✓ ✓ ✓
CO3 | ✓ ✓ ✓ ✓ ✓ ✓
CO4 | ✓ ✓ ✓ ✓ ✓ ✓
CO5 | ✓ ✓ ✓ ✓ ✓ ✓

<table>
<thead>
<tr>
<th>CZCMCP17</th>
<th>ADVANCED CONCRETE LABORATORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

COURSEOBJECTIVES:
- To Design high grade concrete and study the parameters affecting its performance.
- To study Non Destructive Tests on existing concrete structures.
- To understand engineering principles and behaviour of structural/ elements.
- To learn about the cyclic load testing.
- To learn about the durability tests on concrete.

LIST OF EXPERIMENTS
1. Concrete mix design by ACI, IS and BS methods.
2. Use of water reducing admixtures.
3. Use of acceleration/retarding admixtures in concrete.
4. Non-destructing testing methods-use of rebound hammer and ultrasonic pulse velocity tester.
5. Preparation of reinforcement grill and casting of RCC beams (under-reinforced and over reinforced) and RCC columns.
6. Testing of reinforcement (mild steel, HYSD and High Tensile) and prestressing strands.
7. Testing of masonry specimen (as per IS 1905).
8. Test on clear specimen of timber.
10. Methods of sampling of construction material (as per IS code)

REFERENCES:
2. Concrete technology, Shetty M.S., Chand and Co., 2006.
3. Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262-2019& 456-2000, DOE method
4. IS 9103.1999 specification for concrete admixtures
5. Testing of masonry specimen as per IS 1905
8. Methods of sampling and analysis of concrete as per IS 1199.

COURSE OUTCOMES:
At the completion of the course students will be able to
1. Design high grade concrete and study the parameters affecting its performance.
2. Conduct Non Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behaviour of structural/ elements.
4. Know about the cyclic load testing.
5. Know about the durability tests on concrete.
### Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER - II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZCMPC21</td>
<td>SAFETY IN CONSTRUCTION</td>
<td>3 0 0 3</td>
</tr>
</tbody>
</table>

### COURSE OBJECTIVES:
- To Know about Accidents and their Causes and Legal Implications.
- To provide an information about duties and responsibilities of construction management.
- To study about the safety in constructions and their applications.
- To Understand the Various Safety Equipment And Gear Used On Site.
- To learn about the safety policies.

**Construction Accidents**

**Construction Safety Management**
- Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

**Safety in Construction Operations**
- Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. Explosives used.

**Various Safety Equipment And Gear Used On Site**
- First aid on site, Safety awareness program. Labour laws, legal requirement and cost aspects of accidents on site, Incentive for safety practices.

**Study of Safety Policies**
- Methods, equipment, training provided on any ISO approved construction Company, safety in office, working on sites of high rise construction, deep excavation.

### REFERENCES:
 COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Know about Accidents and their Causes and Legal Implications.
2. Gain knowledge about duties and responsibilities of construction management.
3. Learn about the safety in and their applications.
4. Manage the Various Safety Equipment And Gear Used On Site.
5. Summarize the safety policies, methods equipment’s, training provided on any ISO approved construction company.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMPC22 | CONSTRUCTION EQUIPMENT AND MANAGEMENT  | L | T | P | C |
|            |                                             | 3 | 0 | 0 | 3 |

COURSEOBJECTIVES:
- To know about the equipment in construction projects and its cost.
- To learn about construction equipment management.
- To provide an information about soil identification, earth moving technique and equipment’s.
- To understand the working principles of construction Equipment’s.
- To study about the method of scheduling.

Construction Equipment Cost

Construction Equipment Management

Equipment for Earthwork

**Equipment for Other Works**

Production of Aggregate, Concrete, and Asphalt Mixes - Production of Aggregate - Crushers – Feeders - Screening Equipment - Handling Equipment. Production of Concrete - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment - Production of Asphalt Mixes – Problems. Paving and Surface Treatments- Concrete Paving –Asphalt Paving and Surface Treatments - Pavement Repair and Rehabilitation - Problems. Compressed Air and Water Systems - Introduction –Compressed Air Systems - Water Supply Systems – Problems. Drilling, Blasting And Tunnelling Equipment- Definition of terms, bits, Jackhammers, Drifters, wagon drills, che drills, piston drills, blast hole drills, shot drills, diamond drills, tunnelling equipment, selecting the drilling method equipment; selecting drilling pattern; Rates for drilling rock, compressors. Pile driving equipment: Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.

**Equipment Scheduling**


**REFERENCES:**


**COURSE OUTCOMES:**

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

1. Manage the equipment, cost control and maintenance of a project.
2. Identify and understand the working principle of earthwork equipment’s.
3. Identify and understand the working of various equipment’s for different construction process.
4. Identify and understand the working principle of material handling equipment’s.
5. Understand the concept of scheduling.
CZCMCP31

MODEL TESTING LABORATORY

L | T | P | C
---|---|---|---
0 | 0 | 3 | 2

**COURSE OBJECTIVES:**
- To know the dynamic properties.
- To study dynamics response of single degree freedom system using fundamental theory and equation of motion.
- To study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
- To know the available software for dynamic analysis.
- To understand the basic concept of special topics in structural dynamics.

**LIST OF EXPERIMENTS:**
1. Response of structures and its elements against extreme loading events.
2. Model testing: static-testing f plates, shells, and frames models.
4. Beams vibrations, vibration isolation, shear wall building model, time and frequency-domain study, vibration characteristics of RC beams using piezoelectric sensors etc.

**REFERENCES:**
1. Dynamics of structures, Clough R.W and penzien J., McGraw Hill
2. Dynamics of structures, Hard and wong
3. Dynamics of structures- Humar J.L., Prentice Hall
5. IS 875-5(1987) code of ratice for design loads
6. IS 1893-2016- earthquake laods

**COURSE OUTCOMES:**
At the end of the course, Student will be able to
1. Understand the dynamic properties.
2. Analyze dynamics response of single degree freedom system using fundamental theory and equation of motion.
3. Analyze dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
4. Use the available software for dynamic analysis.
5. Gain knowledge about the basic concept of special topics in structural dynamics.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES:

- To find roots of nonlinear equations by bisection method and newton’s method.
- To know curve fitting by least square approximations.
- To study the system of linear equations using gauss-elimination/gauss-Seidal Iteration/ gauss-Jorden method.
- To integrate using trapezoidal and Simpson’s rules.
- To find the numerical solution of ordinary differential equations by Euler’s method, Runge-kutta method.

LIST OF EXPERIMENTS:

1. Find the roots of Non-Linear Equation Using Bisection methods.
2. Find the roots of Non-Linear Equation Using Newton’s methods.
3. Curve fitting by least square approximation
4. Solve the system of Linear Equation Using Gauss-elimination Method.
5. Solve the system of Linear Equation Using Gauss-seidal iteration Method.
7. Integrate numerically using Trapezoidal rule.
8. Integrate numerically using Simpson’s rule.

COURSE OUTCOMES:

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

1. Understand roots of non linear equations by bisection method and newton’s method.
2. Do curve fitting by least square approximations.
4. Integrate numerically using trapezoidal and simpson’s rules.
5. Solve the numerical solution of ordinary differential equations by Euler’s method, Runge-kutta method.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:

- To study the response of structures.
- To understand the models.
- To know about model testing for static loading
- To know about model testing for free and forced vibrations
- To learn about Evaluation of dynamic modulus
The students individually undergo a training program in reputed concerns in the field of Construction Engineering and Management during the summer vacation (at the end of second semester for full – time / fourth semester for part – time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training he had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

**COURSE OUTCOMES:**
At the end of the course, student will be able to:
1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading.
4. Conduct model testing for free and forced vibrations.
5. Evaluate of dynamic modulus.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

**SEMESTER III**

**CZCMPE31 MORDERN CONSTRUCTION MATERIALS**

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZCMPE31</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**
- To identify the various types of concretes and their constituents and properties.
- To provide information about various types of metals, their properties and applications.
- To learn various composite materials, their properties and applications.
- To know the concept of water-proofing and identify the purpose of flooring and façade materials.
- To analyse smart intelligent buildings.

**Special Concretes**
Concrete, 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

**Metals**

**Composites**
Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP- Cellular Cores – Geosynthetics-. Polymers - Fibre reinforced plastic in sandwich panels – Adhesives and sealants. Structural elastomeric bearings, Moisture barriers Applications in civil engineering.

**Other Materials**
Smart and Intelligent Materials

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

REFERENCES:

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Understand the various types of concretes and their constituents and properties.
2. Identify the various types of metals, their properties and applications.
3. Identify the various composite materials, their properties and applications.
4. Use the concept of water-proofing and identify the purpose of flooring and façade materials.
5. Design and develop smart intelligent buildings.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMPV33 | PROJECT WORK AND VIVA-VOCE PHASE I | L | Pr | S | C
|---------|-----------------------------------|----|----|---|---
|        0 | 16 4 10                           |    |    |   |   |

COURSE OBJECTIVES:
- To study structural engineering problems reviewing available literature.
- To study different techniques used to analyze complex structural systems.
- To evaluate given and present solution by using his/her technique applying engineering principles.
- To learn about contemporary / emerging technology.
- To manage effectively in oral and written form and formulate documents.

The student individually works on a specific topic approved by the Head of the Department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical 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.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
1. Identify structural engineering problems reviewing available literature.
2. Understand different techniques used to analyze complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.
4. Understand of contemporary / emerging technology.
5. Share knowledge effectively in oral and written form and formulate documents.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

SEMESTER IV

CZCMPV41 PROJECT WORK AND VIVA-VOCE PHASE -II

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
<td>16</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:

- To learn about the final report of project work in standard format
- To study about knowledge and skills in-depth and execution of new technical problem.
- To analyze suitable research design from different methodologies.
- To present the findings of their technical solution in a written report.
- To provide an information about presenting the work in International/National conference or reputed journals.

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. 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.

COURSE OUTCOMES:

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

1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. Find technical solution in a written report.
5. Present the work in International/National conference or reputed journals.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES:

- To know about Durability criteria of concrete structures.
- To find out the methods of investigation and Diagnosis of concrete structures.
- To examine about the repair materials.
- To provide an information about the strategies for repair and retrofitting of structures.
- To evaluate protection techniques of structures.

Durability and Deterioration of Concrete


Investigation and Diagnosis


Repair Materials


Refurbishment Techniques

Routing and Sealing - Stitching - External Stressing - Resin Injection - Grouting - Blanketing - Overlays - Sprayed Concrete - Prepacked Concrete – Dry packing - Jacketing - Plate Bonding

Protection Techniques

Protective Coatings - Autogenous Healing - Vacuum Impregnation - Chloride Extraction - Realkalization of Concrete - Cathodic Protection.

REFERENCES:

7. R.N. Raikar, Diagnosis and Treatment of Structures in Distress, Structwel, D & C Pvt. Ltd.

COURSE OUTCOMES:

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

1. Understand the concepts of durability criteria.
2. Investigate the methods and Diagnosis of concrete structures.
3. Know about the repair materials.
5. Know the protection techniques of structures.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CZCMPEXX</th>
<th>SYSTEM INTEGRATION IN CONSTRUCTION ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYSTEM INTEGRATION IN CONSTRUCTION ENGINEERING</td>
</tr>
</tbody>
</table>

COURSEOBJECTIVES:
- To introduce the basics of structural integration and systems.
- To learn about the environmental factors and its relevant structural integration.
- To know the services regarding plumbing and electricity.
- To study the maintenance techniques and the materials involved.
- To understand the safety and preventive systems.

Structural Integration

Environmental Factors

Maintenance
  Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance – Feasibility for replacement of damaged components – equal life elemental design – maintenance free exposed and finished surfaces.

Safety
  Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution.

REFERENCES
COURSE OUTCOMES:
At the end of the course, the student will be able to:
1. Have an idea about the system integration.
2. Understand the influence of environmental factors.
3. Learn about the Plumbing and Electricity services in construction Engineering.
4. Know about the maintenance in construction Engineering.
5. Attain knowledge about the safety systems in construction Engineering.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMPEXX PROJECT FORMULATION AND APPRAISAL

COURSE OBJECTIVES:
- To learn about the formulation,
- To study about the costing of construction projects, appraisal, finance and private sector participation in construction Industry.
- To examine different project appraisal methods.
- To know about project finance.
- To find about Technology Transfer

Project Formulation

Project Costing

Project Appraisal

Project Financing

Private Sector Participation
- Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

REFERENCES:
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992

**COURSE OUTCOMES:**

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

1. Formulate and generate the project and prepare reports for executing the work.
2. Understand the costing and cash flows of a project.
3. Assess various methods of project appraisal.
4. Understand the project financing and special schemes.
5. Know about private sector participation in Infrastructure Development Projects

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**

- To introduce types of contract- Indian contract and International contract.
- To find out the Powers and Duties of Arbitrator.
- To understand about the legal requirements for contracts and construction activities.

**Construction Contracts**


**Tenders**


**Arbitration**


**Legal Requirements**


**Labour Regulations**

REFERENCES:

COURSE OUTCOMES:
At the end of the course, the student will be able to:
1. Identify and understand the types of contract
2. Implement the various processes involved in tenders.
3. Achieve awareness on powers and duty of an arbitrator.
4. Assess the legal requirements and the corresponding government laws.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMPEXX CONSTRUCTION ECONOMICS AND FINANCE MANAGEMENT

<table>
<thead>
<tr>
<th>COURSE OBJECTIVES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• To introduce about the Construction Economics.</td>
</tr>
<tr>
<td>• To study about the Finance management.</td>
</tr>
<tr>
<td>• To find about the financial control and the need of financial management.</td>
</tr>
<tr>
<td>• To evaluate the Accounting for tax reporting purposes and financial reporting purposes.</td>
</tr>
<tr>
<td>• To learn about subcontracting and purchasing</td>
</tr>
</tbody>
</table>

Economics
Interests and time value consideration-depreciation, tax, inflation-lifecycle cost analysis-approached to asset valuation-resource allocation decision for asset management-cost of construction resources-cost of construction, land and administration-contingencies provisions and management

Financing
Need for financial management-types of financing-short term borrowing-long term borrowing-leasing-equity financing-internal generation of funds-external commercial borrowing-assistance from government budgeting support and international finance corporation.

Analysis of Finance
Accounting Method
Basics of accounting method - budget and budgeting - site accounts-joint venture, project financial packaging, fund mobilization - accounting for tax reporting purposes and financial reporting purpose.

Lending to Contractors
Loans to contractors-work package breakdown-subcontracting and purchasing.

REFERENCES:

COURSE OUTCOMES:
At the end of the course, the student will be able to:
1. Have an idea about the Construction Economics.
2. Understand Finance management.
3. Analyze the financial control and the need of financial management.
4. Prepare accounting for tax reporting and financial reporting purposes.
5. Know about subcontracting and purchasing.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To introduce the concept of resource planning.
- To know about the resource allocation and leveling techniques in single and multi-projects.
- To study the various Systems approach in resource management.
- To evaluate the resources - material, equipment, labour and time.
- To know about the Skill in management of Time.

Resource Planning

Resource Allocation and Levelling
Time-cost trade of, Computer application in resource leveling examples, resource list, resource allocation graph, Resource loading, Cumulative cost ETC – Value Management.

Resources Management

Materials and Equipment
Time of purchase- Quantity of material- sources- Transportation- Delivery and Distribution. Planning and selecting by optimistic choice with respect to cost- Time- Source and handling.

**Time**

Personnel time- Management and planning - Managing time on the project - forecasting the future - Critical path measuring the changes and their effects.

Cost control: Cash flow and cost control - objectives of cost - Time and Quality.

**REFERENCES:**


**COURSE OUTCOMES:**

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

1. Understand the Resource Planning, Procurement and Identification.
2. Use the resource allocation and leveling techniques in single and multi-projects.
3. Implement various Systems approach in resource management.
4. Assess the resources - material, equipment, labour and time.
5. Manage time on the project and forecasting the future.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C茨CMPEXX</th>
<th>CONSTRUCTION PLANNING, SCHEDULING AND CONTROL</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0 0 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**

- To provide an information about the basic concepts in development of construction planning.
- To evaluate the elements of scheduling and to apply appropriate tools and techniques.
- To study about the monitoring and accounting of projects through cost control.
- To know about the concept of organizing and Use of Project Information.

**Construction Planning**


**Scheduling Procedures**

Scheduling Techniques


Cost Control, Monitoring and Accounting


Organization and Use of Project Information


REFERENCES:


COURSE OUTCOMES:

At the end of the course, the student will be able to:
1. Understand the basic concepts in development of construction planning.
2. Understand the concepts in scheduling procedures.
3. Apply appropriate tools and techniques for scheduling.
4. Gain knowledge about the monitoring and accounting of projects through cost control.
5. Apply the concept of organization and Use of Project Information

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✔</td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
</tr>
</tbody>
</table>

CZCMPEXX ADVANCED TOPICS IN ACOUSTICS, LIGHTING AND VENTILATION

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZCMPEXX</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:

- To examine the effects of acoustics in buildings.
- To analyze the concepts of day lighting and components of daylight factor
- To study about the concept of ventilation and calculation of natural ventilation

Acoustics


**Lighting**


**Ventilation**

Ventilation due to wind – Ventilation due to stack effect – Ventilation due to combined effect – Infiltration – Ventilation of industrial building – Calculation of Natural Ventilation.

Mechanical Ventilation – Examples – Building regulation – Air Conditioning – Summary.

**REFERENCES**


**COURSE OUTCOMES:**

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

1. Learn about the effects of acoustics in buildings.
2. Learn about the design of an auditorium.
3. Understand the concepts of day lighting and components of daylight factor.
4. Understand the concept of ventilation and calculation of natural ventilation.
5. Understand the concept of mechanical ventilation and air conditioning.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**

- To introduce about computer networking and use of network.
- To learn about the Database application in construction industry.
- To study about the role and types of information systems.
- To analyze the development and planning of information systems.
- Know about Computer aided design and issues in information systems.

**Networking and Internet**

Database Application

Creating Database Using MS Access, Tables, Relationships, Queries, Forms, Reports.


Information Systems for Strategic Management


Planning for Information Systems


Emerging Concepts and Issues in Information Systems


REFERENCES:

5. Prasanna Chandra. A management guide to PERT/CPM Project planning, analysis and selection.2011

COURSE OUTCOMES:

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

1. Have an idea about computer networking and use of network.
2. Use database application in construction industry.
3. Implement the role and types of information systems.
4. Identify the development and planning of information systems.
5. Formulate and generate computer aided design and issues in information systems.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping with Programme outcomes</td>
<td>PO1</td>
<td>PO2</td>
<td>PO3</td>
<td>PO4</td>
<td>PO5</td>
</tr>
<tr>
<td>PO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
### COURSE OBJECTIVES:

- To study about the Industrial Health and Psychological problems of Employees.
- To Know about Occupational Stresses.
- To learn about the individual stress factors and career planning.
- To study about the factors influencing personality and emotions.
- To know about formation of Group in organizations and decision making techniques.

### Industrial Health, Safety


### Stress in the Workplace


### Common Stress Factors Time and Career Planning


### Individual Behaviour


### Group Behaviour

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Teambuilding - Interpersonal relations – Communication – Control.

### REFERENCE:

1. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. *Industrial relations and Labour Laws*. Tata

### COURSE OUTCOMES:

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

1. Assess Industrial Health and Psychological problems of Employees.
2. Understand occupational Stresses.
3. Manage individual stress factors and career planning.
4. Solve the factors influencing personality and emotions.
5. Achieve awareness about formation of Group in organizations and decision making techniques.
COURSE OBJECTIVES:
- To learn about the cementitious material and its properties.
- To study mix design for different types of concrete.
- To understand the properties of fresh and hardened concrete.
- To know the special types of concrete.
- To study the various concreting methods.


REFERENCES:

**COURSE OUTCOMES:**
At the end of the course, Student will be able to
1. Understand the cementitious material and its properties.
2. Carry out mix design for different types of concrete.
3. Assess the properties of fresh and hardened concrete
4. Gain knowledge about the special types of concrete
5. Adopt various concreting methods.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✔️</td>
</tr>
<tr>
<td>CO2</td>
<td>✔️</td>
</tr>
<tr>
<td>CO3</td>
<td>✔️</td>
</tr>
<tr>
<td>CO4</td>
<td>✔️</td>
</tr>
<tr>
<td>CO5</td>
<td>✔️</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**
- To introduce basic concepts of numerical methods applicable to construction problems.
- To learn a written computer program for solving a mathematical problem.

**Fundamentals of Numerical Methods:** Error Analysis, Polynomial Approximations and Interpolations,

**Curve Fitting:** Interpolation and extrapolation.

**Solution of Nonlinear Algebraic and Transcendental Equations**

**Elements of Matrix Algebra:** Solution of Systems of Linear Equations, Eigen Value Problems.

**Numerical Differentiation & Integration:** Solution of Ordinary and Partial Differential Equations.

**Finite Difference scheme:** Implicit & Explicit scheme.

**Computer Algorithms:** Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

**REFERENCES:**
3. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India

**COURSE OUTCOMES:**
At the end of the course, students will be able to
1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. Gain the knowledge about the solution of nonlinear equations.
3. Understand the solution of differential equations.
4. Solve the problems using finite difference scheme.
5. Write a program to solve a mathematical problem using software.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>√</td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
</tr>
<tr>
<td>CO3</td>
<td>√</td>
</tr>
<tr>
<td>CO4</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
</tr>
</tbody>
</table>

CZCMPEXX COMPUTER APPLICATION IN CONSTRUCTION ENGINEERING AND PLANNING

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To evaluate Computer aided Cost Estimation.
- To know about the techniques of linear, dynamic and integer programming.
- To learn about Inventory models.
- To study about advanced planning and scheduling concepts.
- To learn about Sequencing problems.

Introduction
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.

Optimization Techniques
Linear, Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.

Inventory Models
Deterministic and Probabilistic Inventory Models - Software applications.

Scheduling Application
PERT and CPM - Advanced planning and scheduling concepts – Computer applications – Case study.

Other Problems
Sequencing problems – Simulation – Enterprises – Introduction to ERP systems.

REFERENCES:

COURSE OUTCOMES:
At the completion of the course, students will be able to
1. Use Computer aided Cost Estimation.
2. Apply the techniques of linear, dynamic and integer programming.
3. Generate inventory models.
4. Understand advanced planning and scheduling concepts.
5. Develop skills on sequencing problems.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

CZCMPEXX ADVANCED CONSTRUCTION METHODS FOR SPECIAL STRUCTURES

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To study about the special structures and their applications.
- To learn about the construction methods of Bridge structures.
- To know about the construction methods of tunnelling and underground structures.
- To analyze the construction methods of marine structures.
- To study about Construction methods and techniques for high-rise buildings and power plant structures.

Introduction
Types of Special Structures: According to - location/environment, design, strength, radiation shielding, shape, aesthetic appearance, type of construction methods and techniques

Bridge Structures
Bridge, steel bridges, arch bridges, cantilever bridges, box girders. Construction of special type of bridges - cable stayed bridge, suspension and pre-stressed bridge. Segmental construction, cantilever construction, incremental construction, successive launching and pushing of box decks.

Underground Structures
Pipe lines, bedding of conduits. Trenchless technology. Tunnelling methods – mechanical boring, cut and cover construction, drilling and blasting, tunnel driving in hard & soft strata and TBM tunnelling. Tunnel forming components, safety in tunnelling operations.


Marine Structures
Off shore structures - beacons, oil drilling platforms, jetties and break water structures. Dredging equipment’s and techniques for construction of channels and islands. Laying operations for built up off-shore system. Underwater concreting using tremie method, underwater construction-problems encountered, caisson well sinking methods – conventional and jack down methods.

High Rise Structures and Power Plant Structures
Construction methods and techniques for high-rise buildings, continuous concreting erection of prefabricated components on tall structures, tunnel form, launching techniques for heavy decks, Slip form, jump form, dry wall technology. Fire fighting and safety. Construction Sequence and methods in Cooling towers, Silos, Chimney.

Energy management - power factor, management of maximum demand, energy savings in(pumps &equipment’s, compressed air systems, fans, lighting system, air conditioning system) construction projects.

REFERENCES:

COURSE OUTCOMES:
At the completion of the course, students will be able to
1. Understand the special structures and their applications.
2. Assess construction methods of Bridge structures.
3. Evaluate the construction methods of tunneling and underground structures.
4. Gain knowledge about the construction methods of marine structures.
5. Get an exposure on construction methods and techniques for high-rise buildings and power plant structures.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

OPEN ELECTIVES

<table>
<thead>
<tr>
<th>CZCMOEXX</th>
<th>GEOGRAPHIC INFORMATION SYSTEM IN CONSTRUCTION ENGINEERING AND MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To provide an information about the application of GIS software in construction projects.
- To Know about Geo reference data and data access.
- To Know about Data structure and Database Management system.
- To learn about Data Quality and its output.

Introduction to GIS

Types of Data

Data Structure
Raster and Vector Data Structure – Raster data storage – Methods of data compression-Run length, Chain and Block Coding – Vector Data Storage – Topology – Topological Models – Arc Node
Structure – Surface Data – DEM – Grid DEM and TIN structure Applications of DEM- Database Management system

**Data Quality and Output**
- Fields of application-construction management Parcel based, AM/FM applications examples – Case study.

**REFERENCES:**

**COURSE OUTCOMES:**
At the end of the course, Student will be able to
1. Understand the application of GIS software in construction projects.
2. Analyze Geo reference data and data access.
3. Gain knowledge about data structure and database management system.
5. Apply in the field for management and from case studies.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COURSEOBJECTIVES:**
- To study the detailed planning of formwork and materials associated with formwork.
- To learn about the design aspects of formwork under various requirements.
- To know the design of forms and shores.
- To evaluate the planning and erection aspects of form work for buildings.
- To know the latest methods of form construction.

**Planning, Site Equipment and Plant for Form Work**
- Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.
Materials Accessories Proprietary Products and Pressures


Design of Forms and Shores

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

Building and Erecting the Form Work

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.

Forms for Domes and Tunnels, Slip Forms and Scaffolds

Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed - Strength requirements - Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles - Types - advantages - Functions of various components - Planning - Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold - Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

REFERENCES:

2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996

COURSE OUTCOMES:

At the end of the course, Student will be able to
1. Have an idea about the detailed planning of formwork.
2. Understand the design aspects of formwork under various requirements.
3. Formulate the design of forms and shores.
4. Identify the planning and erection aspects of form work for buildings.
5. Share knowledge about the latest methods of form construction.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSEOBJECTIVES:
- To provide a basic information about value engineering.
- To learn about the various value analysis.
- To examine different methods of performing value engineering.
- To study about the types, purpose and factors affecting valuation.
- To learn about valuation report.

Value
Value - Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic: identifying reasons or unnecessary costs:

Value Analysis
10 Commandments of value analysis; value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis.

Life Cycle Costing
Life cycle costing – Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis. Different methods of performing value engineering.

Valuation
Types of value, purposes of valuation factors affecting value. Different methods of valuation for different types of assets such as land and building, horticulture, historical places.

Valuation Report
Valuation Report, contents, standard formats, Case study of any one Report.

REFERENCES:
1. Del Younke, Value Engineering: Analysis And Methodology
6. G.S.Birdie, Estimating and Costing
7. CharotarRangwala, Estimating and Costing Published by Publishing House,

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Know about value engineering.
2. Understand the various value analysis.
3. Analyze different methods of performing value engineering.
4. Explain about the types, purpose and factors affecting valuation.
5. Generate valuation report

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSEOBJECTIVES:

- To evaluate energy production systems and energy economic analysis.
- To understand the environmental aspect and resource conservation.
- To introduce smart buildings and energy efficient design strategies.
- To study about the energy efficient and environment friendly building.
- To learn about the concepts of energy management of electrical equipment.

Introduction


Environmental


Design

Natural building design consideration - Energy efficient design strategies – Contextual factors - Longevity and process Assessment –Renewable energy sources and design- Advanced building Technologies - Smart buildings - Economies and cost analysis.

Services


Energy Management


REFERENCES:


COURSE OUTCOMES:

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

1. Have an idea about energy production systems and energy economic analysis.
2. Know the environmental aspect and resource conservation.
3. Share knowledge about smart buildings and energy efficient design strategies.
4. Get an exposure on the energy efficient and environment friendly building.
5. Understand the concepts of energy management of electrical equipment.
COURSE OBJECTIVES:
- To introduce the concept of composite structures and sandwich construction.
- To know about the design of composite members.
- To study about the types and design of connections.
- To know about the design of box girder bridges.
- To find out the seismic behaviour of composite structures.

Introduction

Design of Composite Members
Behaviour of composite beams, columns, design of composite beams, steel composite columns - design of composite trusses.

Design of Connections
Types of connections, Design of connections in the composite structures – shear connections- Design of connections in composite trusses.

Composite Box Girder Bridges
Introduction - behaviour of box girder bridges - design concepts.

Case Studies
Case studies on steel-concrete composite construction in buildings – Seismic behaviour of composite structures.

REFERENCES:

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Assess the concept of composite structures and sandwich construction.
2. Formulate the design of composite members.
3. Identify the types and design of connections.
4. Formulate know about the design of box girder bridges.
5. Understand seismic behaviour of composite structures.

Course Outcome | Mapping with Programme Outcomes
--- | ---
CO1 | ✓ ✓ ✓ ✓ ✓
CO2 | ✓ ✓ ✓ ✓ ✓
CO3 | ✓ ✓ ✓ ✓ ✓
CO4 | ✓ ✓ ✓ ✓ ✓
CO5 | ✓ ✓ ✓ ✓ ✓
COURSEOBJECTIVES:
- To know about design of underwater construction.
- To study about the construction techniques of high rise and large span structures.
- To study about the construction techniques of special structures like Silo, chimney, etc.
- To learn about seismic retrofitting and strengthening techniques.
- To know about demolition and dismantling techniques.

Sub Structure Construction
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.

Super Structure Construction for Buildings
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.

Construction of Special Structures and Demolition
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scapers - 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.

Rehabilitation and Strengthening Techniques

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

REFERENCES:
1. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Formulate the design of underwater construction.
2. Use the construction techniques of high rise and large span structures.
3. Use the construction techniques of special structures like Silo, chimney, etc..
4. Achieve awareness about seismic retrofitting and strengthening techniques.
5. Learn about demolition and dismantling techniques.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping with Programme Outcomes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO6</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO10</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO11</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PO12</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSEOBJECTIVES:
- To know about planning and layout of prefabrication plant and IS Code specifications.
- To learn about prefabricated structures and its connections.
- To analyze the design of roof slab, Stair case, floor slab.
- To study about various types of wall.
- To study about industrial buildings and shell roofs.

Design Principles
General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

Reinforced Concrete
Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, -Connections – Beam to column and column to column.

Floors, Stairs and Roofs
Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

Walls
Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

Industrial Buildings and Shell Roofs
Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design.
REFERENCES:

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Have an idea about the planning and layout of prefabrication plant and IS Code specifications.
2. Identify prefabricated structures and its connections.
3. Generate the design of roof slab, Stair case, floor slab.
4. Know about various types of wall.
5. Gain knowledge about industrial buildings and shell roofs.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

**CZCMOEXXX PUBLIC HEALTH ENGINEERING STRUCTURES**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSEOBJECTIVES:
- To know about water treatment and waste treatment systems.
- To evaluate structural designs – construction below ground level.
- To learn about the functional design of overhead water tanks.
- To learn about the functional aspects of ground level water retaining structures.
- To study about the design of conduits and appurtenances.

Introduction
Review of the principle of design in respect of water treatment and waste treatment systems – criteria considered important structurally in the case of each component – consideration of soil bearing capacity under different combinations of soil types.

Factors Relevant to Structural Design
Ultimate load theory – plastic analysis – consideration on impact due to live and dead loads – considerations of corrosion effects on structural aspects – structural designs – construction below ground level.

Design of Overhead Water Tanks
Functional design – structural design – architectural design – cost aspects.

Design of Ground Level Water Retaining Structures
Functional aspects – maintenance factors.
Miscellaneous Structural Works

REFERENCES:
1. Gray. C, Reservoirs and Tanks
2. Reynolds, R.C. Designers Hand Book.
3. Abeles and Turner, Prestressed Concrete Designers Hand Book.

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Get an exposure on water treatment and waste treatment systems.
2. Understand structural designs – construction below ground level.
3. Assess the design of overhead water tanks.
4. Understand the functional aspects of ground level water retaining structures.
5. Assess the design of conduits and appurtenances.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSEOBJECTIVES
- To know about the Leadership Power, Leadership Styles, Leadership in Administration.
- To provide a basic information about the stress and its causes, performance appraisal and time management.
- To learn about HRM.
- To study the Relations and Compensation Management
- To understand the Labors Training and Development.

Leadership, Interpersonal and Communication

Stress, Conflict, Performance, Time and Motivation
Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress-Introduction to Conflict, Causes of Conflict, Management Managing Conflict- Introduction to

Time as a Resource - Identify Important Time Management Wasters - Individual Time Management Styles - Techniques for better Time Management- Introduction to Motivation, Relevance and types of Motivation - Motivating the subordinates - Analysis of Motivation.

Manpower Management

Relations and Compensation Management

Training and Development

REFERENCES

COURSE OUTCOMES
At the end of the course, Student will be able to
2. Have an idea about the stress and its causes, performance appraisal and time management.
3. Understand the HRM.
4. Know about Relations and Compensation Management.
5. Learn about Labours Training and Development.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES:
- To provide an information about the importance and scope of industrial and organizational psychology.
- To understand the types of psychology and its effect on the efficiency and productivity.
- To study Organizational Psychology
- To evaluate Individual and Group Behavior of workers
- To learn about Occupational Stress

Conceptual Awareness of Industrial Organizational Psychology
Introduction of the terms ‘Industry’ ‘Organization’ and ‘Psychology.’ Definition & Nature – Industrial Organizational Psychology - Importance & Scope of its application - How I/OPsychology is different - Psychological factors responsible for behavior of an individual at work place Industrial-Organizational Psychology on the job and in Everyday Life.

Characteristics Psychology
Types and characteristics of psychology Impacting factors and their effects on the behavior - Human psychology - Differentiating male & female psychology - Determining factors impacting work efficiency and productivity.

Organizational Psychology
Monitoring Industrial Organizational Psychology - Different tools for testing psychology - Problems with Using Psychological Tests - Measuring effectiveness of these tests - Usage of tests for improving the employee psychology - Challenges for I-O Psychology

Workers Behavior
Individual and Group Behavior - Interaction as Individuals and as Groups - Determining factors for improving their psychology Group Dynamics - Characteristics of Group Dynamics - Necessary steps in Group Dynamics to enhance efficiency & productivity.

Occupational Stress

REFERENCES

COURSE OUTCOMES:
At the end of the course, Student will be able to
1. Understand the importance and scope of industrial and organizational psychology
2. Know about the types of psychology and its effect on the efficiency and productivity.
3. Have an idea about Organizational Psychology
4. Manage Individual and Group Behavior of workers
5. Learn about Occupational Stress.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>