Brief about Civil Engineering Department:

Civil Engineering Department is the oldest department in this institute right from the establishment of Government College of Engineering in Nagpur 1956. The department offers the undergraduate course of B.Tech in Civil Engineering and Four Postgraduate Courses of M.Tech as given below.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UG in Civil Engineering</td>
<td>Started with 60 seats in 1956</td>
</tr>
<tr>
<td></td>
<td>Intake increased to 71 in 2008</td>
</tr>
<tr>
<td></td>
<td>Intake increase to 82 in 2009</td>
</tr>
<tr>
<td></td>
<td>Intake increase to 92 in 2010</td>
</tr>
</tbody>
</table>

**PG in Civil Engineering Department**

1. Environmental Engineering  
2. Water Resources Engineering  
3. Construction Technology and Management  
4. Transportation Engineering  

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Environmental Engineering</td>
<td>Started in 1966 (32 seats)</td>
</tr>
<tr>
<td>2. Water Resources Engineering</td>
<td>Started in 2005 (20 seats)</td>
</tr>
<tr>
<td>3. Construction Technology and Management</td>
<td>Started in 2010 (20 seats)</td>
</tr>
<tr>
<td>4. Transportation Engineering</td>
<td>Started in 2012 (20 seats)</td>
</tr>
</tbody>
</table>

VISION:

To contribute effectively to the National Endeavour of producing quality human resource of world class standard in Civil Engineering by developing a sustainable technical education system to meet the changing technological needs of the Country incorporating relevant of social concerns and to build an environment to create and propagate innovative technologies for the economic development of Nation.

MISSION:

The Mission of the undergraduate Civil Engineering program is to develop students into capable civil engineering graduates by imparting appropriate high quality education in Civil Engineering so that they could be readily adapted by the service sector to meet the challenges faced by the Nation. The program strives for excellence in engineering education and profession. It also aims to promote all round development of the personality of students by suitably involving them in Co-curricular and extra-curricular activities.

**TABLE 1. CREDIT REQUIREMENTS FOR UNDERGRADUATE STUDIES**

<table>
<thead>
<tr>
<th></th>
<th>Program Core (PC)</th>
<th>Program Elective (PE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Credit</td>
<td>Category</td>
</tr>
<tr>
<td>Departmental Core (DC)</td>
<td>79-82</td>
<td>Departmental Electives (DE)</td>
</tr>
<tr>
<td>1st year credits</td>
<td>39</td>
<td>Other Courses (OC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HM</td>
</tr>
<tr>
<td><strong>Grand Total DC + DE</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The number of credits attached to a subject depends on number of classes in a week. For example a subject with 3-1-0 (L-T-P) means it has 3 Lectures, 1 Tutorial and 0 Practical in a week. This subject will have eight credits (3x2 + 1x1 + 0x1 = 8). If a student is declared pass in a subject, then
he/she gets the credits associated with that subject. Depending on marks scored in a subject, student is given a Grade. Each grade has got certain grade points as follows:

<table>
<thead>
<tr>
<th>Grades</th>
<th>AA</th>
<th>AB</th>
<th>BB</th>
<th>BC</th>
<th>CC</th>
<th>CD</th>
<th>DD</th>
<th>FF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>09</td>
<td>08</td>
<td>07</td>
<td>06</td>
<td>05</td>
<td>04</td>
<td>Fail</td>
</tr>
</tbody>
</table>

The performance of a student will be evaluated in terms of two indices, viz. the Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester and Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in time. SGPA and CGPA are:

\[
SGPA = \frac{\sum_{\text{semester}} (\text{Course credits} \times \text{Grade points}) \text{ for all courses except audit}}{\sum_{\text{semester}} (\text{Course credits}) \text{ for all courses except audit}}
\]

\[
CGPA = \frac{\sum_{\text{All semester}} (\text{Course credits} \times \text{Grade points}) \text{ for all courses with pass grade except audit}}{\sum_{\text{All semester}} (\text{Course credits}) \text{ for all courses except audit}}
\]

Students can Audit a few subjects, i.e., they can attend the classes and do home work and give exam also, but they will not get any credit for that subject. Audit subjects are for self enhancement of students.
### Details about Faculty members of Civil Engineering Department

<table>
<thead>
<tr>
<th>Name of Faculty Member</th>
<th>Designation</th>
<th>Qualifications</th>
<th>Areas of specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mhaisalkar V.A.</td>
<td>Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Environmental Engg</td>
</tr>
<tr>
<td>Gupta R.</td>
<td>Professor</td>
<td>B. E, M.Tech, Ph.D.</td>
<td>Environmental Engg</td>
</tr>
<tr>
<td>Katpatal Y.B.</td>
<td>Professor</td>
<td>B.Sc, M.Tech, MBA, Ph.D</td>
<td>Remote Sensing and GIS</td>
</tr>
<tr>
<td>Tembhurkar A.R.</td>
<td>Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Environmental Engg</td>
</tr>
<tr>
<td>Ghare A.D.</td>
<td>Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Hydraulic Engg</td>
</tr>
<tr>
<td>Latkar M.V.</td>
<td>Associate Professor</td>
<td>B.Sc., M.Sc, Ph.D</td>
<td>Environmental Biochemistry</td>
</tr>
<tr>
<td>Lataye D.H.</td>
<td>Associate Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Environmental Engg</td>
</tr>
<tr>
<td>Ralegaonkar R.V.</td>
<td>Associate Professor</td>
<td>B.E, M.E, Ph.D</td>
<td>Energy Efficient Building, Disaster Management, Construction Technology &amp; Management.</td>
</tr>
<tr>
<td>Landge V.S.</td>
<td>Associate Professor</td>
<td>B. E., M.E, Ph.D</td>
<td>Traffic Engineering</td>
</tr>
<tr>
<td>Mandal A.</td>
<td>Associate Professor</td>
<td>B. E., M.E, Ph.D</td>
<td>Soil Mechanics and Foundation Engg.</td>
</tr>
<tr>
<td>Vasudeo A.D.</td>
<td>Assistant Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Water Resources Engg.</td>
</tr>
<tr>
<td>Patel A.</td>
<td>Assistant Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Soil Mechanics and Foundation Engg.</td>
</tr>
<tr>
<td>Dongre S.R.</td>
<td>Assistant Professor</td>
<td>B.E., M.Tech, Ph.D</td>
<td>Environmental Engg</td>
</tr>
<tr>
<td>Wanjari S. P.</td>
<td>Assistant Professor</td>
<td>B.E., M.Tech, Ph.D</td>
<td>Construction Technology and Management, Concrete Technology</td>
</tr>
<tr>
<td>Mirajkar A.B.</td>
<td>Assistant Professor</td>
<td>B.E, M.E, Ph.D</td>
<td>Water Resources Engg.</td>
</tr>
<tr>
<td>Madurwar M.</td>
<td>Assistant Professor</td>
<td>B.E, M.E, Ph.D</td>
<td>Building Materials</td>
</tr>
<tr>
<td>Adhikary S.</td>
<td>Assistant Professor</td>
<td>B.E, M.Tech, Ph.D</td>
<td>Soil Dynamics</td>
</tr>
</tbody>
</table>
Programme Educational Objectives (PEOs)
The Civil Engineering program will produce graduates that, within a few years of graduation, will

1. Actively engage in problem solving using engineering principles to address the evolving needs of the society
2. Be able to succeed in positions in civil engineering practice or research, and in other fields they choose to pursue and enroll in advanced studies
3. Make ethical decisions and demonstrate a commitment to service to the profession and society.
4. Acquire a position or degree that values adaptability and innovation in their work.
5. Pursue lifelong learning, and to be leaders, both in their chosen profession and in other activities.

Program Outcomes (PO)
The program outcomes are as follows. Parameters on which the PO's of the program are based are given as below and aim of PO's is to enable students to:

a. Work in Civil Engineering sector which is involved with various aspects of planning, design, construction and operation of structures and systems.
b. Design and analysis of the complex problems and provide state of the art solutions.
c. Contribute to the academic and research in the broad field of civil engineering.
d. Develop knowledge and skills in the area of broad domain of civil engineering including construction technology, water resources, environmental engineering, geotechnical engineering, geospatial technology and transportation engineering.

Program outcomes adopted for correlation to course outcomes.
Graduates Attributes (GA's) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GA's are indicators of the attributes expected of a graduate from an accredited program. The Graduates of this program must acquire:

a. An ability to apply knowledge of mathematics, science, and engineering to solve Civil engineering problems
b. An ability to identify, formulate, design and conduct experiments, as well as to analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, safety, and sustainability
d. An ability to understand engineering and management functions and to be able to function on multidisciplinary teams
e. An ability to identify, formulate, and solve civil engineering problems
f. An understanding of professional and ethical responsibility to extend the social benefit of the civil engineering project
g. An ability to communicate effectively to handle complex engineering activities with the engineering community and the society at large, and should possess the skill of technical writing and effective presentation.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, and societal context
i. A recognition of the need for and an ability to engage in independent life-long learning to incorporate technological innovations
j. A knowledge of contemporary issues and environment,
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
### Scheme for B.Tech in Civil Engineering

**For batches 2015 onwards**

<table>
<thead>
<tr>
<th>Program Core(PC)</th>
<th>Program Elective (PE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Credits</td>
</tr>
<tr>
<td>Departmental Core(DC)</td>
<td>80</td>
</tr>
<tr>
<td>1st Year credits</td>
<td>43</td>
</tr>
<tr>
<td>Grand total PC+PE</td>
<td>170</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III Semester</th>
<th>IV Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td><strong>Course</strong></td>
</tr>
<tr>
<td>CORE (DC)</td>
<td>CORE (DC)</td>
</tr>
<tr>
<td>AML262</td>
<td>Mechanics of Solids</td>
</tr>
<tr>
<td>AMP 262</td>
<td>Mechanics of Solids*</td>
</tr>
<tr>
<td>CEL 201</td>
<td>Soil Mechanics</td>
</tr>
<tr>
<td>CEP 201</td>
<td>Soil Mechanics*</td>
</tr>
<tr>
<td>CEL 204</td>
<td>Building Materials and Technology</td>
</tr>
<tr>
<td>CEP 204</td>
<td>Building Materials and Technology*</td>
</tr>
<tr>
<td>CEL 207</td>
<td>Surveying I</td>
</tr>
<tr>
<td>CEP 207</td>
<td>Surveying I*</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Core Credits</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>ELECTIVE (DE)</td>
<td>ELECTIVE (DE)( Any One)</td>
</tr>
<tr>
<td>CEL 208</td>
<td>Hydrology</td>
</tr>
<tr>
<td>MAL 203</td>
<td>Numerical Methods and Computation</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>OPEN COURSES (OC)</td>
<td>OPEN COURSES (OC)</td>
</tr>
<tr>
<td>CEL 220</td>
<td>Environmental Studies</td>
</tr>
<tr>
<td></td>
<td><strong>4 DC + 2DE / OC = 22Credits</strong></td>
</tr>
<tr>
<td>V Semester</td>
<td>VI Semester</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td><strong>CORE (DC)</strong></td>
<td><strong>CORE (DC)</strong></td>
</tr>
<tr>
<td>Code</td>
<td>Course</td>
</tr>
<tr>
<td>AML 361</td>
<td>Structural Analysis</td>
</tr>
<tr>
<td>AMP 361</td>
<td>Structural Analysis*</td>
</tr>
<tr>
<td>CEL 303</td>
<td>Environmental Engineering II</td>
</tr>
<tr>
<td>CEL 312</td>
<td>Transportation Engineering</td>
</tr>
<tr>
<td>CEP 312</td>
<td>Transportation Engineering*</td>
</tr>
<tr>
<td>CEL 313</td>
<td>Concrete Engineering</td>
</tr>
<tr>
<td>CEP 313</td>
<td>Concrete Engineering*</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td><strong>ELECTIVE (Any Two)</strong></td>
<td><strong>ELECTIVE (Any two)</strong></td>
</tr>
<tr>
<td>CEL 315</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>CEP 315</td>
<td>Fluid Mechanics*</td>
</tr>
<tr>
<td>CEL 417</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>CEL 423</td>
<td>Introduction to Soil Dynamics</td>
</tr>
<tr>
<td>CEL 404</td>
<td>Railway, Airports, Ports and Harbor Engineering</td>
</tr>
<tr>
<td>AML 365</td>
<td>Design of Masonry Structures</td>
</tr>
<tr>
<td><strong>OC/HM</strong></td>
<td><strong>OC/HM</strong></td>
</tr>
<tr>
<td></td>
<td>4 DC + 2 DE/OC/HM =22/23 Credits</td>
</tr>
<tr>
<td>VII Semester</td>
<td>VIII Semester</td>
</tr>
<tr>
<td><strong>CORE</strong></td>
<td><strong>CORE</strong></td>
</tr>
<tr>
<td>Code</td>
<td>Course</td>
</tr>
<tr>
<td>CED 401</td>
<td>Project Phase I</td>
</tr>
<tr>
<td>CEL 307</td>
<td>Project Planning and Management</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6</strong></td>
</tr>
<tr>
<td><strong>ELECTIVE</strong></td>
<td><strong>ELECTIVE</strong></td>
</tr>
<tr>
<td>AML 461</td>
<td>Advanced Structural Analysis</td>
</tr>
<tr>
<td>CEL 413</td>
<td>Pre-stressed Concrete Structures</td>
</tr>
<tr>
<td>AML 424</td>
<td>Structural Dynamics</td>
</tr>
<tr>
<td>CEL 409</td>
<td>Quality and Safety in Construction</td>
</tr>
<tr>
<td>CEL 552</td>
<td>Construction Contracts and Specifications</td>
</tr>
<tr>
<td>CEL 442</td>
<td>Geotechnical Investigation for Construction Projects</td>
</tr>
<tr>
<td>CEL 419</td>
<td>River Engineering</td>
</tr>
<tr>
<td>CEL 422</td>
<td>Hazardous Waste Management</td>
</tr>
<tr>
<td>CEL 436</td>
<td>Computer Aided Design and Analysis*</td>
</tr>
<tr>
<td>CEP 436</td>
<td>Computer Aided Design and Analysis*</td>
</tr>
<tr>
<td>CEL 423</td>
<td>Introduction to Soil Dynamics</td>
</tr>
<tr>
<td>CEL 408</td>
<td>Construction Site Administration and Control</td>
</tr>
<tr>
<td>CEL 429</td>
<td>Hydraulic Transients</td>
</tr>
<tr>
<td>AML 468</td>
<td>Maintenance and Rehabilitation of Civil Engineering Structures</td>
</tr>
</tbody>
</table>

* Student must register both for practical and theory of a course.
### SCHEME FOR B.TECH IN CIVIL ENGINEERING
(Batch 2014 and Earlier)

<table>
<thead>
<tr>
<th>Undergraduate Core (DC)</th>
<th>Undergraduate Elective (DE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>Credit</strong></td>
</tr>
<tr>
<td>Departmental Core (DC)</td>
<td>146-152</td>
</tr>
<tr>
<td>Basic Science (BS)</td>
<td>32</td>
</tr>
<tr>
<td>Engineering Sciences(ES)</td>
<td>36</td>
</tr>
<tr>
<td>HM</td>
<td>0-6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>214-226</td>
</tr>
<tr>
<td><strong>Grand Total DC + DE</strong></td>
<td>320</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Credit</th>
<th>Category</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental Electives (DE)</td>
<td>60-96</td>
<td>Other Courses (OC)</td>
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<td><strong>Total</strong></td>
<td>60-108</td>
<td><strong>Total</strong></td>
<td>60-108</td>
</tr>
</tbody>
</table>

#### I Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>L-T-P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>AML262</td>
<td>Mechanics of Solids</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>AMP 262</td>
<td>Mechanics of Solids</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 201</td>
<td>Soil Mechanics</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 201</td>
<td>Soil Mechanics</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 204</td>
<td>Building Materials and Technology</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 204</td>
<td>Building Materials and Technology</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 207</td>
<td>Surveying I</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 207</td>
<td>Surveying I</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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#### II Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>L-T-P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEL 210</td>
<td>Environmental Engineering I</td>
<td>3-0-0</td>
<td>6</td>
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<tr>
<td>CEP 210</td>
<td>Environmental Engineering I</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 211</td>
<td>Surveying II</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 211</td>
<td>Surveying II</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 215</td>
<td>Building Design and Drawing</td>
<td>2-0-0</td>
<td>4</td>
</tr>
<tr>
<td>CEP 215</td>
<td>Building Design and Drawing</td>
<td>0-0-2</td>
<td>2</td>
</tr>
<tr>
<td>CEL 213</td>
<td>Engineering Geology</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 213</td>
<td>Engineering Geology</td>
<td>0-0-2</td>
<td>2</td>
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<tr>
<td>CEL 214</td>
<td>Hydraulic Engineering</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEP 214</td>
<td>Hydraulic Engineering</td>
<td>0-0-2</td>
<td>2</td>
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<td><strong>Total</strong></td>
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<td>38</td>
</tr>
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</table>

#### III Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>L-T-P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>AML264</td>
<td>Advanced Mechanics of Solids</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>MAL 203</td>
<td>Numerical Methods and Computation</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEL 208</td>
<td>Hydrology</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEL 209</td>
<td>Construction Materials</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>CEL 212</td>
<td>Rural Water Supply and Sanitation</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>AML 364</td>
<td>Advanced Mechanics of Solids</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>44</td>
</tr>
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</table>

#### IV Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>L-T-P</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEL 220</td>
<td>Environmental Studies</td>
<td>3-0-0</td>
<td>6</td>
</tr>
<tr>
<td>V Semester</td>
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<td>CEL 404</td>
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<td>CEL 423</td>
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<td>AML 365</td>
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<td>CEL409</td>
<td>Quality and Safety in Construction</td>
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<td>CEL552</td>
<td>Construction Contracts and Specifications</td>
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<td>CEL442</td>
<td>Geotechnical Investigation for Construction Projects</td>
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<td>CEL422</td>
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<tr>
<td>CEL408</td>
<td>Construction Site Administration and Control</td>
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<td>CEL 429</td>
<td>Hydraulic Transients</td>
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<td>AML 468</td>
<td>Maintenance and Rehabilitation of Civil Engineering Structures</td>
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Course Objectives:
1. Introduction of formation of soil.
2. Different soil Properties and co-relation.
4. Determination and physical understanding of soil parameters.

Syllabus:
Introduction: Formation of soil, residual and transported soils, soil, generally used in practice such as sand, gravel, organic silt, clay, Bentonite, black cotton soil etc.


Permeability and Seepage: Darcy’s law and its validity, Discharge and seepage velocity, factors affecting permeability, Determination of coefficients of permeability by laboratory and field methods, permeability of stratified soil, Seepage pressure, quick condition, flow-nets, Laplace’s equation, methods to draw flow-nets, their characteristics and uses of flow-nets, Preliminary problems of discharge estimation of homogeneous soils. Effective, Neural and total stresses in Soil mass.

Stress Distribution: Stress distribution in soil mass, Boussinesque’s, Theory point and uniformly loaded rectangular and circular areas, Newark’s charts.

Consolidation: Compression of laterally confined soil, Terzaghe’s 1-D consolidation theory (formation of differential equation only) determination of coefficient of consolidation, degree of consolidation. Determination of pre-consolidation pressure, settlement and rate of settlement.

Compaction: Mechanics of compaction factors affecting compaction, standard and modified compaction tests, OMC, Field compaction equipment, quality control, Concept of blending.

Shear Strength: Introduction, Mohr’s diagram, Mohr-Coloumb’s theory, Measurement of shear strength by direct shear test, tri-axial test, unconfined compression test, vane shear test, and sensitivity.

Course Outcomes:
1. Gain a broad understanding of mechanics of soil
2. Get accustoms with the measurement of different soil parameters.
3. Determination of shear strength and permeability of soil as suitable construction material.
4. Contemporary issues and developments.

REFERENCE:
1. Grain size Distribution-(Mechanical Method)
2. Liquid Limit and Plastic Limit Test
3. In-Place Density Test
4. Specific Gravity Test
5. Permeability Test-Variable Head, Constant head
6. Specific Gravity Test
7. Compaction Test
8. Unconfined Compression Test
9. Direct Shear Test.
Course Objectives:
1. Introduce to Fluid state of matter.
2. Making students understand the importance of Fluid and its flow.
3. To make student explore the various equations and the concepts related fluid motion and equilibrium.
4. To make students understand the correlation between theory and practical by making them do practical’s which are physical simulations of the theory such as Bernoulli’s equation, venturimeter, orifices etc.

Syllabus:
Fluid Properties and measurement of pressure – manometers and gauges, Hydrostatics- Total pressure and centre of pressure, pressure forces on vertical and inclined laminae, pressure on curved surfaces, Buoyancy and floatation – Centre of buoyancy, body immersed in two different fluids, metacentre, metacentric height, stable, unstable and neutral equilibrium
Types of fluid flows and flow lines, Methods of describing fluid motion, Fundamental equations of fluid flow, Venturimeter, Orifice and mouthpiece, Notches and weirs
Elements of flow through pipes: Darcy Weisbach formula, Hydraulic Gradient Line, Total Energy Line, Minor losses, series and parallel connections
Introduction to open channel flow: Manning’s and Chezy’s formula, Most economical section of channel, Uniform flow and Critical flow, Hydraulic jump elements.
Impact of Jet, Types of hydraulic turbines, Introduction to Centrifugal and Reciprocating pumps.

REFERENCE:
1. Ship model
2. Triangular notch
3. Rectangular notch
4. Orifice
5. Mouthpiece
6. Manometers and pressure gauges
7. Pitot tube
8. Friction factor of pipeline
9. Chezy’s and Manning’s constant for a channel
10. Venturimeter.
Course Objectives:
1. To learn the fundamentals of Water Engineering
2. To understand various components of water supply scheme
3. To build skills to quantitative and qualitative assessment of water requirement
4. To understand how to solve water treatment unit design problems using hydraulic principles and methods
5. To understand operation of water treatment units.
6. To provide broad knowledge of solid waste management systems.

Syllabus:
Importance and necessity of water supply scheme; planning of WSS; design period; population forecasting; water demand; sources of surface water, ground water, intake structure; conveyance of water, types of pipe joints and fitting; hydraulic design of pipes, rising main; pumps; water quality, standards of drinking water, Theory and application of water treatment unit operation and processes, aeration, coagulation, flocculation, sedimentation, filtration, disinfection; Selection of site and processes of water treatment, treatment flowsheet; Distribution system, appurtenances, detection and prevention of leakage, storage reservoir for treated water. Introduction to solid waste management,

Course Outcomes:
1. Understand the water supply scheme and be able to estimate quantities and quality of water for municipal use
2. Understand the types of processes used to treat water for municipal purpose
3. Understand how processes are configured in treatment systems.
4. Understand the fundamental engineering and science principles that are used to design and operate the processes used in treatment systems.
5. Learn how to use laboratory procedures and measurements to determine qualitative parameter of water and wastewater.
6. Understand basics of solid waste management.

REFERENCE:
1. Determination of pH
2. Determination of conductivity
3. Determination of chlorides
4. Determination of Solids
5. Determination of turbidity
6. Determination of Acidity and alkalinity
7. Determination of dissolved oxygen
8. Determination of hardness
9. Determination of available chlorine
10. Jar test
11. Bacteriological plate count and MPN
12. Demonstration of COD, BOD
Course Objectives:

1. To retrieve various components of building, interpret their functions and methods of construction along with fundamentals of design.

Syllabus:

Foundations: necessity and types of foundations, details of shallow foundations, bearing capacity of soils and its assessment, loads on foundations, causes of failures of foundations and remedial measures, foundation on black cotton soil, setting out foundation trenches, excavation, timbering of trenches.

Brickwork: constituents of brick earth, manufacturing, types, IS Classification of bricks, specification of mortar for brick masonry, commonly used types of bonds in brickwork, principles of construction, common defects in brick masonry, brick knogging, parapets, copings, sills and corbels, masonry construction using cement concrete blocks (solid & hollow) and clay blocks, reinforced brickwork, walls - cavity walls, load bearing and partition walls.

Stone work: common building stones in India, selection of stones, quarrying and dressing of stones, lifting appliances for heavy stones, types of stone masonry, principles of construction, joints in masonry, specification of mortar for stone masonry.

Arches and lintels: terminology in construction, types, chajjas and canopies, precast lintels & arches, Damp proofing: causes and effect of dampness, methods of damp proofing, materials used including new materials like epoxy, resins etc., techniques of damp proofing.

Floors and roofs: components, materials, types and method of construction, tiled flooring such as ceramic tiles, terracotta, introduction to upper floor, flat and pitched roofs, roof coverings, types and their constructional features, thermal insulation of roofs.

Stairs: Terminologies in stairs, types of stairs, functional design of stairs, Doors & windows: purpose, materials of construction and types.

Plastering & pointing: necessity, mortars used, methods of plastering, types of finishes, types of pointing, Temporary timbering: centering and formwork, shoring, underpinning and scaffolding, painting: white washing, color washing and distempering, new materials & techniques, principle of acoustics, and sound insulation, introduction to principles of earthquake resistant buildings.

Course Outcome:

1. Understand the importance and role of each component in building.
2. Apply basic fundamentals of design and construction for any building.
3. Select construction materials under different site conditions by understanding the basic properties of materials.
4. Supervise the construction work of buildings.

REFERENCE:

3. Sushil Kumar, Building Construction and Materials, Standard Publisher and Distributor, 2003 reprint
Course Objective:
To test the physical properties of different construction materials as per the standard procedures lay down by I.S. codes.

1. To perform dimension test on burnt clay building bricks
2. To determine water absorption of burnt clay building bricks.
3. To determine Efflorescence of burnt clay building bricks.
4. To determine crushing strength of burnt clay building bricks.
5. To determine water absorption of cement concrete/terrazzo flooring tiles.
6. To determine flexural/transverse strength of cement concrete flooring tiles.
7. To test resistance of cement concrete flooring tiles against wear.
8. To determine water absorption of Mangalore roofing tiles.
9. To determine breaking load of roofing tiles.
10. To determine moisture content and specific gravity of timber.
11. To determine compressive strength of timber specimen in parallel and perpendicular to grains direction.
12. To determine impact value of white glazed ceramic tiles.
Course Objectives:

1. To design and plan the residential buildings as per local bye-laws and produce different types of drawings for the same.

Syllabus:

Importance of building drawing as engineer’s language in construction & costing.

Selection of scales for various drawings, thickness of lines, dimensioning, combined first angle and third angle methods of projection, abbreviations and conventional representations as per IS: 962, 1989, free hand dimensioned sketches of various building elements and their importance in civil engineering.

Developing working drawing to scale as per IS 962 from the given line plan, design and general specifications for different components of the building including terraced and pitched roofs, developing submission drawings to scale with location plan, site plan and block plan.

Functional planning of residential buildings, principles of site selection, types of residential buildings, design requirements of residential areas, planning regulations and building bye-laws, principals of planning, functional planning of public buildings, factors affecting site selection, design aspects for different public buildings, recommendations of CBRI, Roorkee.

Graph paper drawings (line plans) for residential, public, educational, industrial buildings based on various requirements and interior aspects.

Two point perspective of residential building neglecting small elements of building such as plinth offset, chajja projections etc.

1. Working drawing of single storied residential building of terrace and pitched roofs with foundation plan of load bearing structure. (Two assignment)
2. Submission drawing of single storied residential building (framed structure) with access to terrace including all details and statements as per the local bye-laws. (One assignment A1 sheet)
3. Working drawing of multistoried Public / Educational/ Health / Community / Industrial building including structural details and layout of services. (One assignments)
4. Two point perspective of the single storied Residential building neglecting small building elements. (Two assignments – pitched & terrace roof)
6. Line plans of various types of buildings e.g. Public / Educational / Industrial / Hospital / Community on graph papers (04 assignments)
7. One compulsory field exercise.

Course Outcome:

1. Gain a broad understanding of planning and designing of buildings
2. Develop working and submission drawings for any building
3. Know the procedures of submission of drawings and getting sanctions for a project
4. Plan and design a residential or public building as per the given requirements
5. Develop the perspective views for any building.

REFERENCE:

4. IS: 962-1989 (Code of practice for architectural and building drawing)
Course Objectives:
1. To Understand the Earth System
2. Teach fundamental geomorphic and dynamic processes on the Earth
3. To know about the material present i.e. minerals and rocks
4. Understand Structural deformations and impacts
5. Earthquakes and causes, effects, zones
6. Know subsurface exploration methods
7. Know groundwater availability and domains; recharge
8. Teach consideration for site selection for projects.

Syllabus:

Mineralogy: Definition and classification of Minerals, Megascopic physical properties of Minerals, Overview of silicate family minerals (Quartz, Feldspar, Olivine, Pyroxene, Amphibole, Mica).

Petrology: Rock cycle; Genesis, Textures, Forms/structures, classification and strength aspects of Igneous, sedimentary and Metamorphic rocks. Geomechanical properties of rocks, Rock as construction aggregate and road metal.

Structural Geology: Rock Deformation; Attitude of rocks, Mechanism of formation, nomenclature classification and field identification of Folds, Joints, Faults. Problems on Strike, Dip, thickness and depth of strata.

Stratigraphy: Scope & application of Stratigraphic principles, overview of Indian Stratigraphy.

Introduction to Rock Mechanics: Concept of stress and strain in rocks, rock mass classification and rating, RQD, etc. Surface and subsurface geological investigations; Drilling, core logging, Geological, geophysical and remote sensing investigations; Scope of rock excavation, blasting techniques, Geological criteria for design & construction of Dams, Bridges, Tunnels, buildings.


Engineering Seismology: Causes and effects of earthquakes; Seismic waves, magnitude, intensity, seismic zoning & seismic Zones of India; Tsunamis.

Geohydrology: Rocks as aquifers, occurrence and availability of Groundwater; Groundwater investigations, groundwater development and management in India; Techniques of groundwater recharge.

Course Outcomes:
1. Generate global vision of Earth process
2. Identify the subsurface material.
4. Know about ground water availability zones and ground water management.
5. Know megascopic and mechanical properties of rocks.
6. Know field procedures of subsurface exploration.
7. Generate subsurface profiles and map structures.
8. Know considerations for site selection for engineering projects.

REFERENCE:
1. KVGK Gokhale, Principles of Engineering Geology, BS Publications.
1. Megascopic study of Minerals and Rocks
2. Geological maps and Profiles
3. Three point and Dip Strike problems
4. Electrical Resistivity Survey
5. Groundwater availability is aquifers
6. Rock Mass rating problem
Course Objectives:
1. Principal and rule of Surveying.
3. Use of field book for different Survey.
4. Use of with different survey equipment.

Syllabus:
Linear Measurements: Methods, Equipments, Ranging, Chain Surveying, Field Work and Plotting, Obstacles in Chaining, area and Volume Computation
Compass Surveying: Instrument, Principles, Bearings
Plane Table: Equipment, Methods, Errors, Adjustment Survey, Traversing and Plotting
Leveling: Instruments, Collimation Method, Rise-Fall Method, Curvature and Refraction, Contouring
Tachometric Surveying: Theory, Instrument Constants, Methods

Course Outcome:
1. Gain a broad understanding of Land Survey
2. Get accustom with the angular and linear measurements.
3. Trained with recording the field information and necessary plot.
4. Contemporary issues and developments.

REFERENCE:
1. B. C. Punmia, Standard Book-House Latest
3. A. M Chandra, Plane Surveying, New Age International Publication.
1. Chain survey Traversing and plotting of details- Area Determination.
2. Building lay-out work.
4. Plane table survey solving two/ three point problem.
5. Plane table survey Traverse.
Course Objectives:
1. Introduction to Hydrology.
2. Making students understand the importance of Water Resources.
3. To expose the students to the various components of the water cycle and their importance.
4. Teach data analysis using various techniques and implementation of the results.

Syllabus:
Introduction: Hydrological cycle, Precipitation- forms and types.
Abstractions: Infiltration, Evaporation, Transpiration, Evapotranspiration, Interception.
Runoff: Sources and components of runoff, Classification of streams and measurement of discharge of a stream by Area – Slope and Area – Velocity methods.
Hydrograph: Flood hydrographs and its components, S-Curve technique, unit hydrograph, synthetic hydrograph. Statistical Methods, Various methods of averages, probability of an event, Frequency analysis.
Floods: Causes and effects, Factors affecting peak flows and its estimation, Flood routing and Flood forecasting.

Course Outcome:
1. Gain broad understanding of hydrology.
2. Get to know about different hydrographs and statistical methods.
3. Understand various components of water cycle and their importance.
4. Know various data analysis techniques and its implementation.

REFERENCE:
Course Objectives:
1. Introduction to various masonry units, classification and properties.
2. Introduction to different types of mortars and concrete and the factors affecting strength and suitability.
3. Introduction to timber and its various characteristics.
4. To know the recent advancement in building material and their effect on environment.
5. To understand different types of masonries and their applications.

Syllabus:
Masonry units - Building stones, classification of rocks, common building stones and their properties, qualities of good building stones, criterion of selection, quarrying, methods of quarrying, deterioration and preservation of stones, Composition of brick earth, manufacturing of bricks, classification, special types of bricks, other clay and ceramic products, clay tiles, manufacturing process, types.
Mortars and Concrete – limes, classification and slaking of lime, manufacturing of cement, types of cements, sources of sand, classification and characteristics of sand for mortars and plasters, types of mortars, preparation of mortars, properties, factors affecting their strength, concrete types and their suitability.
Timber – classification of trees, structure of a timber tree, characteristics of good timber, defects in timber, decay, seasoning of timber, methods, preservation of timber, characteristics of other timber products such as plywood, particle board, hardboard etc. and their uses.
Glass manufacturing, classification and uses, glass wool, plastics, polymerization, classification, types and uses, ferrous, non-ferrous metals and alloys such steel, aluminum, copper, zinc etc., gypsum and allied products such as plaster of paris, paints, distempers and varnishes, rubber, adhesives and sealants, miscellaneous materials, recent advances in building materials, characteristics and their effect on environment.

Course Outcome:
1. To identify various building materials and select suitable type of building material.
2. To be aware of various traditional building materials and also the emerging materials in the field of Civil Engineering construction.
3. Understand different types of masonry and its applications.

REFERENCES
5. Building Construction by Sushil Kumar, Standard Publisher,
Course Objectives:
1. Introduce to various natural resources, their importance and status.
2. Introduce to the concepts of ecosystem, their structure and functions.
3. Introduce to the concept of biodiversity conservation.
4. Introduce to possible causes of various forms of environmental pollution and their consequences, methods of prevention.
5. Introduce to various social and climatic changes due to pollution.

Syllabus:

Natural resources: Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources.

Ecosystem: Concept of an ecosystem, Structure and functions of an ecosystem, Producers, consumers and decomposers, Ecological succession, Food chain, food webs and pyramids.


Environmental pollution: Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management: Causes, effects and control measures of urban and industrial wastes.

Social issues and environment: Sustainable development, Water conservation, Rain water harvesting, Watershed management, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accident, Holocaust, Environmental rules and regulations.


Course Outcome:
1. Understand various natural resources, their importance and status.
2. Understand the concepts of ecosystem, their structure and functions.
3. Understand the concept of biodiversity conservation.
4. Understand the causes of various forms of environmental pollution and their consequence, and methods of prevention.
5. Understand the various changes in social and climate due to pollution.

REFERENCE:
1. Rajgopalan R., Environmental Studies.
3. ErachBaruch Environmenta study University press (UGC).
Course Objectives:
1. To introduce about various rural water supply programs in India
2. To introduce various rural water supply schemes
3. To introduce various rural sanitation programs in India
4. To introduce various low cost sanitation methods in India

Syllabus:
National Water Policy, Status of Rural water supply in India, National and State level programs of RWS, Planning and implementation of rural water supply, problem village Source development, springs, dug wells, infiltration wells etc. Package water treatment plants, appropriate technology for removal of excess iron and manganese, fluoride, arsenic for drinking water, surface water treatment, slow sand filtration, disinfection in RWS. Guidelines for Design of RWS, Types of RWS systems and their components, types of pipes, pumps used in RWS, Community participation in planning, design, O and M of RWS.


Course Outcome
1. Gain knowledge about various rural water supply programs in India.
2. Able to understand various water supply scheme, design of rural water supply schemes.
3. Able to understand about various rural sanitation schemes in India.
4. Gain knowledge about the methods of low cost sanitation.
5. Gain knowledge about the design of septic tank.

REFERENCE:
1. E.G. Wagner and J.N. Lanoix, Excreta Disposal for Rural Areas and Small Communities.
Course Objectives:
1. Decision of choosing appropriate shear parameters for stability of slopes, assessment of earth pressures, foundation design & analysis.
3. Various earth pressure theories
4. Design & analysis of shallow foundations
5. Deciding dimensions of piles & their load carrying capacity
6. Learn methods & process of Geotechnical Exploration
7. Introduction to Ground Improvement techniques.

Syllabus:
Shear Strength: General principle of tests, concept of failure strength, Drainage condition, pore pressure and its measurement, pore pressure parameters, Modified failure envelope. Liquefaction and effect of soil shaking, Shear Strength of cohesionless and cohesive soils.


Lateral Earth Pressure: Earth pressure at rest, active and passive pressure, General and local states of plastic equilibrium in soil. Rankine’s and Coulomb’s theories for earth pressure. Effects of surcharge, and submergence. Rebhann’s criteria for active earth pressure. Graphical construction by Culman for simple cases of wall-soil system for active pressure condition.

Ground Improvement: Methods of soil stabilization use of admixtures (lime, cement, fly-ash) in stabilization. Basic concepts of reinforced earth, use of geo-synthetic materials, Salient features, function and applications of various geo-synthetic materials.

Bearing capacity of soils: Terzaghi’s theory, its validity and limitations, bearing capacity factors, types of shear failure in foundation soil, effect of water table on bearing capacity, correction factors for shape and depth of footings. Bearing capacity estimation from N-value, factors affecting bearing capacity, presumptive bearing capacity.


Pile Foundation: Classification of piles, constructional features of cast-in-situ and pre cast concrete piles. Pile driving methods, effect of the driving on ground. Load transfer mechanism of axially loaded piles. Pile capacity by static formula and dynamic formulae, pile load test and interpretation of data, group action in piles, spacing of piles in groups, group efficiency, overlapping of stresses. Settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, general feature of under reamed piles.

Geotechnical Exploration: Importance and objectives of field exploration, principal methods of subsurface exploration, open pits and shafts, types of boring, number, location and depth of boring for different structures, type of soil samples and samplers. Principles of design of samplers, boring and sampling record. Standard penetration test, corrections to N-values and correlation for obtaining design soil parameters.

Course Outcome:
1. Choose appropriate shear parameters in various applications
2. Analysis stability of slopes
3. Decide exerted earth pressure on different structures
4. Determine and decide safe bearing capacity of soil
5. Able to design shallow and deep foundations
6. Plan & conduct Geotechnical Exploration Program
7. Able to select suitable ground improvement technique and implement it in field

REFERENCES:
1. Alam Singh Soil Mechanics in Theory and Practice Asia Publishing House
Course Objectives:
1. Introduce to transportation and traffic engineering.
2. Introduction to transportation planning.
3. Teach geometric design of highways.
4. Teach design of flexible and rigid pavements.
5. To teach various laboratory testing for characterization of pavement materials
6. Introduction to bridge engineering

Syllabus:
Introduction: Fundamentals of Transportation System, spatial significance of transportation system, impact on an life style, components of the system, Transportation Scenario in India, Five year plans, privatization Efforts, Multilateral funding, Modern Transportation.

Development and Planning: Road transport Characteristics, Classification of roads, development plans, network patterns, data collection and surveys, principles of alignment, evaluation of plan proposals; Traffic Engineering: 3E’s of, traffic characteristics, Surveys, Intersection-types, layouts, design principles, Urban traffic, parking, lighting, Accidents, Traffic control Devices-marking, Signs, Signals, Regulations Motor Vehicle Act and Rules

Materials: Sub grade Soil – AASHTO Classification, group Index, Sub grade soil Stabilization. CBR, aggregate Physical and Mechanical properties and tests-Bituminous materials classification sources properties and tests. Cutback and Emulsions, modified Bitumen IRC/IS Standards, Introduction to Geotextiles; Construction and Maintenance: IRC, MOST specifications for quality and quantity of materials, techniques, tools and plant, for the Earthwork, sub base, base and wearing / surfacing course of flexible pavements with gravel, W.B.M., WMM, stabilized Bituminous and concrete as Construction material, Drainage, shoulders, maintenance and repairs


Course outcome:
1. Gain a broad understanding of transportation engineering
2. Transportation systems and organizations
3. Driver, vehicle, pedestrian, road and traffic characteristics.
4. Basic understanding of various bridge design parameters
5. Ability to characterize pavement materials
6. Contemporary issues and developments.
REFERENCE:
1. Subgrade Soil: AASHTO Classification, group index and rating, CBR test (Vide IS : 2720)


3. Petrographic identification (Vide IS : 2386)


5. Students should be familiar with relevant BIS, IRC, MOST specifications of various materials for different constructions.
Course Objectives:

1. Understand the concept of wastewater, its sources, characteristics, methods of treatment of wastewater and methods of disposal of wastewater.
2. Understand the concept of air pollution and its effects on human, animals, plants and materials.

Syllabus:
General Aspects of Wastewater Engineering; System of collection and conveyance of sewage – separate and combined systems; Patterns of sewage collection systems; Quantity of sewage and storm water;

Sewer: Types, Shapes, Hydraulic Design (Capacity, Size, Grade, etc.); Construction of sewer – Shoring Trenching and Laying to grade. Sewer materials; Sewer Appurtenances – Manhole, Street Inlets, Storm water overflows, Inverted Syphons, Flushing and Ventilation. House plumbing systems – sanitary fitting and appliances, traps, anti-syphonage, inspection chambers and intercepting traps; Sewage pumping – location of pumping station and types of pumps. Sewer testing and maintenance.

Characteristics of wastewater; Sewage treatment flow sheet; Site selection for sewage treatment plant. Preliminary and primary treatment – Screens, Grit chambers, Primary settling tank (including simple design).

Secondary treatment – Principle of Biological Treatment Activated sludge process, trickling filter; Methods of disposal – disposal on land and in water stream, Sewage farming, Self-purification of stream. Sludge digestion, Sludge drying beds. Rural sanitation – Pit privy, aqua privy; Bio-gas recovery; Septic tank including soak pit, (including design problem); Sludge collection and disposal.

Industrial Waste Water Treatment – Significance of Industrial Waste Water Treatment, important physical and chemical parameters, unit operations and treatment processes (flow equalization, neutralization, adsorption, chemical and biological treatment etc.).

Introduction to air pollution; Sources of air pollution and its classification ill – effects of air pollutants on man, animal and materials Meteorological parameters Methods of air pollution control.

Course Outcome:

1. Gain a broad understanding of wastewater engineering
2. Wastewater management systems and design of various treatment units
3. Understand about the disposal of wastewater.
4. Contemporary issues and developments.

REFERENCE:

1. Punmia B.C.; Waste Water Engineering; Laxmi Publication, 2002
6. Rao C.S.; Environmental Pollution Control Engineering; 1990
Course Objectives:
1. To Emphasis upon importance of concrete as versatile construction material & its suitability & adaptability in concrete construction
2. To study knowledge of Concrete making materials & ingredients &. Various parameters affecting properties of concrete including concrete mix proportioning.
3. To provide need based Knowledge of methods to obtain various types of concretes.
4. Conceptual understanding of Reinforced cement concrete & Properties and design of structural elements like slab, beam column and footings as per Indian standard codes.
5. To study the concept of prestressed concrete its properties & to impart knowledge about its mechanized design & methods in light of modern construction.
6. To analyze & design various prestressed concrete structural elements per Indian standard speciation.

Syllabus:
Hardened concrete: Tests on concrete, properties and factors affecting properties of concrete., Non destructive tests on concrete, Concrete mix design and methods of mix design Concepts of durability, Types of concrete
Concepts of Prestressed concrete: Materials, their properties, advantage and disadvantages, methods of prestressing and prestressing systems, Losses in prestress,

Course Outcome:
1. Achievement of basic knowledge on Concrete Technology, Concrete production, its type & applications in field of construction.
2. Achievement of Conceptual understanding of what is Engineered concrete?
3. Achievement of Knowledge of pre-stressed concrete ,its requirement in construction , application & design
4. Acquired basic knowledge of design of elementary RCC elements like one way slab, beams, column & footings.

REFERENCE:
4. M.S.Shetty, Concrete Technology, S.Chandand Company New Delhi, 2005.
2. Tests on aggregates: Sieve analysis, grading, Fineness modulus, Bulk density and specific gravity of coarse and fine aggregate. Deleterious materials, Silt content and Bulking of sand.
4. Concrete mix design.
5. Casting, curing and testing of concrete for compressive strength.
6. Nondestructive testing of concrete
7. Study experiment on pre-stressed concrete.

Following RCC designs with drawings on A4 size sheet:

1. Design of slab: One way simply supported and cantilever slab
3. Design of Axially loaded Column with pad/sloped rectangular footing
Course Objectives:
To make Civil Engineering students able to design concrete various RCC members of building using Limit State Design method.

Syllabus:

Moment redistribution analysis and design of fixed beams, propped cantilever, two span symmetric continuous beams. Limit State of collapse in shear, Bond and Torsion, Design for Interaction between Bending moment, Torsional moment and Shear. Limit state of serviceability: Deflection and moment curvature relationship, for beams and one-way slabs.

Limit state of collapse under compression axially loaded short and long column, column with axial load, uniaxial and biaxial moment, Interaction diagram / Charts. Isolated footing for axially loaded columns, Uniaxial bending, combined footing: Rectangular footing, Strap beam, Trapezoidal, raft etc.

Analysis and design of portal frames (single bay single storey) hinged or fixed at base. Design of Cantilever and Counterfort Retaining Walls.

Design of Dog legged and Open Well Staircase. Design of Circular and Rectangular water tank with roof slab / dome resting on ground by approximate method. (Using Working Stress Method).

Course Outcome:
1. To understand conceptually the difference between Working stress method, Ultimate load theory method & Limit state Design method.
2. To design the structural elements like RCC beam, slab, column, and footings by limit state Design method as per I.S.456-2000.
3. To design two way slab & one way continuous slabs
4. To design columns & footings for eccentric loads.
5. To design RCC Retaining walls & design of water tanks.

REFERENCE:
Course Objectives:
1. To teach about the curve surveying for highways
2. Introduction to Geodetic surveying, Field astronomy, Triangulation, Photographic and hydrographic surveying.
3. To make the students able to do base line measurement and handle Auto Level & Total station in the field for various surveying works.
4. To teach how to compute for geodetic position, how to do triangulation adjustment and apply corrections in geodetic quadrilateral

Syllabus:
Tachometry – Classification, stadia method, Analytic lens, distance and elevation formulae, tangential method, errors.
Curves – Simple, Compound, Reverse, Transition and Vertical Curves : Elements, methods, setting out curves.
Geodetic Surveying – Geodetic Surveying: Classification of triangulation survey, intervisibility of stations field work, reduction to centre, base line measurement corrections.
Triangulation adjustment and Aerial Surveying – Definitions, weighted observations, laws of weights, station adjustment Definitions, classification, tilt and height displacements, height from parallax measurements, flight planning, phototheodolite and stereoscope.
Underground Surveying and Global Position System (GPS) – Corelation of underground and surface survey, transferring the levels underground.

Course Outcome:
1. Do curve surveying for highways and railways curves
2. Understand the basics of geodetic surveying, Field astronomy, Triangulation, Photographic and hydrographic surveying.
3. Use Auto level, Total stations and other advanced instruments in surveying
4. Plan and doing surveying in a team for real life works.

REFERENCE:
5. Arthur Bannister, Stanley Raymond, Raymond Baker, Surveying, Person Education.
2. Study and Application of Auto Level
3. Study and Application of Total Station
4. Setting out of simple curves – linear methods
5. Setting out of simple curves – angular method
6. Setting out of transition curve
7. Computation of geodetic position
8. Correction of geodetic quadrilateral
9. Triangulation Adjustments
10. Determination of Azimuth
Course Objectives:
1. Student shall be able to Plan Bar Chart, material requirement schedule, Manpower schedule, Machinery Schedule.
2. Student shall be able to plan Quality and Safety Checklist for the Construction Site
3. Student shall be able to outline the Construction Labour law for their project site.
4. Student shall be able to check suitable type of machinery for their project site.
5. Students shall be able to estimate rate analysis of Excavation by excavator, Concreting by Batching plant Concrete.

Syllabus
Introduction: Significance of Construction Management, Objectives, Functions, Resources, and Stages in construction, construction team, Organization Structure,
Project planning: Work Break down structure, Bar charts, Detailed Bar chart for a Construction Project, CPM and PERT analysis, Line of balance method. Resources levelling.
Construction safety: Importance of safety, safety measures, accident cost and its prevention, Safety measures in Excavation, Drilling Blasting, Hot Bituminous work, scaffolding, ladder, formwork
Materials management: Functions and objective, Inventory control, EOQ, ABC analysis
Equipment Management: Classification, selection, Equipment of major projects: Excavating Machines (Shovels, draglines, Bulldozer, Scraper), Drilling and blasting, Transporting and Handling equipment, Cranes, Hoists, Conveyor belts, Dumpers, Cableways. Concrete equipments: Mixers, vibrators, batch mixing plants, Calculation of Unit rate for Excavating Equipment and Concreting Equipment.

Course Outcome:
1. Planning of various construction projects such as Building, Roads, etc.
2. Manpower requirement planning during project
3. Equipment planning
4. Material planning
5. Quality and Safety measures at Site

REFERENCE:
5. P G. Gahoitand B.M. Dhis, Construction Management New age international (p) Ltd.
Course Objectives:
1. Analyze relative equilibrium of fluids
2. Teach Hydro-kinematics
3. Introduce Boundary Layer Theory
4. Analyze flow through pipes, turbines and pumps
5. Teach Drag and Lift forces

Syllabus:
Relative equilibrium of fluids, Liquid masses subjected to uniform horizontal and vertical acceleration, Acceleration of fluid mass along a slope, Free and forced vortex, Velocity potential function and stream function, flownet, circulation, Kinetic energy correction factor, Momentum correction factor, Pipe flow, branching, power transmission, syphon, Viscous flow, laminar incompressible flow in a circular pipe, Hydraulically smooth and rough pipes, Moody’s diagram, two dimensional laminar flow between parallel plates
Boundary Layer Theory, Displacement thickness, Momentum thickness, Laminar boundary layer Forces on immersed bodies, Drag and Lift, Magnus effect
Hydraulic turbines and their performance, centrifugal and reciprocating pumps, working principles, specific speed, characteristic curves, Air vessels.

REFERENCE:
1. Free and forced vortex
2. Laminar flow
3. Model studies for turbines, pumps, losses in pipes
4. Assignments
Course Objectives:
1. Introduction to basic principles pavement design as per IRC.
2. Mechanical properties of pavement material like bitumen and cement.
3. Introduce rigid pavement design and its advantages over flexible pavement.
4. Pavement maintenance


Analysis of Flexible and Rigid Pavements: Stress, Strain deformation analysis for single, two three and multi layered flexible pavement systems. Stress and deflections for rigid pavements due to load and temperature, influence Charts, ultimate load analysis, joints in C.C. pavements.

Highway Pavement Design:
 a) Flexible: North Dakota cone, Group index, CBR, IRC-37, Brumister, Triaxial (Kansas), AASHTO method of design.
 b) RIGID IRC-58, P.C.A., AASHO method of design, Design of joints and reinforcement.

Airfield Pavement Design:
 a) Flexible: U.S. Corps of Engineering, CBR, FAA, Mcload (Canadian)
 b) Rigid: PCA, FAA & LCN, ultimate load Analysis yield lines patterns, methods.


Course Outcome:
1. Gain broad understanding of mechanical properties of pavement material like bitumen and cement and various methods of pavement design being practiced in India
2. Design a pavement using relevant IS/IRC codes.
3. Carry out bitumen mix design

REFERENCE:
1. Yoder & Witzace, Principles of Pavement Design ; Prentice Hall, 2000
4. Goyal & Praveen Kr., Airport Planning &Design ;Galgotia Publication, 2002
5. Croney & Croney ; Design and Performance of Road Pavements; McGraw Hill, 2002
Course Objectives:
1. To understand various water surface profiles.
2. To study free surface flow measurements on field.
3. To know the physical modeling laws.

Syllabus:

Cavitation, Laboratory study, Effects and prevention of cavitation, Cavitation parameter, Aeration of rectangular weir, Submerged sharp crested weirs.

Physical modeling: Dimensional homogeneity, Methods of dimensional analysis, Rayleigh’s method, Buckingham’s method, Model analysis and its advantages, Similitude, Dimensionless numbers, Reynolds number, Froude’s number, Mach number, Weber number, Scale ratios, Ship resistance model, Models of pumps and turbines, Distorted models, Various modes of distortion, Scale effects of model testing, River models, Limitations of hydraulic similitude.

Course Outcome:
1. Estimate equivalent roughness for compound channels
2. Analyze and compute the Gradually Varied Flow (GVF) profiles
3. Locate the hydraulic jump in prismatic channels

REFERENCE:
Course Objectives:
1. To get a feel of problems involved with Irrigation Engineering, socio Economic
2. Study various types & requirements of irrigation, soil moisture relationship Crop patterns.
3. Design & construction of various types of dams.

Syllabus:
General: Necessity and importance, scope and development of Irrigation in India, Classification of Irrigation, Comparative study of different irrigation systems
Quality of irrigation water, salt constituents and their effects, Soil moisture – Consumptive use, water requirements of crops Duty-Delta-Base period-Factors affecting duty – Duty for principal types of crops grown in India, reclamation of saline soil.

Reservoir Planning and Management: Investigation- Selection of site – Detail surveys to be conducted and data collection– Determination of field and storage capacity – Determination of L.S.L. and F.R.L. of reservoir sedimentation B-C ratio

Dams: Different types and their suitability – Factors governing the selection of type of dam for project.
Gravity Dam: Forces acting on a gravity dam (including seismic load) – Stability requirement, Design and Construction aspects.

Earthen Dams: Types of Earthen Dams – Factors and general Principles to be considered in the design.
Failures of Earthen Dams – Seepage and drainage arrangement

Weirs: Different types of weirs – Spillways – General principles of design – types, spillway gates –energy dissipation downstream of spillway.


Course outcome:
1. Relate with socio economic aspects of agriculture.
2. Understand & assess requirements of irrigation.
3. Have insight of planning & design of storage irrigation systems- Dams.
4. Plan & design irrigation water conveyance systems

REFERENCE:
3. Creager, Justin, Hinds; Engineering for Dams; 1995.
Course Objectives:
To estimate the cost of a building from given set of drawings and detailed specifications.

Syllabus:

Specifications: Definition, Objectives, Use, Types, Classification, Design of Specifications, Principles of Specification Writing, Sources of Information and Typical Specifications.


Rate Analysis: Purposes of Rate Analysis, Factors affecting, importance, Schedule of Rates, Task works per Day, Rate analysis of typical Items.

Valuation: Purposes, Cost, Price and Value, Forms of Value, Classification of Property, Freehold and Leasehold Properties, Sinking Fund, Amortization, Depreciation and Obsolescence, Outgoings, Gross Income and Net Income, Capitalized value, Deferred Land Value, Year's Purchase, Rate of Interest, Mortgage, Legal Mortgage, Accommodation Land and Accommodation Works, Annuity, Land Valuation, Methods of Land Valuation, Rent fixation.


Course Outcome:
1. Estimate the cost of any building.
2. Design technical specifications for any project.
3. Invite tenders and arrange contracts on behalf of Govt.
4. Carry out rate analysis of various items in construction.
5. Fix the value of built-up properties and land, fixation of rent for a property.

REFERENCE:
1. A Complete set of Contract document (Including specifications along with a building estimate)
3. Rate Analysis of 10 Major Terms of Building.
4. Earth Work of Road for minimum 1 Km Length.
5. Practical examination shall consist of viva voce based on the syllabus and a sessional work.
Course Objectives:
1. Introduction to basic design of railway, airport and ports.
2. Geometric design of railway tracks.
3. Planning of an airport design of airstrip and facilities at airport.

Syllabus:

Railway Transportation and its development: Long term operative plans for Indian Railways. Classification of Railway lines and their track standards, Railway terminology, Railway Administration and Management. Traction and tractive Resistance, Hauling capacity and tractive effort of locomotives, different Types of Tractions.


Points and crossings: Left and right hand turnout, design calculation for turnout and Crossover, railway track Junctions.

Stations and Yards: Types, functions facilities and equipment.


Air traffic control: Need, Network, control aids, Instrumental landing systems, Advances in Air-traffic control.

Docks and Harbor: Importance, Sea and tides, tidal theories, tide table, wind waves and Cyclones, harbour layout, break waters, jetties and moorings.

Course Outcome:
1. Knowledge of basic design of railway, airport and ports.
2. Knowledge of geometric design of railway tracks.

REFERENCE:
1. Saxena; Railway Engineering.
5. Srivastav R., Docks harbour and tunnels engineering, Charoter.
6. Goyal and Praveen Kumar, Airport Planning and Design, Galgotia Publication.
Course Objectives:
1. To introduce the students about quality and safety related challenges in construction industry
2. To make students aware about the globally recognized guidelines/theories for quality and safety in construction
3. To make students self efficient to audit quality and safety related challenges in construction

Syllabus:
Total quality management concepts; ISO9000; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.

Safety issues; Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws.

Safety Organization and Management: Safety policies, safety organization, safety committees, safety representatives, outside agencies – Govt. intervention, international agreements.

Course Outcome:
1. Gain a broad understanding of quality and safety in construction
2. An ability to function on multidisciplinary teams
3. Contemporary issues and development
4. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

REFERENCE:
Course Objectives:
1. To bring the civil engineers to such a level so as to enable them to take the appropriate decision in respect of choice of Prestressed section over R.C.C.
2. To make the learners to be aware of such a highly mechanized technology in civil engineering construction.
3. To imbibe the culture of entrepreneurship in precast prestressed industry in mass housing, railway sleepers, electric transmission poles etc.
4. To understand the basic design considerations in prestressed concrete structures in relation to its applications.
5. To employ & develop new techniques in rehabilitation of distressed structures like buildings, Bridges & infrastructures.

Syllabus:

Course Outcome:
1. Achievement of adequate knowledge in prestressed concrete structures ready for its dissemination & application.
2. Achievement of adequate knowledge in industrial requirements of prestressed concrete.
3. Emergency preparedness in case repairs & rehabilitation of structures in case of disasters like earthquake, fatigue & dynamic loadings etc.
4. Updating of knowledge in design & research.

REFERENCE:
Course Objectives:
1. Introduction to Water Distribution Networks
2. Methods for Analysis
3. Types of Analysis
4. Methods for Designs

Syllabus:


Optimal and Economical diameter of pumping main, Design of pumping main considering diameter as continuous as well as discrete variable. Water hammer consideration.


Determining number of branching configuration for a looped network, Use of path concept and minimum spanning tree concept, Application of critical path method for design of looped networks. Introduction to methods for Looped WDNs.

Course Outcome:
1. Types of problems in water distribution systems
2. Methods for analysis of existing network
3. Various types of analysis of the networks
4. Analysis of networks with controlling elements
5. Design of new networks and strengthening of existing system

REFERENCE:
2. Bhave P.R., Optimal Design of Water Distribution Networks  Nawas Publishing Co, New Delhi.
5. CPHEEO, Manual on Water Supply and Treatment, Ministry of Urban Development G01.
Course Objective
1. To understand the Philosophy of Design of RCC & Steel Structural Elements with advanced concept.
2. To acquire the skill & knowledge about design of special & typical structures in steel & concrete.
3. To design simple structural forms in roof structures in RCC & steel.
4. To study the Concept of design with respect to plastic Design of steel structural elements.
5. To study the basics of Optimum & minimum weight design of structural elements.

Syllabus:

Steel Structures: Design of Steel tanks and chimney and bunkers. Plastic analysis and design for steel structures, plastic hinge concepts collapse load calculations. Design for upper bound and lower bound solutions and mechanisms. Design of single span and continuous beams, columns, Gable and Portal frames. Design of light gauge steel sections and members, minimum weight design

Course Outcome:
1. To understand the Philosophy of Design of RCC & Steel Structural Elements with advanced concept.
2. To acquire the skill & knowledge about design of special & typical structures in steel & concrete.
3. To design simple structural forms in roof structures in RCC & steel.
4. To study the Concept of design with respect to plastic Design of steel structural elements.
5. To study the basics of Optimum & minimum weight design of structural elements.

REFERENCE:
2. Borg ;Gennaro ; Structural Analysis , Affiliated East-West press ltd. VamNostrand company Design
10. Arya A.S.,J.L.Ajamani;Design of Steel Structures,Nemchandand Bros.1989
Course Objectives:
1. Understanding the Geoinformatics approach
2. Teach fundamental principles involved in RS and GIS
3. Understand the Fundamentals of Remote sensing Products
4. Know the Indian Remote Sensing Program
5. Role of Remote Sensing for various surveys and information extraction
6. Know about different software available in RS and GIS
7. Learn fundamental procedures in RS and GIS
8. Teach data integration and defining problems in digital format

Syllabus:


Applications: Integrated approach of RS & GIS application; Geotechnical investigations (soil studies, dam site studies), water resources management, environmental studies (EIA and Land Use Land cover studies), transportation planning, Urban Planning, E-Governance.

Practicals:
1. RS Data formats & their study; analogue & digital data products
2. Image registration
3. Digital enhancement
4. Image classification
5. GIS: Vector data generation, Data attachments and analysis
6. Data analysis in GIS
7. Case studies: Water resources, environmental applications, geotechnical investigations

Course Outcome:
1. Understand the remote sensing process
2. Understand digital data in different and their formats
3. Know about National and International RS Programs
4. Know about various satellites and images
5. Know about changing field practices in Survey
6. Know how to generate different types of digital data
7. Know about Application areas

REFERENCE:
Course Objectives:
1. To introduce the students about the challenges/phases in disaster management.
2. To make students aware about technologies, which can be implemented for solving the problem of disaster management.
3. To make students self-efficient to solve the challenges with the aid of technological aids.

Syllabus:
Introduction to Disasters- Overview, Classifications, causes, loss of resources
Disaster Risk Management- Objectives, Processes, Events, analysis, base-line data, forecasting and warning.
Emergency operation centre and IT aids- physical environment, IT Aids, Applications.
Techno-legal and Techno-financial aspects- regulatory mechanism for compliance, administrative structure for legal framework, additional cost on infrastructure, building by-laws.
Public-private agency co-ordination- federal, state and local disaster response organization and network, citizen and community role in disaster response and recovery.
Case studies: Natural and man-made disasters, preparedness and planning.

Course Outcome:
1. Gain a broad understanding of disaster management.
2. Broaden the education necessary to understand the impact of disaster in a global, economic, environmental, and societal context
3. Contemporary issues and development
4. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

REFERENCE:
Course Objectives:
1. Introduce to the application part of open channel flow.
2. Making students understand the importance of nature and the complications involved in natural processes.
3. To expose students to complex scenarios and explain hen the importance of various equations and the concepts in handling the situations.
4. To make students understand the correlation between complex natural events and the difficulties in addressing them from engineering view point.

Syllabus:

Origin and properties of sediments: Nature of sediment problems, origin and formation of sediments, properties of sediments, incipient motion of sediment particles, tractive force approach, cohesive materials.

Regimes of flow: Description of regimes of flow, ripple, dune, antidune, prediction of regimes of flow. Resistance to flow and velocity distribution in alluvial streams, velocity distribution in turbulent flow over rough boundaries, resistance and velocity distribution in alluvial streams.

Bed load transport and saltation: Bed load equations, bed load equations based upon dimensional considerations and semi-theoretical equations, general comments on bed load equations, saltation.

Suspended load transport: Mechanism of suspension, equation of diffusion, sediment distribution equation, relations for suspended load, wash load, transport of suspended sediment.

Total load transport: sediment samplers design of canals carrying sediment laden water. Types of sediment samplers. Design of channels carrying sediment laden water. Sediment transport through pipes

Course Outcome:
1. Understand the relation between formulations and occurrences in nature.
2. Application of equations of Hydraulic Engineering in the understanding river systems.
3. Will develop analytical skills in handling variety of data.
4. State of art research and their applications.

REFERENCE:
Course Objectives:
1. To introduce hazardous waste materials.
2. Teach about the generation, classification and categories and sources of hazardous waste.
3. Teach about the methods of treatment and management of hazardous waste.
4. Various rules about the management and handling of hazardous waste.

Syllabus:
Generation, storage, transportation, treatment, disposal, exchanges and minimization, legislative and technical aspects, current management practices; Environmental audits, pollution prevention, facility development and operations, treatment and disposal methods; physical, chemical, thermal, biological processes, land disposal with general applications to the industrial and energy-producing sectors, Site remediation. Special wastes, such as infectious and radioactive waste.

Course Outcome
1. Gain a broad knowledge about the hazardous waste
2. Understand sources and classification of hazardous waste.
3. Waste minimization techniques
4. Management of hazardous waste Various rules and regulations for the management and handling of hazardous waste

REFERENCE:
Course Objectives:
To make Civil Engineering students able to prepare business plan by analyzing the economic and market situations.

Syllabus:

Principles of management and Personnel management: Economic environment of business, Introduction to managerial economics; Role of a Manager: Tasks and responsibilities of a professional manager, Human Resource development systems Organization structure and design, manpower planning Processes Managerial skills and Management Systems, techniques and processes, SWOT Analysis.

Business Policy and Strategic Management: Assessment of capital requirement and sources of capital planning the establishment and development of business, fixed and current assets, liquid resources, Forecasting of business, cash flow, effect of taxation, Public and private sources of finance, methods of obtaining finance from external sources and internal sources, cost of capital, forms of capital structures.

Value engineering and quality assurance: Marketing planning and organization, marketing research and Marketing strategies, determinants of consumer behavior, Models of consumer behavior, Pricing and promotion strategies. Business forecasting, Modern Control Systems, Total quality Management (TQM), JIT, DSS, ERP, Strategic Management, Technological innovation and creativity.


Construction Finance: Accounting information and application, Financial versus economic evaluation, financial statements and project appraisal. Project yield, taxation and inflation, risk and uncertainty, Turnkey activities; finance and working capital, depreciation and amortization; cost control, performance budgeting, equipment rentals. Bidding and awards, work pricing, cost elements of contracts, letters of credit, financing plans, multiple sources of finance. Qualifying, bidding, bidders, comparing the bids, under-writing, unforeseen revisions, costs and rates escalation, cost progress reporting. Legal aspects.

Course Outcome:
1. Analyse the management system of the organisation
2. Understand the role of manager and skills required
3. Use the swot analysis in decision making
4. Understand the terminology in marketing, HR, finance, Accounting apply knowledge in industry for effective management

REFERENCES:
Course Objectives:
1. To introduce the students about the application tool useful for civil engineering.
2. To make students aware about techniques and programming aids which can be implemented for solving the problem of civil engineering?
3. To make students self efficient to solve the challenges with the aid of technological aids.

Syllabus:
Introduction to CAAD and computer graphics: Overview, programming language, application area, software environment. Data types, graphics devices, representation of images, transformations, computer aided drafting.

Programming language and techniques: Overview, variables and data types, operators, input-output, control structures, functions, arrays, pointers, strings, data-files, trees, and recursion.

Database management system (DMBS): Introduction, Components of DBMS, Data Models, query language, design of database

Knowledge based expert system: Introduction, Artificial intelligence, components of expert system, knowledge representation, inference mechanism, and building expert system.

Simulation: Introduction, Concept of System, models and its purpose, types, approaches.


Course Outcome:
1. Knowledge of application tool for civil engineering.
2. Application of techniques and programming aids and implementation in civil engineering problem solving.
3. Students should be able to solve the challenges with the aid of technological aids.

REFERENCE:
1. Vijay duggal, Caad primer, a general guide to computer aided design and drafting
10 lab experiments will be conducted based on above topics.
Course Objectives:
1. Introduction to vibration of a system.
2. Concept of different mode of vibration.
3. Physical significance of wave propagation theory.
4. Relevant soil parameters and Instrumentation.

Syllabus
Introduction: Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping.

Mode of vibration: Basic theory of vibrations-free and forced vibration of single degree of freedom with and without damping-two degrees of freedom with and without damping-dynamic soil properties-mass spring model and constants- elastic half space approach-determination of dynamic soil constants in laboratory and field based on IS code provisions. Modes of vibration of block foundation – natural frequency of foundation of soil system by Barkan’s approach-methods of analysis-Barkan’s method. Vertical translations, sliding, rocking, yawing (IS code method).

Concept of waves and wave propagation: Wave propagation in an elastic homogeneous isotropic medium-Raleigh, shear and compression waves in elastic half space.


Vibration isolation technique: Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location isolation by barriers- active passive isolation tests.

Tutorial:
1. Determination of degree of freedom for different systems.Single degree freedom system-free and forced vibration with and without damping, determination of natural frequency, damping ratio etc.
2. Determination of natural frequency of foundation- soil system by Barkan’s approach and IS code method (IS 2974-PART 1, 2, 3 and 4).
3. Determination of dynamic properties of soil for real sites, numerical.
4. Simple design procedures for foundations under reciprocating machines, using IS Code provisions. A complete design problem will be practiced.

Course Outcome:
1. Gain a broad understanding of Vibration of a system.
2. Get accustoms with mode of vibration and wave propagation concept.
3. Knowledge of different instruments and relevant soil parameters for design of foundation.
4. Contemporary issues and developments.

REFERENCES:

CEL 442- GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION PROJECTS

[(3-0-0); Credits: 3]

Course Objectives:
1. To make the students capable of solving real problems related to Geotechnical engineering, once he/she join industries as a fresh geotechnical engineer.
2. In this course all the topics will be taught from the application point of view with examples from case histories and a student will get a chance to apply his theoretical knowledge to solve real geotechnical challenges.
3. Introduction with advance methodology, techniques and tools related to geotechnical investigation
4. To discuss ground improvement with various methodologies.

Syllabus:
Site Investigations: Planning of investigation programmes, Information required for planning different stages of investigations. Geophysical methods,

Methods of site investigations: Direct methods, semi-direct methods and indirect methods, Drilling methods. Boring in soils and rocks, methods of stabilizing the bore holes, measurement of water table, field record. Field tests: In-situ shear test, in-situ permeability test, SPT, DCPT, SCPT, in-situ vane shear test, pressure meter test, plate load test. Sampling techniques, Sampling disturbances, storage, labeling and transportation of samples, sampler design, influence on properties. Geotechnical specification and proposal and report writing, boring log preparation, Safety measures, Geotechnical risks.

Geotechnical Processes: Field compaction, field compaction techniques- static, vibratory, impact, Earth moving machinery, Compaction control in field.

In-situ stabilization with additives: Lime, flyash, cement and other chemicals and bitumen.

Deep Stabilization: Sand column, stone column, sand drains, prefabricated drains, electro-osmosis, lime column. soil-lime column.


Geotechnical Engineering Case Histories: Earthen dam and reservoir, Industrial Structures, Ground Liquefaction, opencast coal mining, landslides, failure of geotechnical structures under critical natural hazards, debris flow, forensic geotechnical investigation.

Course Outcome:
1. Write geotechnical proposal, specification and reports.
2. Bore logging and trial pit logging.
3. Supervise field and lab testings of soil and rocks.
4. Collect and analyze geotechnical data for various construct projects.
5. Analyse and suggest proper ground improvement technique for problematic ground conditions.

REFERENCES:
1. S. K. Saxena, S. A. Gill and R. G. Lukas, Subsurface Exploration and Soil Sampling, American Society of Civil Engineers
2. Raj Purushothama, Ground Improvement Techniques, Laxmi Publications
Course Objective:
This course is designed to provide an introduction to dynamics with Soil Dynamics and Geotechnical Earthquake Engineering. The fundamental theoretical and computational aspects of dynamics are developed for important geotechnical problems. The topics include: foundation vibration, dynamic soil structure interaction, construction-induced vibration, seismic ground motion, dynamic response of soil sites, and soil liquefaction.

Syllabus:
Introduction to dynamic loading: Earthquake loading, machine vibrations, blast loading, background and lessons learnt from damages in past earthquakes due to soil and ground failure, effect of soil on seismic response of structures, seismic waves and their characteristics
Dynamic soil properties: Static and dynamic characteristics of soils, stress-strain behaviour of cyclically loaded soils, effect of strain level on the dynamic soil properties, equivalent linear and cyclic nonlinear models, measurement of seismic response of soil at low and high strain, using laboratory tests, cyclic triaxial, cyclic direct simple shear, resonant column, shaking table, centrifuge and using field tests - standard penetration test, plate load test, block vibration test, SASW/MASW tests, cross bore hole
Ground Response Analysis: Introduction to 1, 2 and 3 D ground response analyses, derivation of 1 D ground response analyses, equivalent linear and nonlinear approaches, fundamental period of uniform and layered soil
Soil Amplification: Effects of local soil conditions on ground motion, concept of response spectra, instrumental, experimental and numerical methods to determine soil amplification factors, standard spectral ratio, surface to borehole ratio, H/V ratio for noise and microtremors, Indian response spectra for different soil types IS 1893 Part 1
Soil-Structure Interaction: Introduction to soil-structure interaction, direct and substructure methods of analysis, kinematic interaction, inertial interaction, foundation damping, effect of base slab averaging and embedment, SSI analyses for nonlinear static analyses of structures
Liquefaction: Effects of liquefaction, pore pressure, liquefaction related phenomena – flow liquefaction and cyclic mobility, factors affecting liquefaction, liquefaction of cohesionless soils and sensitive clays, liquefaction susceptibility, evaluation of liquefaction potential, characterization of earthquake loading and liquefaction resistance, cyclic stress ratio, Seed and Idriss method.

Course Outcome:
In this course, the students are expected to learn
1. Basic Theoretical and Computational Dynamics
2. Earthquake and Seismic Hazards
3. Strong Ground Motion Characteristics
4. Design Ground Motion at a Site
5. Dynamic Response Analysis
6. Effect of Local Site Conditions
7. Soil Liquefaction
8. Foundation Vibration Analysis
9. Dynamic Soil Structure Interaction
10. Construction-induced Vibration

REFERENCES:
Course Objective:
To make Civil Engineering students able to analyze, evaluate and design construction contract documents.

Syllabus:

Construction Specifications: Standard specifications, general specification, development, interpretation.

Tender and tender documents: Types of bidding, tender notice, tendering procedure.

Construction claims: Extra item, excess quantity, deficit quantity, price escalation.

Dispute resolution mechanism: Litigation, arbitration, conciliation, mediation, dispute resolution board.

Contractual Problems: possible contractual problems, creation of claims, development of disputes.

Contract document: Drafting of clauses, development, and interpretation, CPWD conditions of contract, FIDIC conditions of contract.

BOT contract: Types of contract, PPP framework, types of risk, concession agreement, drafting of clauses, development, and interpretation.


Relational Contract: Partnering, alliancing, key elements, processes.

Course Outcome:
1. Knowledge of types of construction contracts and their essential conditions.
2. Knowledge of standard specification.
4. Knowledge of different dispute resolution mechanisms and laws.

REFERENCE:
3. General Conditions of Contract, Central Public Works Department, New Delhi, 2010
4. S. Ranaga Rao, Contract Management & Dispute Resolutions, Engineering staff College of India, January 2008
Objective:
To introduce mechanical properties of materials. To introduce concepts of stress and strain. To introduce distribution of stresses & deformations.

Syllabus:
Mechanical Properties:
Concept of stress and strain, stress-strain behaviour of ductile and brittle material in uniaxial state of stress, elastic constants.
Axial Force, Shear Force and Bending Moment:
Determination of axial-force, shear force and bending moment at a section. Axial force diagram, shear force diagram and bending moment diagrams for simple determinate frames, differential relation between loads, shear force and bending moment.
Stresses in Beams:
Assumption and derivation of simple a bending theory, relation between bending moment, bending stress and curvature for homogeneous and composite beams. Shear stresses in simple beams, shear flow and shear stress distribution, Asymmetric bending.
Membrane Stresses:
Thin walled cylindrical and spherical pressured vessels subjected to internal pressure.
Torsion:
Torsion of circular sections, assumptions and derivation of relation between torsion moment, shear stress and angle of twist.
Combined Bending Moment and Axial Force:
Resultant normal stress due to combined effect of bending moment and axial force, eccentric loading, core section and its importance to masonry structure.
Transformation of stresses:
State of stress in two dimensions, State of stress in three dimensions, Principal stresses, Maximum shear stress, Use of Mohr’s circle. Introduction to theories of failure
Deflection of Beams:
Derivation of differential equation of moment curvature relation, Deflection of simple beams by double integration method.
Columns and Struts:
Buckling of column, slenderness ratio, Euler’s buckling load for slender column, effective length for different end condition.
Introduction to strain energy, Stresses due to Impact and concept of virtual work.

Method of Assessment:
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

Reference:
1. Determination of stiffness of Tension Spring.
2. Tension Test on Mild Steel
3. Direct Shear Test on Bolts
4. Shear Strain due to Torsion
5. Torsion Test on Circular Shaft
7. Modulus of Rupture for Rectangular Wooden Beam
8. Determination of Flexural Rigidity of a Beam
9. Deflection of Beam
10. Study of Maxwell’s reciprocal theorem
11. Principal stresses (Analytical / Graphical method)
12. Plotting stress contours /vectors
13. Deflection of Composite Beam
Objective:
The objective of this subject is to expose students to various methods for structural analysis.

Syllabus:
Moment Area Method, Conjugate Beam Method, Analysis of fixed and continuous beams by theorem of three moments, effect of sinking of support.

Analysis of continuous beams and simple (non-sway) portal frames using Moment Distribution Method.

Rolling loads (including IRC) on simply supported beams with concentrated and uniformly distributed loads, maximum B.M. and S.F., Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers and beams with overhangs, Influence lines for forces in members of simple trusses.

Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees.

Determination of deflection of trusses, Williot-Mohr diagram, Castigliano's theorem, Maxwell's reciprocal theorem, Betti's theorem.

Buckling of Column and beam-column, Euler’s and Rankine’s formula, Analysis of Two-Hinged arches, S.F. and normal thrust, parabolic arches.

Slope deflection method as applied to indeterminate beams & continuous beams, portal frames.

Course Outcome:
1. Able to analysis determinant and in-determinant structures
2. Able to understand Structural Responses
3. Able to analyseField problems of Structural analysis
4. Dissiminate knowledge of structural Analysis to society.
5. Communicate effectively the design parameters to the stakeholders.

REFERENCES:
Objective of the course is to have better understanding at structures & their responses to various loading. To enable students to determine forces, stresses, deflection and behavior of various structural members when subjected to different types of loading practically. This course will help students to apply their theoretical understanding learnt in the courses such as solid mechanics and structural analysis.

1. Study of Indeterminacy (static and dynamics) of structures. 
2. Verification of Shear Force and Bending Moment Diagrams for Beams using standard structural analysis package.
3. Verification of Maxwell’s reciprocal theorem.
5. Verification of Betti’s theorem.
6. Study of Three Hinge Arch.
7. Verification of Three Moments Theorem using standard structural analysis package.
8. Verification of Moment Distribution Method using standard structural analysis package.
10. Verification of Slope Deflection Method using standard structural analysis package.
Course Objective:
The objective of this course is to introduce the students to the general design of tension, compression, beam members including connection, study of IS codes with latest design methods.

Syllabus:
Steel as a structural material: Various grades of structural steel, properties, various rolled steel sections (including cold formed sections, structural pipe (tube) sections) and their properties. Introduction to I.S. 800, 808, 816, 875, 1893 etc.; Design of axially loaded members: (a) Tension members (b) Compression members.

Design of roof truss: Load assessment for DL, LL and WL

Design of simple and built up beams: Laterally restrained and unrestrained, (symmetrical as well as unsymmetrical section). Curtailment of flange plates. Design of welded plate girder, concept of gantry girder. Design of single rolled steel section column subjected to axial load and biaxial moment including base design. Design of axially loaded built up columns. Laced and battened (Column bases slab base gusseted base moment resistant bases)

Structural Fasteners: a) Behavior of bolted and welded connections (types, Designations, properties, permissible stresses), failure of bolted and welded joints. Strength of bolt and strength of weld. Efficiency of joints. Design of simple bolted and welded connections. (b) Moment resistant bolted and welded connection (bending and torsion).


Course Outcome:
1. Capable of using all loading and limit state design methods for steel structures.
2. Capable of elementary design of tension /compression member.
3. Able to provide the design of beams, column base plates, plate girder.
4. Capable of understanding the types of structural fasteners and their behavior and connections.
5. Competent enough to analysis and design of steel structures and able to provide the good quality control during the steel construction.

REFERENCES:
7. Shah & Gore, “Limit State Design of Steel Structures”. 
Course Objective:
The objectives of this course is to expose UG students to various methods of analysis of indeterminate structures and inter-relationship between the methods

Syllabus:
Kani’s Method applied to symmetrical and unsymmetrical frames with sway (Up to single bay Two storey)

Moment Distribution applied to frames with sway correction, Approximate method of Structural analysis for multi-storied frames with lateral loads (Portal and Cantilever method), Approximate methods for vertical loads i.e. Substitute frame method etc. (Max three bay three storey)

Column Analogy method, Applications to beams, Calculations of Stiffness factors and carry over factors for non-prismatic members, Analysis of non-prismatic fixed beams.

Concept of static indeterminacy of structures, Formulation of Flexibility matrix and equations applied to simple trusses and continuous beams. Flexibility matrix for non-prismatic members.

Concept of kinematics indeterminacy of structures, Formulation of stiffness matrix and equations applied to simple trusses and continuous beams.

Stiffness matrix method applied to simple plane frames.

Course Outcome:
1. Able to choose method of analysis for indeterminate structure.
2. Able to understand stiffness method: structure as well as member approach.
3. Able to analyze non-prismatic beams.

REFERENCES:
AML 462 - ELEMENTS OF STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING

[(3-0-0); Credits: 3]

**Course Objective:**
1. Introduction to the concept of damped and undamped system.
2. Introduction to the concept of earthquake and its origin.
3. Introduction to IS 1893
4. Introduction to the concept of Multi-degree-of-freedom.

**Syllabus:**
Undamped and damped Single Degree of Freedom System (SDOF), Equation of motion, Natural frequency, Logarithmic Decrement

Response of SDOF to Harmonic Loading, Response of SDOF to arbitrary loading; Impulse response, Duhamel integral, Concept of Response Spectra

Origin of earthquakes, Engineering geology, Seismicity of the world, Faults, Propagation of earthquake waves, Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording)

IS 1893: Equivalent Static Analysis, Regular Irregular buildings, Torsion provision, Four virtues of EQRD: Stiffness, Strength, ductility and Configurations, Introduction to Capacity design concepts

Introduction to Multi-degree-of-freedom (MDOF) system, Mode shapes, Response Spectrum Method of IS 1893, Modal Combination Rule, SRSS.

Concept of ductility, provisions of IS 13920

**Course Outcome:**
1. Knowledge of concept of damped and un-damped system.
2. Understanding the concept of earthquake and its origin.

**REFERENCE:**
5. IS 13920, “Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces-Code of Practice”, Bureau of Indian Standard; New Delhi, 1993
AML 525- Design of Advanced Steel Structures

[(3-0-0); Credits:3]

**Objective:**
To design the structures used for works shop building foot bridges, road bridge study of IS codes.

**Syllabus:**
Introduction to Allowable Stress Design, Plastic design
Loadings as per IRC, IRS, IS (IS:800, IS:875 part 1-V, IS:1893) applicable to various steel structures.
Design of Beam-column, Plate Girders, Open web structures and Space structures.
Bridges, Industrial Buildings including crane girders.
Welded and riveted connections.

**Method of Assessment:**
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

**Reference:**
Course Objective:
The objective of this subject is to expose student to understand the basic theory of structural dynamics, structural behavior under vibratory load and the effect of damping.

Syllabus:
Sources of vibration, types of excitations, Principle and working of piezoelectric transducers, Spring action and damping; Degrees of freedom; Application of Newton’s laws, D’Alembert’s principle, Single degree of freedom systems; Mathematical model of physical systems; Free vibrations of undamped and viscously damped systems; Coulomb damping material and radiation damping.

Response of viscously damped SDOF systems to harmonic excitation; Vibration Isolation, Force transmissibility and base motion; Principle of vibration measuring instruments; Equivalent viscous damping; structural damping, Response of an undamped SDOF to short duration impulse; unit impulse response. Response of undamped system of rectangular, triangular and ramp loading; response to general dynamic excitation.


Multiple degree of Freedom system, Vibration of undamped 2 DOF systems; Response of 2 DOF to harmonic excitation, mode superposition, vibration absorber, Lagrange equation and their application to lumped parameter models of MDOF (up to 3 DOF). Free vibration of MDOF (up to 3 DOF) systems, methods of solving eigen value problems; iteration methods.


Course Outcome:
1. Convert structure into SDOF system.
2. Find response of free and force vibration (harmonic, periodic and transient) of SDOF system.
3. Find natural frequency and mode shapes of MDOF system.
4. Carry out modal analysis of MDOF system.
5. Perform experiments and computer simulation of vibrating system.

REFERENCES:
Course Objective:
The objective of this course is to expose the students to the application of basic design procedures to the design of important structures such as bridges, multistoried buildings and water tanks.

Syllabus:
Approximate analysis and design of building frames, Calculation of loads due to Dead load, Live load, Wind load, Earthquake loads (Codal co-efficient method only) on multistoried frames as per relevant IS codes, Design of elements of multistoried frames such as beams, columns, foundations etc., detailing of structures as per IS: 456 & IS: 13920.

Analysis and design of rectangular and circular tanks (Underground, on-ground and elevated) using coefficients given in IS: 3370, Analysis and design of staging for static, wind and earthquake forces, Design of foundations for ESRs.

Analysis and design of slab type bridges subjected to various types of IRC loads, Analysis and design of T-beam bridges (limited to two girders, simply supported ends) with load distribution as per Courbon’s method.

Course Outcome:
1. Design a building from foundation to roof level.
2. Read structural drawings of RCC building.
3. Understand seismic analysis, design and detailing of building.
4. Design water tanks on ground surface, underground tank and overhead tank.
5. Design small bridges.

REFERENCES:
1. Jain, O.P.; & Jaikrishna, “Plain and Reinforced Concrete (Vol-I&II)”, NemChnand& Bros; Roorkee.
8. “SP- 16; Design Aids for Reinforced Concrete to IS- 456”, 1980.
Course Objective:
The objective of this subject is to make the students aware of the numerical methods for the solution of scientific problems which cannot be solved analytically.

Syllabus:
Interpolation: Existence, Uniqueness of interpolating polynomial, error of interpolation, unequally spaced data, Lagrange’s formula, and Newton’s divided difference formula. Equally spaced data, finite difference operators and their properties, Gauss’s forward and backward, Sterling’s formulae - Inverse interpolation - Hermite interpolation.

Differentiation: Finite difference approximations for first and second order derivatives.

Integration: Newton-cote type closed methods, particular cases, error terms; Newton-cotes open type methods, Romberg integration, Gaussian quadrature, Legendre Formulae.


Solution of linear algebric system equations: LU decomposition, Gauss-seidal methods; Solution of tridigonal system, III conditioned equation, Eigen values and Eigenvectors; Power and Jacobi methods.

Course Outcome:
The students should be able to solve scientific problems, which otherwise cannot be solved analytically using numerical methods.

REFERENCE:
2. S. D. Cante and C. de Boor, Elementary Numerical Analysis, an algorithm approach, McGraw-Hill
Course Objective:
1. The course intends to equip the students with sufficient technical knowledge of job site layout planning.
2. To make the students aware with the various project delivery systems.

Syllabus:
Overview and Introduction to Indian Construction industry – Various sectors in Indian Construction Industry, Various reasons of project delays, Contribution of Indian Construction Industry towards the GDP, Project as a business.

Project Life Cycle – Understanding the project from concept to completion/closeout, Role of client/owner, consultant and contractor in different stages of the project.

Project delivery systems – Different Project delivery systems their merits and demerits, role of agencies and people involved in different project delivery systems.

Construction Site Management – Job Site Layout, Facilities Setup, Site Safety and accident prevention, documentation and record keeping, contract appreciation document for contract administration and coordination.

Field Procedure Manual (FPM) – Field Procedure Manual and its importance, Labor and subcontractor management, Site waste management, measurement and billing, project control estimate, and project escalations.

Project Communication – Meetings, review, inter & intra organizational relationships, Enterprise resource planning,

Case Studies – Construction project case studies.

Course Outcome:
At the completion of this course, students would be able to
1. Plan job site layout for any construction project
2. Overcome the factors affecting the project productivity
3. Make the project communication with various agencies involved in the project
4. Analyse the project escalations
5. Control construction project

REFERENCE:
Course Objectives:

1. To understand unsteady flow in pipelines
2. To know the methods of computation of water hammer
3. To understand the unsteady flow in channels

Syllabus:

Review of flow through pipe, Flow through pipe under variable head, Application of momentum equation for pipe bends

Unsteady flow in a pipe line for incompressible fluid, Time of flow establishment, Rigid water column theory of water hammer and computation of water hammer pressures

Water hammer phenomena when compressibility of fluid and elasticity of pipe is considered, computation of water hammer pressure of frictionless flow in horizontal pipe - for sudden and slow closure of valve, Application of Allievi’s method for calculation of approximate pressures, Water hammer pressures in pumping systems

Computation of water hammer pressures in branched pipe system and in surge tank system, Devices used for protection from water hammer pressures, Function of surge tank and different type of surge tanks, Equations governing the flow in the simple surge tank system, Analysis of flow in a simple surge tank system, Computation of maximum surges in a simple surge tank, Case of hydraulic stability in a simple surge tank system, General arrangement of Hydropower project

Unsteady flow through channels, Gradually Varied Unsteady Flow (GVUF), Saint Venant Equations, Types of waves, Monoclinal rising wave, Unsteady Rapidly Varied Flow (URVF), Positive and Negative Surges, Wave velocities

REFERENCE:

Syllabus:
Buckling of Columns, Theory of Beam-column, Buckling of beam-column,
Beam on Elastic Foundation
Analysis of Thick Cylinders
Analysis of Three-Hinged arches, Analysis of cables, Three hinged suspension bridges,
virtual work method for deformable bodies.
Stress-Strain Relation for Advanced Materials, Basics of Stress Tensors, Mohr’s Circle in 3-D,
Theories of failure: Introduction, statement, significance and application of the theories of failure, Shear Centre.

Method of Assessment:
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

Reference:
Objective:
To provide fundamental knowledge for designing various types of masonry structures.

Syllabus:
Material Properties: Masonry units- stones, brick and concrete blocks, hollow and solid units; Mortar, grout and reinforcement; various tests and standards.
Masonry Under Compression: Prism strength, Failure mechanism, types of construction and bonds; slenderness – effective length and effective height, effect of openings; code provisions.
Behavior of Masonry Structures: Common modes of failure, effect of unit shapes and mortar type, effect of roof and floor systems; Common deficiencies.
Analysis of masonry structures: Analysis for vertical and lateral loads, role of floor and roof diaphragm; Concept and design of bands, bandages, splints and ties; Reinforced masonry; Vertical reinforcement at corners and jambs; Measures in random-rubble masonry; Confined masonry; Code provisions.
Design of Masonry Building: Using IS code simplified provision; based on mathematical procedure.
Design of Masonry structures: Masonry chimneys; Industrial Masonry Sheds.
Retrofitting of Masonry Building: Techniques of repair and retrofitting of masonry buildings.

Method of Assessment:
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

Reference:
8. IS 875 (Part 1-IV).
10. IS 4326.
11. IS 1905.
12. IS 13935
13. IITK BMTPC Eq. Tips
AML 468 Maintenance and Rehabilitation of Civil Engineering Structures  [(3-0-0); Credits: 3]

Objective: To understand various methods for maintenance and rehabilitation of civil engineering structures

Syllabus:

Introduction:

Maintenance Works:

Materials & Techniques for Maintenance:
Materials for repairs like cement, cement grouts, epoxy grouts, mortars and coatings, polymer concrete composites, sealants, membrane overlays, fiber reinforcement concrete, Resin based compounds, emulsions and paints, geotextiles. Techniques like stiffening, linings, guniting protection systems, prestressing, post-tensioning and base isolation technology. Temporary supporting system for Structures like timering, shoring etc.

Maintenance Planning, Design & Costing:

Rehabilitation/ Retrofitting: Techniques, Design & Costing

Research in to Maintenance:
Importance of research in areas of materials, techniques, field equipment and tools for investigation, repairs and monitoring non-destructive Evaluation techniques.

Case Studies.

Method of Assessment:
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

Reference:
2. Facilities Maintenance and Repair of damaged structures by Karper. A Compilation of technical papers issued by Maharashtra India Chapter of American Concrete Institute.
4. Proceeding of the All India Seminar on Maintenance of Civil Engineering Structures and systems, Nagpur.
9. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication
11. Concrete Repair Manual, Volume I & II, Published jointly by ACI, BRE, Concrete Society, ICRI.
AML 469 Basics of Finite Elements Method

Objective: To introduce concepts of finite element method and its use for structural analysis.

Syllabus:
General finite element solution procedure, Advantages and disadvantages of FEM, Basic ideas in a finite element solution, Compatibility, equilibrium and completeness requirements, Finite element equations using Rayleigh-Ritz method.

One-dimensional FEM: Linear spring, Expression for equivalent spring constant and nodal forces (parallel spring and springs in series), Local and global element equation for bar in x-y plane, computation of stress for bar in x-y plane, 1-D torsion of circular shaft, 1-D steady state heat conduction, 1-D flow through porous media, bar element and application to Trusses

Beam Element: Review of beam theory, Finite element formulation for beam element, Analysis of plane frames

Two-Dimensional FEM: Step by step formulation for CST element for 2-D, plane stress and plane strain problems, I

Introduction to Iso-parametric bar and 2-D elements

Computer implementation of FEM

Method of Assessment:
Assignments + Tutorials, Sessional Exam (I + II) and End Semester Exam

Reference:
1. P. N. Godbole, Introduction to Finite Element Methods, I K International Publishing House