Form A-7
(See OA-14 of Part A)
Performa for the submission of the minutes of the Board of Studies

Part A.

i. Recommendations regarding courses of study in the subject or group of subjects at the undergraduate level:

- **Modification of approved scheme and syllabus of SE (CIVIL) Seem IV to BE (CIVIL)SEM VIII to remove minor discrepancies. Modified scheme is submitted as Annexure A. Syllabus for BE Civil Engineering RC 2019-20 SEM V to SEM VIII is submitted for approval as Annexure B.**

ii. Recommendations regarding courses of study in the subject or group of subjects at the postgraduate level:

----- NIL -----

Part B

i. Scheme of Examinations at undergraduate level:

----- NIL -----

ii. Panel of examiners for different examinations at the undergraduate level:

----- NIL -----

iii. Scheme of Examinations at postgraduate level:

----- NIL -----

iv. Panel of examiners for different examinations at post-graduate level:

----- NIL -----

Part C.

i. Recommendations regarding preparation and publication of selection of reading material in the subject or group of subjects and the names of the persons recommended for appointment to make the selection:

----- NIL -----

Part D

i. Recommendations regarding general academic requirements in the Departments of University or affiliated colleges:

----- NIL -----

ii. Recommendations of the Academic Audit Committee and status thereof:

----- NIL -----

Part E.

i. Recommendations of the text books for the course of study at undergraduate level: ----- NIL -----

ii. Recommendations of the text books for the course of study at post graduate level:

----- NIL -----

Prof. Annapurna Sakhardande
Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Nais
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

Part F.

Important points for consideration/approval of Academic Council

i. The important points/recommendations of BoS that require consideration/approval of Academic Council (points to be highlighted) as mentioned below

a)…….

b)-----

ii. The declaration by the chairman that the minutes were readout by the Chairman at the meeting itself.

Date: 03/05/2021

Place: GEC

Sd/-

(Dr. Ganesh Hegde)

Signature of the Chairman

BOS in Civil Engineering

Part G. The Remarks of the Dean of the Faculty

i) The minutes are in order

ii) The minutes may be placed before the Academic Council with remarks if any.

iii)May be recommended for approval of Academic Council.

iv)Special remarks if any.

Date: 03/05/2021

Place GEC

Signature of the Dean

Sd/-

(Dr .V .N. Shet)

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

ANNEXURE A

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of SURVEYING & GEOMATICS for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of SURVEYING & GEOMATICS for SE (Civil Engineering) SEM-IVRC 2019-20</td><td></td></tr>
<tr><td>
<table>
<tr><td colspan="6">SURVEYING & GEOMATICS</td></tr>
<tr><td>Course Code</td><td colspan="2">CV410</td><td>Credits</td><td colspan="2">4</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>0</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td><td>
<table>
<tr><td colspan="6">SURVEYING & GEOMATICS</td></tr>
<tr><td>Course Code</td><td colspan="2">CV410</td><td>Credits</td><td colspan="2">4</td></tr>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 150 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>25</td><td>100</td><td>0</td><td>0</td></tr>
</table>
TW-25 MARKS INCLUDED
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td><td>The course has tutorial class for 1 hour per week, wherein students learn and solve special assignments in the course and prepare report. Hence it is felt that the term work marks are to be included in this course. The credits remain unchanged.
Total credits and marks for the semester remain unchanged.</td></tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of HYDRAULIC ENGINEERING for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of HYDRAULIC ENGINEERING for SE (Civil Engineering) SEM-IVRC 2019-20</td><td></td></tr>
<tr>
<td>
<table>
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<tr><td>Course Code</td><td colspan="2">CV420</td><td>Credits</td><td colspan="2">4</td></tr>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>0</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 150 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>25</td><td>100</td><td>0</td><td>0</td></tr>
</table>
TW-25 MARKS INCLUDED
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
<td>The course has tutorial class for 1 hour per week, wherein students learn and solve special assignments in the course and prepare report. Hence it is felt that the term work marks are to be included in this course. The credits remain unchanged.
Total credits and marks for the semester remain unchanged.</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of Structural Analysis for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of Structural Analysis for SE (Civil Engineering) SEM-IV RC 2019-20</td><td></td></tr>
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<td>
<table>
<tr><th colspan="6">STRUCTURAL ANALYSIS</th></tr>
<tr><td>Course Code</td><td colspan="2">CV430</td><td>Credits</td><td colspan="2">4</td></tr>
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Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
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<table>
<tr><th colspan="6">STRUCTURAL ANALYSIS</th></tr>
<tr><td>Course Code</td><td colspan="2">CV430</td><td>Credits</td><td colspan="2">4</td></tr>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 150 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>25</td><td>100</td><td>0</td><td>0</td></tr>
</table>
ORAL MARKS 25 REMOVED. TOTAL MARKS CHANGED TO 150

Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
<td>The course has tutorial hours and TW marks, however ORAL marks are not required as such students are not undergoing practical examination in this course in the current semester. The total credits and marks for the semester remains unchanged</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

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Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of TRANSPORTATION ENGINEERING for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of TRANSPORTATION ENGINEERING for SE (Civil Engineering) SEM-IV RC 2019-20</td><td></td></tr>
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<td>
<table>
<tr><th colspan="6">TRANSPORTATION ENGINEERING</th></tr>
<tr><td>Course Code</td><td>CV440</td><td>Credits</td><td colspan="3">4</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>0</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
<td>
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<tr><td>Course Code</td><td>CV440</td><td>Credits</td><td colspan="3">3</td></tr>
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<tr><td>3</td><td>0</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>0</td><td>0</td></tr>
</table>
CREDIT CHANGED TO 3.
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
Tutorial are not required for this course
</td>
<td>The tutorial class for 1 hour per week is removed as the course has more theory content and students are undergoing a lab course in the same subject in higher semester. The total credits and marks for the semester remains unchanged</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Nais Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of GEOTECHNICAL ENGINEERING for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of GEOTECHNICAL ENGINEERING for SE (Civil Engineering) SEM-IV RC 2019-20</td><td></td></tr>
<tr><td>
<table>
<tr><th colspan="6">GEOTECHNICAL ENGINEERING</th></tr>
<tr><td>Course Code</td><td colspan="2">CV450</td><td>Credits</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>0</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td><td>
<table>
<tr><th colspan="6">GEOTECHNICAL ENGINEERING</th></tr>
<tr><td>Course Code</td><td colspan="2">CV450</td><td>Credits</td><td colspan="2">4</td></tr>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 150 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>25</td><td>100</td><td>0</td><td>0</td></tr>
</table>
TW-25 MARKS INCLUDED, CREDIT CHANGED TO 4, TOTAL MARKS CHANGED TO 150
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
Tutorial shall consist of at least 5 assignments based on the syllabus.
</td><td>The tutorial class for 1 hour per week is added wherein students learn and solve special assignments in the course and prepare report. Hence it is felt that the term work marks are to be included in this course. The credit for this course is changed to 4; however total marks and credits for the semester remains unchanged.</td></tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

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Dr. Nisha Nais Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of SURVEYING & GEOMATICS LAB for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of SURVEYING & GEOMATICS LAB for SE (Civil Engineering) SEM-IVRC 2019-20</td><td></td></tr>
<tr>
<td>
<table>
<tr><th colspan="6">SURVEYING & GEOMATICS LAB</th></tr>
<tr><td>Course Code</td><td>CV460</td><td>Credits</td><td colspan="3">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 75 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>25</td><td>00</td><td>50</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
<td>
<table>
<tr><th colspan="6">SURVEYING & GEOMATICS LAB</th></tr>
<tr><td>Course Code</td><td>CV460</td><td>Credits</td><td colspan="3">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 50 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
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TW-25 REMOVED, TOTAL MARKS CHANGED TO 50
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
Lab report shall be evaluated as a part of examination.
</td>
<td>The course has 2 hours practical classes per week, and will be assessed by practical examination for 50 marks. There is no requirement of Term work marks for this Lab course.
Total marks and credits for the semester remains unchanged.</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of FLUID MECHANICS & HYDRAULICS LAB for SE (Civil Engineering) SEM-IV RC 2019-20</td><td>Modified scheme of FLUID MECHANICS & HYDRAULICS LAB for SE (Civil Engineering) SEM-IV RC 2019-20</td><td></td></tr>
<tr>
<td>
<table>
<tr><th colspan="6">FLUID MECHANICS & HYDRAULICS LAB</th></tr>
<tr><td>Course Code</td><td colspan="2">CV470</td><td>Credits</td><td colspan="2">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 75 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>25</td><td>00</td><td>50</td><td>0</td></tr>
</table>
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
No change.
</td>
<td>
<table>
<tr><th colspan="6">FLUID MECHANICS & HYDRAULICS LAB</th></tr>
<tr><td>Course Code</td><td colspan="2">CV470</td><td>Credits</td><td colspan="2">1</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 50 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>00</td><td>00</td><td>50</td><td>0</td></tr>
</table>
TW-25 REMOVED, TOTAL MARKS CHANGED TO 50
Course Objectives:
No change.

Course Outcomes:
No change.

Syllabus Contents
Lab report shall be evaluated as a part of examination.
</td>
<td>The course has 2 hours practical classes per week, and will be assessed by practical examination for 50 marks. There is no requirement of Term work marks for this Lab course.
Total marks and credits for the semester remains unchanged.</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Nais Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of CONCRETE TECHNOLOGY for TE (Civil Engineering) SEM-V RC 2019-20</td><td>Modified scheme of CONCRETE TECHNOLOGY for TE (Civil Engineering) SEM-V RC 2019-20</td><td></td></tr>
<tr>
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<tr><td>3</td><td>1</td><td>--</td><td colspan="2">42 Hrs/Sem</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 150 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>25</td><td>100</td><td>--</td><td>0</td></tr>
</table>
TW-25 ADDED, TOTAL MARKS CHANGED TO 150
</td>
<td>The course has tutorial class for 1 hour per week, wherein students learn and solve special assignments in the course and prepare report. Hence it is felt that the term work marks are to be included in this course. The credits remain unchanged. Total marks and credits for the semester remains unchanged.</td>
</tr>
</table>

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Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of OCCUPATIONAL SAFETY AND HEALTH ASSESSMENT for TE (Civil Engineering) SEM-V RC 2019-20</td><td>Modified scheme of OCCUPATIONAL SAFETY AND HEALTH for TE (Civil Engineering) SEM-V RC 2019-20</td><td></td></tr>
<tr>
<td>
<table>
<tr><th colspan="6">OCCUPATIONAL SAFETY AND HEALTH ASSESSMENT</th></tr>
<tr><td>Course Code</td><td colspan="2">CV535</td><td>Credits</td><td colspan="2">3</td></tr>
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<tr><td>3</td><td>0</td><td>0</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>--</td><td>100</td><td>--</td><td>0</td></tr>
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<tr><th colspan="6">OCCUPATIONAL SAFETY AND HEALTH</th></tr>
<tr><td>Course Code</td><td colspan="2">CV535</td><td>Credits</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>--</td><td>100</td><td>00</td><td>0</td></tr>
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</td>
<td>The course nomenclature is changed from OCCUPATIONAL SAFETY AND HEALTH ASSESSMENT” to OCCUPATIONAL SAFETY AND HEALTH “</td>
</tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of CONCRETE TECHNOLOGY AND TRANSPORTATION ENGINEERING LAB for TE (Civil Engineering) SEM-V RC 2019-20</td><td>Modified scheme of CONCRETE TECHNOLOGY AND TRANSPORTATION ENGINEERING LAB for TE (Civil Engineering) SEM- V RC 2019-20</td><td></td></tr>
<tr><td>
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<tr><td colspan="6">CONCRETE TECHNOLOGY AND TRANSPORTATION ENGINEERING LAB</td></tr>
<tr><td>Course Code</td><td>CV560</td><td>Credits</td><td colspan="3">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 75 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>25</td><td>00</td><td>50</td><td>0</td></tr>
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<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 50 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
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TW-25 REMOVED, TOTAL MARKS CHANGED TO 50
</td><td>The course has 2 hours practical classes per week, and will be assessed by practical examination for 50 marks. There is no requirement of Term work marks for this Lab course.
Total marks and credits for the semester remains unchanged.</td></tr>
</table>

Prof. Annapurna Sakhardande
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Member- BOS Civil Engg

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Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING LAB for TE (Civil Engineering) SEM-V RC 2019-20</td><td>Modified scheme of GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING LAB for TE (Civil Engineering) SEM- V RC 2019-20</td><td></td></tr>
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<tr><th colspan="6">GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING LAB</th></tr>
<tr><td>Course Code</td><td colspan="2">CV570</td><td>Credits</td><td colspan="2">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
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TW-25 REMOVED, TOTAL MARKS CHANGED TO 50
</td><td>The course has 2 hours practical classes per week, and will be assessed by practical examination for 50 marks. There is no requirement of Term work marks for this Lab course.
Total marks and credits for the semester remains unchanged.</td></tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

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Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of Construction Equipments & Automation for TE (Civil Engineering) SEM-VI
RC 2019-20</td><td>Modified scheme of Construction Equipment & Automation for TE (Civil Engineering) SEM- VI
RC 2019-20</td><td></td></tr>
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<tr><th colspan="6">Construction Equipments & Automation</th></tr>
<tr><td>Course Code</td><td colspan="2">CV642</td><td>Credits</td><td colspan="2">3</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>00</td><td>0</td></tr>
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<tr><td>Course Code</td><td colspan="2">CV642</td><td>Credits</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
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</table>
</td><td>Typographical error in the course nomenclature “Construction Equipments is changed” to “Construction Equipment & Automation”</td></tr>
</table>

Prof. Annapurna Sakhardande
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Dr. Ganesh Hegde
Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of CONSTRUCTION ENGINEERING AND MANAGEMENT for BE (Civil Engineering)
SEM-VII RC 2019-20</td><td>Modified scheme of CONSTRUCTION ENGINEERING AND MANAGEMENT for BE (Civil Engineering)
SEM-VII RC 2019-20</td><td></td></tr>
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<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>--</td><td>100</td><td>--</td><td>0</td></tr>
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TW-25 ADDED, TOTAL MARKS CHANGED TO 150
</td><td>The course has tutorial class for 1 hour per week, wherein students learn and solve special assignments in the course and prepare report. Hence it is felt that the term work marks are to be included in this course. The credits remain unchanged. Total marks and credits for the semester remains unchanged.</td></tr>
</table>

Prof. Annapurna Sakhardande Member- BOS Civil Engg

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Dr. Ganesh Hegde Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of ADVANCE MATERIALS TESTING LAB for BE (Civil Engineering) SEM-VII
RC 2019-20</td><td>Modified scheme of ADVANCE MATERIALS TESTING LAB for BE (Civil Engineering) SEM- VII
RC 2019-20</td><td></td></tr>
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<tr><td>Course Code</td><td colspan="2">CV730</td><td>Credits</td><td colspan="2">1</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 75 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>25</td><td>00</td><td>50</td><td>0</td></tr>
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<tr><td>--</td><td>--</td><td>2</td><td colspan="2">28 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 50 marks)</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>00</td><td>00</td><td>00</td><td>50</td><td>0</td></tr>
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TW-25 REMOVED, TOTAL MARKS CHANGED TO 50
</td><td>The course has 2 hours practical classes per week, and will be assessed by practical examination for 50 marks. There is no requirement of Term work marks for this Lab course.
Total marks and credits for the semester remains unchanged.</td></tr>
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Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of HYDRAULICS, HYDROLOGY AND WATER RESOURCES ENGINEERING for BE (Civil Engineering) SEM-VIII RC 2019-20</td><td>Modified scheme of HYDROLOGY AND WATER RESOURCES ENGINEERING for BE (Civil Engineering) SEM- VIII RC 2019-20</td><td></td></tr>
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<tr><td>Course Code</td><td colspan="2">CV810</td><td>Credits</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>00</td><td>0</td></tr>
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<tr><td>Course Code</td><td colspan="2">CV810</td><td>Credits</td><td colspan="2">3</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>00</td><td>0</td></tr>
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</td><td>The nomenclature of the course “HYDRAULICS, HYDROLOGY AND WATER RESOURCES ENGINEERING” to “HYDROLOGY AND WATER RESOURCES ENGINEERING”</td></tr>
</table>

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Member- BOS Civil Engg

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Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

<table>
<tr><th>Existing Provisions</th><th>Proposed Changes</th><th>Justifications</th></tr>
<tr><td>Approved scheme of HIGH SPEED RAIL ENGINEERING for BE (Civil Engineering) SEM-VIII RC 2019-20</td><td>Modified scheme of PORT AND HARBOUR ENGINEERING for BE (Civil Engineering) SEM- VIII RC 2019-20</td><td></td></tr>
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<tr><td>Course Code</td><td colspan="2">CV825</td><td>Credits</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">Scheme of Instruction (Hours/ Week)</td><td>L</td><td>T</td><td>P</td><td colspan="2">TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td colspan="2">42 Hrs/Sem</td></tr>
<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
<tr><td>25</td><td>00</td><td>100</td><td>00</td><td>0</td></tr>
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<tr><td colspan="6">PORT AND HARBOUR ENGINEERING</td></tr>
<tr><td>Course Code</td><td colspan="2">CV825</td><td>Credits</td><td colspan="2">3</td></tr>
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<tr><td rowspan="2">Scheme of Examination (TOTAL = 125 marks</td><td>IA</td><td>TW</td><td>TM</td><td>P</td><td>O</td></tr>
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</td><td>The Elective course of “HIGH SPEED RAIL ENGINEERING” IS Replaced by “PORT AND HARBOUR ENGINEERING”. This is relevant to Goa region.
Total marks and credits for the semester remains unchanged.</td></tr>
</table>

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Dr. Ganesh Hegde Chairman- BOS Civil Engg

SECOND YEAR CIVIL ENGINEERINGENGINEERING COURSE
SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – III

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW**	P	O	Total	
CV310	Mechanics of Solids	3	1	--	3	100	25	25	--	--	150	4
CV320	Fluid Mechanics	3	1	--	3	100	25	25	--	--	150	4
CV330	Engineering Geology	3	--	--	3	100	25	--	--	--	125	3
CV340	Building Materials and Construction	3	1	--	3	100	25	25	--	--	150	4
CV350	**Computer-Aided Building Planning And Design**	**3**	**0**	**2**	**4**	**100**	**25**	**25**	**--**	**--**	**150**	**4**
CV360	Mechanics of Solids Lab	--	--	2	--	--	--	--	50	--	50	1
CV370	Material Testing Lab	--	--	2	--	--	--	--	50	--	50	1
HM001	Technical Communication	2	--	--	--	--	--	75	--	--	75	2
AC390	Mathematics-I & II (Bridge Course*)	2	--	--	--	--	--	--	--	--	--	0
	TOTAL	**18**	**4**	**6**	**--**	**500**	**125**	**175**	**100**	**--**	**900**	**23**

*Bridge course is only for direct second year admitted candidates, **Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

SECOND YEAR CIVIL ENGINEERINGENGINEERING COURSE
SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – IV

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV410	Surveying & Geomatics	3	1	--	3	100	25	25	--	--	150	4
CV420	Hydraulic Engineering	3	1	--	3	100	25	25	--	--	150	4
CV430	Structural Analysis	3	1	--	3	100	25	25	--	--	150	4
CV440	Transportation Engineering	3	--	--	3	100	25		--	--	125	3
CV450	Geotechnical Engineering	3	1	--	3	100	25	25	--	--	150	4
CV460	Surveying & Geomatics Lab	--	--	2	--	--	--	--	50	--	50	1
CV470	Fluid Mechanics & Hydraulics Lab	--	--	2	--	--	--	---	50	--	50	1
HM003	Economics for Engineers	3	--	--		100	25	--	--	--	125	3
	TOTAL	**18**	**4**	**4**	**--**	**600**	**150**	**100**	**100**	**00**	**950**	**24**

*Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

THIRD YEAR CIVIL ENGINEERINGENGINEERING COURSE
SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – V

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV510	Concrete Technology	3	1	--	3	100	25	25	--	--	150	4
CV520	Environmental Engineering	3	1	--	3	100	25	25	--	--	150	4
CV531	Pavement Design and Construction	3	--	--	3	100	25	--	--	--	125	3
CV532	Numerical methods											
CV533	Environmental Impact Assessment and Life Cycle Analysis											
CV534	Foundation Engineering											
CV535	**Occupational Health and Safety**											
CV541	Advanced Structural Analysis	3	--	--	3	100	25	--	--	--	125	3
CV542	Ground Improvement Techniques											
CV543	Green Building											
CV544	Rural Water Supply & Onsite Sanitation System											
CV545	Advanced Surveying											
CV560	Concrete Technology and Transportation Engineering Lab	--	--	2	--	--	--	--	50	--	50	1
CV570	Geotechnical and Environmental Engineering Lab	--	--	2	--	--	--	--	50	--	50	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
HM005	Entrepreneurship & IPR	3	--	--	3	100	25	--	--	--	125	3
	TOTAL	**18**	**2**	**4**	**--**	**600**	**150**	**50**	**100**	**--**	**900**	**22**

*Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

THIRD YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VI

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV610	Design of Reinforced Concrete Structures	3	1	--	3	100	25	25	--	--	150	4
CV620	Design of Steel Structures	3	1	--	3	100	25	25	--	--	150	4
CV631	Geosynthetics and Application	3	--	--	3	100	25	--	--	--	125	3
CV632	Finite Element Method											
CV633	Air and Noise Pollution and Control											
CV634	Advanced Engineering Geology.											
CV635	Remote Sensing & GIS											
CV641	Bridge Engineering	3	--	--	3	100	25	--	--	--	125	3
CV642	Construction Equipment & Automation											
CV643	Structural Dynamics											
CV644	Advanced Geotechnical Engineering											
CV645	Ground Water Engineering											
CV 670	Structural Engineering Lab	--	--	2	--	--	--	25	50	--	75	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
HM011	Estimation & Costing	3	1	--	3	100	25	25	--	--	150	4
	TOTAL	**18**	**3**	**2**	**--**	**600**	**150**	**100**	**50**	**--**	**900**	**22**

*Term Work marks are to be awarded through continuous evaluation

**Student will have to enter the course code that he/she takes as part of the open elective

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

FOURTH YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW *	P	O	Total	
CV710	Construction Engineering and Management	3	1	--	3	100	25	25	--	--	150	4
CV721	Structural Repair and Retrofitting	3	--	--	3	100	25	--	--	--	125	3
CV722	Design of Prestressed Concrete structures											
CV723	Soil dynamics and Machine Foundations											
CV724	Advanced Steel Structures											
CV725	Biological Processes for Contaminant Removal											
CV730	Advanced Materials Testing Lab	--	--	2	--	--	--	--	50	--	50	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
CV740	Internship#	--	--	6		--	--	50	--	50	100	3
CV750	Project Work - Phase I	--	--	6		--	--	50	--	75	125	3
	TOTAL	**09**	**01**	**14**		**300**	**75**	**125**	**50**	**125**	**675**	**17**

#at 7th Semester 8 weeks internship/training// Research Assistantship-(in the month of September & October)

*Term Work marks are to be awarded through continuous evaluation, **Student will have to enter the course code that he/she takes as part of the open elective,

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member-BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

FOURTH YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VIII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW *	P	O	Total	
CV810	Hydrology and Water Resources Engineering	3	--	--	3	100	25	--	--	--	125	3
CV821	Architectural Engineering	3	--	--	3	100	25	--	--	--	125	3
CV822	Earthquake Engineering											
CV823	Structural design of Foundations											
CV824	Solid & Hazardous Waste Management											
CV825	Port and Harbour Engineering											
CV830	Elective - NPTEL / MOOC / SWAYAM	3	--	--	--	--	--	50	--	50	100	3
CV840	Project Work - Phase II	--	--	18	--	--		200	--	200	400	9
	TOTAL	**9**	**0**	**18**	**--**	**200**	**50**	**250**	**--**	**250**	**750**	**18**

If required additionally at 8th Sem (before start of semester or during vacation) 4 weeks of Internship/ Training/ Research Assistantship can be provided to deserving students to enhance their employability -(in the month of January), *Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Total Credits for the four-year Engineering course= 160
Total Marks for the four-year Engineering course= 6425

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ANNEXURE B

B.E. Civil Engineering

SEM V to SEM VIII Syllabus

Prof. Annapurna Sakhardande
Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Naik
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

THIRD YEAR CIVIL ENGINEERINGENGINEERING COURSE
SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – V

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV510	Concrete Technology	3	1	--	3	100	25	25	--	--	150	4
CV520	Environmental Engineering	3	1	--	3	100	25	25	--	--	150	4
CV531	Pavement Design and Construction	3	--	--	3	100	25	--	--	--	125	3
CV532	Numerical methods											
CV533	Environmental Impact Assessment and Life Cycle Analysis											
CV534	Foundation Engineering											
CV535	Occupational Safety and Health											
CV541	Advanced Structural Analysis	3	--	--	3	100	25	--	--	--	125	3
CV542	Ground Improvement Techniques											
CV543	Green Building											
CV544	Rural Water Supply & Onsite Sanitation System											
CV545	Advanced Surveying											
CV560	Concrete Technology and Transportation Engineering Lab	--	--	2	--	--	--	--	50	--	50	1
CV570	Geotechnical and Environmental Engineering Lab	--	--	2	--	--	--	--	50	--	50	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
HM005	Entrepreneurship & IPR	3	--	--	3	100	25	--	--	--	125	3
	TOTAL	**18**	**2**	**4**	**--**	**600**	**150**	**50**	**100**	**--**	**900**	**22**

*Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

Prof. Annapurna Sakhardande Member- BOS Civil Engg

Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

CONCRETE TECHNOLOGY

Course Code	CV 510	Credits		4	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	1	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 150 marks	IA	TW	TM	P	O
	25	25	100	0	0

Course Objectives:|

1. To acquaint students with various materials used in making concrete
2. To understand the properties of fresh and hardened concrete and their importance
3. To understand relevant codal stipulations in concrete production.
4. To train the students in designing concrete mix as per codal provisions

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand various materials used in concrete and their effect on concrete properties
CO2	Understand properties of fresh and hardened concrete
CO3	Design concrete mixes with the knowledge of codal provisions.
CO4	Recommend appropriate procedure and techniques for testing of concrete and its components.

UNIT I

Materials for Concrete : Importance of cement in preparation of concrete, Chemical compound of ordinary Portland cement, Bougue's compounds and its functions, Types and Grades of cement and its uses, Lime calcined clay cement. Physical properties- Fineness, consistency of Cement, IST & FST, Soundness & Compressive Strength of cement and its I.S. Requirements, Its Importance &their related Test as per Indian Standards, Role of Coarse & Fine Aggregates in Concrete, Classifications of aggregate on the basis of its size, shape, texture and weight Sieve Analysis, Water Absorption Specific Gravity of Fine Aggregate & Coarse Aggregate, Coarse Aggregate Impact Value, Crushing Value & Abrasion Value, Flakiness & Elongation Index, its importance & their related Test as per Indian Standards, Requirements of quality for water in concrete. **12Hrs**

Fresh Concrete : Fresh concrete and its properties - Workability, harshness, Segregation and bleeding, Factors affecting workability, water cement ratio, Methods of measurement of workability Slump Test & Compaction Factor Test, Relation between workability and strength of

concrete, Methods of mixing of concrete – Hand & Machine Mixing and its Transportation and Placing, Methods of compaction of concrete and its suitability, Factors affecting compaction, Curing and its importance , its methods and suitability, Effect of curing on development of strength of concrete

UNIT II

Hardened Concrete : Hardened Concrete and its Properties, Compressive Strength ,Tensile Strength, Bond Strength, Flexure Strength Durability, impermeability, Factors affecting Compressive Strength, Creep of Concrete & its effect , factors affecting Creep, IS Test Procedure to find Compressive & Tensile Strength of Concrete, Acceptance Criteria , Mean Strength & Standard Deviation, Durability of Concrete & factors affecting it, Economy of Concrete & factors affecting it, Methods of Non Destructive Test of Concrete Rebound Hammer Test, Ultrasonic Pulse Velocity Test, Importance of NDT **10Hrs**

UNIT III

Special Concrete & Concreting Techniques: Light weight concrete, Plum concrete, Fiber reinforced concrete, Polymer concrete, High density concrete, High performance concretes, No fines concrete, Ferro cement, Fly ash concrete, Pumpable Concrete, Ready mix concrete, Self-compacting concrete. **12 Hrs**

Reinforced Cement Concrete: Fundamentals of RCC and its properties.

Admixtures and Construction Chemicals: Admixtures and its benefits, Types of Admixtures - Accelerator and Retarder Plasticizer and Super Plasticizer Water roofing and Air entraining admixture, Utility of Admixtures, Possible construction chemicals to be covered

UNIT IV

Concrete Mix Design: Factors affecting quality of concrete, Advantages of Quality control. Concrete Mix Design and its importance. Nominal Mix and Design Mix., Factors affecting concrete mix design. Different methods of Mix Design and its suitability. I.S. method to design a Concrete Mix As per IS 10262-2009, Example of Mix design as per I.S. method, design Mix of self-compacting concrete **08Hrs**

TERM WORK: Term work shall consist of at least 8 Assignments covering entire syllabus. Student shall submit assignment for evaluation

Textbooks

1 Shetty,M.S, “Concrete Technology”, S.Chand and Company Ltd, New Delhi, 2016 Recommended

2 Gupta.B.L., Amit Gupta, “Concrete Technology”, Jain Book Agency, 2010.

3 N V Nayak, K G Gupta, Puranand Savoikar “Text book of Concrete Technology” Creative books 2021

4 Gambir, M.L; “Concrete Technology”, 3rd Edition, Tata McGraw Hill Publishing Co Ltd,

New Delhi, 2007

Reference Books:

5 Santhakumar,A.R; “Concrete Technology” , Oxford University Press, New Delhi, 2007

6 Neville, A.M; “Properties of Concrete”, Pitman Publishing Limited, London,1995

7 IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2006

ENVIRONMENTAL ENGINEERING

Course Code	CV 520	Credits		4	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	1	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 150 marks	IA	TW	TM	P	O
	25	25	100	0	0

Course Objectives:|

1. To impart knowledge of water treatment for potable and community use.
2. To acquaint students with the characteristics of water its analysis and design treatment and distribution processes.
3. To impart knowledge of wastewater treatment for maintaining health and hygiene of the community.
4. To acquaint students with the characteristics of wastewater its analysis and design, treatment, and disposal processes.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the terms and parameters frequently used in water supply engineering and wastewater management.
CO2	Evaluate the influence of the different parameters in design and treatment of water. treatment and wastewater treatment.
CO3	Understand the fundamental processes to treat water and wastewater design processes.
CO4	Propose treated water distribution and wastewater collection and disposal methods.

UNIT I

Introduction water, its sources, water Quantity estimation, its demand including factors affecting demand. Population forecasting methods. Intakes systems for surface and underground sources. Water quality criteria as per standards and codes **09 Hrs**

UNIT II

Principles and Design –Sedimentation, Sedimentation aided with coagulation, Filtration, Aeration, Disinfection. Water distribution and supply - Requirements, Systems of distribution, Distribution reservoirs, Maintenance & Storage, Layout of distribution systems. Principles of design of water supply in buildings, House service connection, Systems of plumbing & appurtenances. **12Hrs**

UNIT III

Introduction to wastewater, characteristics, quality analysis and quantity estimation Principles of design- Unit operations and Unit process and Design systems like – Screens, Equalization Basin, Grit Chamber, Sedimentation Tanks, Suspended and Attached Growth Systems. **12 Hrs**

UNIT IV

Miscellaneous Methods of treatment including tertiary treatment, Sludge thickening and disposal techniques, Plumbing systems for sewerage & Appurtenances **09Hrs**
On-site disposal Systems – Septic Tank and Imhoff Tanks, Aerobic and Anaerobic bio reactors, Sludge digesters, Waterless urinalsetc

TERM WORK: Term work shall consist of at least 8 Assignments covering entire syllabus.
Student shall submit assignment for evaluation

Textbooks

1 Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.

2 Garg, S.K, Water Supply Engineering. 18th Edition, Khanna Publishers, Delhi.

3 Garg, S.K, Sewage and Air pollution Engineering, Khanna Publishers, Delhi.

4 Metcalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi

Reference Books:

5 G. S. Birdie and J. S. Birdie, Water Supply and Sanitary Engineering: Dhanpat Rai Publishing Company, New Delhi.

6 Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1997.

7 Viessman Jr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning, New Delhi, 2009.

PAVEMENT DESIGN AND CONSTRICTION

Course Code	CV531	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To impart knowledge of various types of materials used in pavement construction.
2. To familiarize the student with various methods of analysis and design of pavements
3. To prepare detailed project report for various types of pavement construction and its maintenance
4. To acquaint students with various causes of pavement failures

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the failure mechanism in pavements and suggest suitable corrective measures
CO2	Evaluate the strength of the soil subgrade and suggest good maintenance methods
CO3	Propose sustainable design of pavements for different exposure conditions
CO4	Prepare detailed project reports for any given proposed road projects

UNIT I

Pavement materials: Types of pavement materials -- requirements, -design gradation. Cement- testing, admixtures, fibers, properties and testing of pavement quality concrete, high performance concrete. Chemical constitution of bituminous road binders. Emulsions and cutback -preparation, mechanism of stripping, Bituminous mixes: preparation, design and testing. **12 Hrs**

Pavement construction: Evaluation of soil strength, CBR and plate load test, preparation of subgrade, quality control test, subgrade stabilization. Flexible pavements- specification of materials, construction method and field control checks for various types of flexible pavements, super pave concept, new materials such as polymer modified bitumen, geo synthetics. Rigid pavements -specification and method of construction, quality control tests, construction of various types of joints

UNIT II

Pavement Evaluation: Methods of pavement evaluation -structural evaluation by Benkelman beam method ,Pavement surface condition evaluation **10 Hrs**

Pavement Design: Design Parameters- Material properties, Traffic Characteristics, Environmental characteristics

Design Philosophies: CBR Method, Limiting Shear failure Method, Limiting Deflection Method, Regression method based on Pavement Performance, Mechanistic method for Bituminous pavement design, Japan Roads Association method, IRC method of design, AASHTO Design Method

UNIT III

Drainage Consideration in Pavement design: Surface Drainage, Sub surface drainage, Frost damage in Pavement design. **10 Hrs**

Design of rigid pavements: Rigid pavement- Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC:58-2002, Factors affecting design and performance, AASHTO method, PCA method.

Interlocking Concrete Block Pavement: Structural design of concrete block pavement, materials, construction procedure and methods, detailing of block pavements, drainage and maintenance

UNIT IV

Pavement maintenance: Failures in pavements-methods of measurement of skid resistance, unevenness, ruts and cracks. -maintenance strategies evaluation by non-destructive tests- Benkelman beam method, overlay design. Pavement performance prediction concepts and models and recycling of pavements. **10 Hrs**

Preparation of detailed project report- design details, estimates and drawings, use of software Road safety audit

Textbooks

1 S.K. Sharma (1998), Principles, Practice and design of highway Engineering, S. Chand & Co Ltd, New Delhi.

2 Alkins and Harold, "Highway Material", Prentice Hall, Pearson, 2003

3 K. P. Subramanian , Transportation Engineering, Scitech Publications India Pvt Ltd

4 Specifications for "Road and Bridge works", Fourth Revision, MoSRT&H, Government of India, 2001

5 Partha Chakroborty & Animesh Das , Principles of Transportation Engineering , Prentice Hall of India , New Delhi

6 Yang, Design of functional pavements, McGraw- Hill.

Reference Books:

7 David Croney, 'The Design & Performance of Road pavements', HMSO publications

8 Hass & Hudson, 'Pavement Management System', McGraw Hill Book Co

Prof. Annapurna Sakhardande Member- BOS Civil Engg | Dr. Shwetha Prasanna Member- BOS Civil Engg | Dr. Nisha Nais Member- BOS Civil Engg | Dr. Ganesh Hegde Chairman- BOS Civil Engg

9 S. P. Bindra , A course in Highway Engineering, , Dhanpat Rai Publications

10 IS CODES: IRC Code for flexible pavement – IRC – 37 -2001. v2. IRC Code for Rigid pavement – IRC – 58 – 2002., IRC SP: 63-2004 "Guidelines for Use of Interlocking Concrete Block Pavement"

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Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

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Dr. Ganesh Hegde
Chairman- BOS Civil Engg

NUMERICAL METHODS

Course Code	CV532	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To develop and apply problem solving skills through the introduction of numerical methods
2. To provide students with an introduction to the field of numerical and error analysis.
3. To develop competency in the topics integration, numerical solution of equations and systems of equations, approximation of functions, numerical solution of differential equations, applications and computer implementation of numerical methods.
4. To provide a ground for applying knowledge acquired in mathematics course and give students an opportunity to develop skill to solve engineering problems through numerical methods.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Effectively write mathematical solutions and their interpretation in a clear and concise manner
CO2	Locate and use information to numerically solve engineering problems using numerical methods
CO3	Demonstrate ability to think critically by analyzing a practical problem and understanding the mathematical basis of the problem
CO4	Demonstrate the ability to study the solution of a differential equation, integration, interpolation and develop a practical interpretation of the numerical results

UNIT I

Solution of equations and Eigenvalue problems: Introduction to numerical methods and error analysis. Solution of algebraic polynomial and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting -Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices. **10 Hrs**

UNIT II

Interpolation and approximation : Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Difference operators **10 Hrs**

and relations – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT III

Numerical differentiation and integration : Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule, 3/8th rule – Romberg's Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules. **10 Hrs**

UNIT IV

Initial value problems for ordinary differential equations: Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order equations – Multi step methods – Milne's and Adams – Bash forth predictor corrector methods for solving first order equations. **12 Hrs**

Partial differential equations: Finite difference solution two-dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Textbooks

1 / Steven C. Chapra, Raymond P. Canale , Numerical methods for Engineers. — McGraw-Hill,

2 Gregory, J., and Redmond, D., Introduction to Numerical Analysis Jones and Bartlett Publishers, Boston.

3 Anton, H , Elementary Linear Algebra,., Fifth Edition, John Wiley and Sons, 1987.

4 Braun, M. V , Differential Equations and Their Applications., Fourth Edition, Springer-Verlag, 1993.

5 Burden, R. L., and Faires, J. D.,Numerical Analysis, Sixth Edition, Brooks/Cole Publishing Company, 1997.

Reference Books:

6 , Simmons, G. F., Differential Equations with Applications and Historical NotesSecond Edition, McGraw Hill, Inc., 1991

7 Gerald, G. F., and Wheatley, P. O ., Applied Numerical Analysis,., Fourth Edition, Addison Wesley Publishing Company, 1989

8 The Mathematica Book, Wolfram, Third Edition, Wolfram Research, Inc.,1996.

9 G. R. Lindfield., Numerical Methods: Using MATLAB,, John Penny academic press Elsevier, fourth edition

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Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS

Course Code	CV 533	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To enable the students to acquire the knowledge and skills needed to address concepts of sustainability and cleaner production and social impact assessment
2. To understand and analyze the concept of life cycle analysis (LCA) and the basic principles of EIA

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Frame the concepts of sustainability and cleaner production, and the challenges that engineers face
CO2	Understand the basic concepts of LCA and EIA
CO3	Analyze environmental methodologies to control and mitigate sustainability problems.
CO4	Apply the concepts of LCA and EIA

UNIT I

Introduction to EIA & Audit: Environment & Industries, Input information, Plant operation, Environmental Management planning, Waste Streams impact on water bodies. Environmental Impact Assessment planning. Activities, Methodology for Environmental Impact Assessment, Role of Environmental Engineering firm, Role of Regulatory agencies & control boards, Role of the Public. **10 Hrs**

Environmental Audit: Introduction, Environmental information Purpose & advantage of studies, General approach of environmental Auditing Environmental Audit, Audit programs in India, Auditing program in major polluting Industries, Reports of the Environmental audit studies.

UNIT II

Pollution prevention and control laws & acts: Constitution of India & environment, Constitution protection to Environment laws, Administrative & legislative arrangement for Environmental production, Indian Standards, Pollution control acts in India, critical appraisal, fiscal incentives for environmental protection. **11 Hrs**

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Guidelines of preparation of project report and its evaluation: methods of clearance from the concern authorities at various labels. Design for Sustainability and Case Studies: Environmental Design for Sustainability: Economic, Environmental, and Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis

UNIT III

Introduction to Sustainability : Introduction, The magnitude of sustainability challenge, Energy, Material use, Environmental emissions, Economic and Social dimensions)Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Life Cycle Frameworks, Life Cycle Assessment Tools) **11 Hrs**

Life Cycle Analysis : Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools)Review of Environmental Laws and Regulations Introduction, Environmental Law and Sustainability, International Programs and Protocols relevant to this course, Voluntary Programs from end of pipe to Pollution Prevention and Sustainability, Pollution Prevention Concepts and Terminology

UNIT IV

Green, Sustainable Materials: Introduction, Environmental and Natural Resource Use Footprints of Material Extraction and Refining, Tracking Material Flows in Engineered Systems, Environmental Releases, Design for Sustainability: Economic, Environmental Indicators Introduction, Sustainable Engineering Design Principles, Economic Performance Indicators, Environmental Performance Indicators (LCA). **10 Hrs**

Design for Sustainability: Social Indicators (Social Performance Indicators) Case Studies (e.g., Biofuels for Transportation, Transportation Logistics and Supply Chain, Sustainable Built Environment etc.

Textbooks

1 Jain, R.K., Urban, L.V. and Stacey, G.S., Environment Impact Analysis, Von Nostrand Reinhold Company.

2 Lawrence, David P., Environmental Impact Assessment (Practical Solutions to Recurrent Problems), Wiley International, New Jersey.

3 Life Cycle Assessment, Theory and Practice, Editors: Hauschild, Michael, Rosenbaum, Ralph K., Olsen, Stig (Eds.), Springer Publications

4 Niemann, Jörg, Tichkiewitch, Serge, Westkämper, Engelbert (Eds.) Design of Sustainable Product Life Cycles, Springer Publications

Reference Books:

5 MoEF, GoI, Environment Impact Assessment, Impact Assessment Division, January 2001 (Manual).

6 Water (Prevention and Control of Pollution) Act 1974. Air (Prevention and Control of Pollution) Act 1981.

7 Trivedi, P.R., Natural Resources Conservation, APH Publishing Corporation, New Delhi.

8 Westman, Walter E., “Ecology, Impact Assessment and Environment Planning” John Wiley and Sons, Canada, 1985.

FOUNDATION ENGINEERING

Course Code	CV534	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To impart knowledge necessary in determining geotechnical properties of soil
2. To determine bearing capacity of soil strata using various theories.
3. To analyze and design shallow and deep foundation systems under different loading conditions for different site and soil conditions.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the nature and behaviour of soil, In-situ tests, Types of foundations, bearing capacity, contact pressure
CO2	Apply the concepts of contact pressure, bearing capacity theories in understanding foundation behaviour in clays and sands
CO3	Analyse soil failure, foundation behaviour in different soils, settlements in clay and sand, problems related to expansive soils, ddifferent types of soil conditions considering the time effect on soil behaviour.
CO4	Design safe foundations (shallow and deep) for different types of soils

UNIT I

SITE INVESTIGATIONS: Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation – Strength parameters – Bore log, report writing and data interpretation **10 Hrs**

SELECTION OF FOUNDATION: Types of foundation, Factors affecting the selection of foundation type, ground movements due to construction

UNIT II

BEARING CAPACITY: Generalized bearing capacity equation, Factors affecting bearing capacity, bearing capacity of shallow foundation theories (Prandtl and Skempton), Bearing **12 Hrs**

capacity using IS code, Settlement analysis in clays and sands, components of settlement and its estimation, permissible settlement, proportioning of footing for equal settlement, allowable bearing pressure, bearing capacity from in-situ tests (SPT, SCPT, Plate Load). Effect of water table on bearing capacity, bearing capacity of raft, mat foundation as per IS code, Contact pressure under rigid and flexible footings, floating foundations.

SHALLOW FOUNDATION: Location and depth of foundation – Codal provisions – modes of shear failures, Types of Isolated footing, Combined footing, Mat foundation. Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation.

UNIT III

PILE FOUNDATIONS: Load transfer mechanism of piles, Types of piles, functions, factors influencing the selection of pile – Load carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae– Capacity from in situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Pile Group capacity – Settlement of pile groups – Interpretation of pile load tests as per IS code, laterally loaded piles, Mini and micro piles, CPRF - Introduction and basic principles of design. **10 Hrs**

CAISSON AND WELL FOUNDATION: Types of Caissons, Components of Well foundation, Stability analysis of well foundation, Tilt. and Shift.

UNIT IV

FOUNDATIONS ON PROBLEMATIC SOILS: Identification, swelling pressure, foundation on expansive soil, problems and preventive measures, under-reamed pile foundation-its concept, design principle and field installation, Foundations on weak soils, reclaimed areas. **10 Hrs**

RETAINING WALLS: Earth pressure theories - Rankine and Coulomb**,** Types – flexible and rigid earth retention systems, Stability Analysis and design principles.

SHEET PILE: Analysis and design of excavations, slopes and underground structures. Analysis of anchored sheet piles and cantilever sheet piles, Lateral supports in open cuts.

Textbooks:

1 P. Purushottam Raj , Soil Mechanics and Foundation Engineering, Pearson Education.

2 Bell F. G , Foundation in difficult ground , Butterworths & Co

3 J. E. Bowles , Foundation Analysis and Design, McGraw Hill

4 V. N. S. Murthy , Soil Mechanics and Foundation Engineering

5 Braja M. Das , Principles of Foundation Engineering by, Thomson Asia Pvt. Ltd

6 Terzaghi Karl and Peck R. B., Soil Mechanics in Engineering Practice, John Wiley and Sons, NY

Reference Books:

7 David F. McCarthy , Essentials of Soil Mechanics and Foundations: Basic Geotechnics by

8 Shenbage R Kaniraj , Design Aids in Soil Mechanics and Foundation Engineering-, TATA Mc-Grawhill

9 IS code of practice for determination of bearing capacity of shallow foundations IS: 6403

10 IS code of practice for Design and Construction of Pile Foundation IS: 2911 (Part I to IV)

11 IS code of practice for structural safety of buildings: shallow foundations – IS : 1904 1986

12 IS code of practice for subsurface investigation for foundation: IS 1892

13 IS: 2131- 1981 reaffirmed 2002, Indian standard method for standard penetration test for soil

Prof. Annapurna Sakhardande
Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Nais
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

OCCUPATIONAL SAFETY AND HEALTH

Course Code	CV535	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To anticipate, recognize, evaluate, and develop control strategies for hazardous conditions and work practices.
2. To demonstrate an understanding of the fundamental aspects of safety, industrial hygiene, environmental science, fire science, hazardous materials, emergency management, ergonomics and/or human factors.
3. To apply adult learning theory to safety training methodology.
4. To identify and apply applicable standards, regulations, and codes

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the importance of maintaining a safe workplace and understand that safety standards must be maintained in compliance with regulatory requirements and within engineering limits.
CO2	Demonstrate an understanding of workplace injury prevention, risk management, and incident investigations.
CO3	Demonstrate knowledge of safety recordkeeping and management, and the role of the safety manager.
CO4	Understand the acute and chronic health effects of exposures to chemical, physical and biological agents in the workplace. Graduates will demonstrate knowledge of different types of exposure and biological effects, exposure guidelines and basic workplace monitoring.

UNIT I

Occupational Health: Concept of occupational health, Occupational and Work related diseases, History of occupational health, Characteristics of occupational diseases. **10 Hrs**

Occupational Health Hazards: Adverse health effects of noise, Vibration, Cold, Heat stress, Improper illumination, Thermal radiation. Fire hazards, fire prevention and firefighting,

equipment and methods.

Permissible Threshold **Exposure Limits:** Short term and Long term effects of exposures; Preventive and Control measures.

UNIT II

Accident and Incident Investigation: Definition; Incident, Accident, Injury, Unsafe acts, Unsafe conditions, Hazards, Error, Oversight, Mistakes etc. **10 Hrs**

Accident and Incident Analysis: Standard classification of factors associated with accident. Accident reporting: Report forms, Writing reports, Essential elements.

Factories Act, Workmen's Compensation Act and Rules, ESI Act and Rules, Labour Act (Abolition And Regulation), Right to Know.

UNIT III

Risk Assessment and Hazard Identification: Preliminary hazard analysis, What if analysis, Failure mode effect analysis, Hazard and Operability (HAZOP) studies, Hazard analysis techniques; Fault tree analysis, Event tree analysis, On-site and Off-site emergency preparedness. **12 Hrs**

Meaning and Scope of Safety in Construction: Basic parameters governing the safety in construction e.g.: Scaffolding, shuttering/form work, Working at Heights, Safe access, Good housekeeping, Safety in the use of construction machinery Safety with regard to storage, Stocking and Handling materials of construction. Safety in demolition operations; Safety precautions to be taken for and during demolition.

UNIT IV

Employee Participation in Safety: Purpose, Areas of participation, Methods, Role of trade union in Safety Health and Environment Protection. **10 Hrs**

Personal Protective Equipment: Need for personal protection equipment, selection, Applicable standards, Care and Maintenance of respiratory and Non-respiratory personal protective equipment. Non-respiratory personal protective devices: Head protection, Ear protection, Face and Eye protection. Hand protection, Foot protection, Body protection, Respiratory personal protective devices.

Textbooks:

1 D. A. Colling; Industrial Safety Management and Technology; Prentice Hall, New Jersey.

2 H. W. Heinrich; Industrial Accident Prevention; McGraw Hill Publication, New York.

3 D. L. Goetsch; Occupational Safety and Health for Technologists; Engineers and Managers, Prentice Hall.

4 R. K. Mishara; Construction Safety; AITBS Publishers, India.

Reference Books:

5 D. E. Della and Giustina; Safety and Environmental Management; Van Nostrand Reinhold

International Thomson Publishing Inc.

6 CPHEEO; Manual on Sewerage and Sewage Treatment; Ministry of Urban Development, GOI, New Delhi.

7 Industrial Safety and Pollution Control Handbook; National Safety Council and Associate (Data) Publishers Pvt. Ltd.

8 Woodson; Human Factors Design Engineering; Tata McGraw Hill.

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Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Naik
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

ADVANCED STRUCTURAL ANALYSIS

Course Code	CV541	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To enable the student to have a good grasp of all the fundamental issues in advanced topics in structural analysis.
2. To develop skills to idealize, formulate, and analyze determinate and indeterminate structures (beams, trusses, and frames) using matrix structural analysis methods.
3. To enable a good understanding of how standard software packages operate.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Formulate mathematical model for structural analysis using matrix methods
CO2	Analyse the components of civil engineering structures like trusses, beams, frames and grids under all probable loading conditions
CO3	Interpret the results of analysis for design purpose.
CO4	Perform computer aided structural analysis to derive conclusions.

UNIT I

Review of basic Structural Analysis: Static indeterminacy and Kinematic indeterminacy, Degree of freedom, Analysis of determinate structures (trusses, beams, frames), Analysis of indeterminate structures (Force based and Displacement based methods). **10 Hrs**

Matrix concepts and Basics of Matrix analysis of structures: Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigenvalues and eigenvectors; coordinate systems; displacement and force transformation matrices; element and structure stiffness matrices; element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

UNIT II

Matrix analysis of structures with axial elements: Stiffness and flexibility matrices for one dimensional axial element, plane truss, space truss, Analysis by conventional stiffness and **10 Hrs**

flexibility methods.

UNIT III

Matrix analysis of beams: Stiffness and flexibility matrices for beam element, continuous beams, beams with hinged and fixed supports, internal hinges, Analysis by stiffness and flexibility method. **12 Hrs**

Matrix analysis of grids: Torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element).

UNIT IV

Matrix analysis of frames: Stiffness and flexibility matrices for plane frame element, dealing with internal hinge and various support conditions, Analysis by stiffness and flexibility method, stiffness matrix for space frames and analysis by reduced stiffness method. **10 Hrs**

Structural Modeling and Computer Software Applications: Modeling of buildings (G+3) structure, Bridges, Typical example problems using any FEM based standard software.

Textbooks:

1 William Weaver J. R., James M. Gere; Matrix Analysis of Frames Structures; CBS publications.

2 Ashok K. Jain; Advanced Structural Analysis; Nem Chand and Bros.

3 C.K.Wang; Indeterminate structural Analysis.

Reference Books:

5 Amin Ghali; Adam M Neville and Tom G Brown; Structural Analysis: A Unified Classical and Matrix Approach; Sixth Edition; 2007; Chapman & Hall.

6 G.S. Pandit and S.P. Gupta; Structural Analysis: A Matrix Approach; Tata McGraw Hill.

7 Amin Ghali; Adam M Neville and Tom G Brown; Structural Analysis: A Unified Classical and Matrix Approach; Sixth Edition; 2007; Chapman & Hall.

8 G.S. Pandit and S.P. Gupta; Structural Analysis: A Matrix Approach; Tata McGraw Hill.

GROUND IMPROVEMENT TECHNIQUES

Course Code	CV542	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To study engineering properties of soft, weak and compressible soil strata
2. To understand principles and methods of ground improvement
3. To familiarize with the emerging trends in ground improvement techniques.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Select appropriate ground improvement technique considering soil condition, type of structure, environmental aspect and economy
CO2	Suggest various ground improvement techniques for typical engineering problems.
CO3	Analyse slopes for stability and suggest appropriate ground improvement techniques
CO4	Understand various soil stabilization techniques using admixtures

UNIT I

Introduction: Different types of problematic soils and their geological formation, Engineering properties of soft, weak and compressible deposits, principles of treatment, methods of soil improvement, Classification of ground modification techniques, Emerging trends in ground improvement. **12 Hrs**

Treatment of Loose Sands: Mechanical Stabilization - Shallow and Deep compaction requirements, Principles and methods of soil compaction, Shallow compaction and methods. Properties of compacted soil and Compaction control, Deep compaction and vibratory methods, dynamic compaction. Compaction piles, Vibroflot technique, controlled blasting for compaction, Electro Heating, Microbial geotechnology.

UNIT II

Treatment by Admixtures: Cement stabilization and Cement columns, Lime stabilization and Lime columns. Stabilization using bitumen and Emulsions, Stabilization using industrial wastes, Construction techniques and Applications. Grouting Techniques: Permeation grouting, Compaction technique, Jet grouting, Different varieties of grout materials, Grouting in difficult conditions. Treatment of Expansive Soils: Lime treatment for expansive soils, Injection methods, **10 Hrs**

Nano- technologies.

UNIT III

Accelerated Consolidation Methods for Soft Clay Soils: Preloading and the techniques of preloading, consolidation by sand drains, Pre-fabricated vertical drains, Radial consolidation, Effect of smear zone on radial consolidation, Vacuum consolidation **10 Hrs**

Vibro-compaction methods, Stabilization of soil by vitrification, Ground freezing, Dewatering and Electro kinetics, freezing, Grouting and micro piles

UNIT IV

In-situ ground Treatment for Slopes: Different types of in situ soil stabilization like soil nails, Rock anchoring, Pre-stressed anchors, etc. Optimum design of nailed slopes, Design methods and Construction techniques. Evaluation of zone of liquefaction in field, Ground improvement techniques for improving liquefaction resistance of soils, in ground improvement and site remediation **10 Hrs**

Textbooks:

1 M. R. Haussmann; Engineering Principles of Ground Modification; Tata McGraw-Hill Inc., USA.

2 Gulati and Datta; Geotechnical Engineering; Tata Mc Graw Hill.

3 Raj Purushothama; Ground Improvement Techniques; Laxmi Publications.

Reference Books:

5 J. E. Bowles; Foundation Analysis and Design; Tata McGraw Hill.

6 M. P. Mooseley and K. Kirsch; Ground Improvement; 2nd Edition, Spon Press, Taylor and Francis Group, London, United Kingdom.

7 Bell F.G.; 'Engineering Treatment of Soils', E&FN Spon

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GREEN BUILDING

Course Code	CV543	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To introduce students with the concepts of green buildings and need for construction of green building.
2. To get students acquainted with the principles, elements, design and assessment methods and rating criteria's of green building.
3. To understand lighting, ventilation and cooling mechanisms in green building.
4. To create awareness about water conservation methods, different green materials used in construction of buildings.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the importance and necessity of green buildings.
CO2	Assess a building based on the green building norms.
CO3	Suggest materials and technologies to improve energy efficiency of building.
CO4	Propose suitable methods for conservation of water, materials and electricity

UNIT I

Introduction of green building: Concept of green building, History of green building, Need of green building in present scenario, Importance of green building, Merits and demerits, Classification of green building, Terminologies associated with green building. **10 Hrs**

UNIT II

Assessment methods and criteria's for rating - Global assessment and certification, Local assessment, LEED, GRIHA, IGBC. Principles and elements of design of green building based on assessment criteria's **10 Hrs**

UNIT III

Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, **10 Hrs**

orientation, roof form.

Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U value and insulation thickness, Day lighting stimulation, Ventilation.

UNIT IV

Water conservation: 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling. **12 Hrs**

Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction.

Electricity conservation: Bureau of energy efficiency - Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings, carbon calculators.

Textbooks:

1 Arvind Krishnana, SimosYannas, Nick Baker, S V Szokolay ., Climate responsive architecture -A design hand book for energy efficient buildings, McGraw hill Publications

2 H, Ravindranath, K UshaRao, B Natarajan, P Monga, Renewable Energy and Environment -A Policy Analysis for India, Tata McGraw Hill

3 J M Fowler ., Energy and the Environment, , McGraw Hill, New York

Reference Books:

4 Anthony Floyd ., Green Buildings: Professional Guide to Concepts, Codes and Innovations,; Cenage Learning India Pvt. Ltd., New Delhi

5 Ross Spiegel and Dru Meadows; Green Building Materials: A Guide to Product Selection and Specification, John Wiley and Sons.

6 IGBC Green Homes – Detailed Reference Guide; IGBC, Hyderabad.

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RURAL WATER SUPPLY AND ON-SITE SANITATION SYSTEMS

Course Code	**CV544**	**Credits**		**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**42 Hrs/Sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

1. To understand and analyze the problems in rural water supply and sanitation methods in rural areas
2. To understand the water treatment practices and sludge/septage disposal systems.
3. To analyze different methods for the prevention of communicable diseases

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Identify problems pertaining to rural water supply and sanitation.
CO2	Design water supply and sanitation system for rural community.
CO3	Design low-cost waste management systems for rural areas.
CO4	Plan and design an effluent disposal mechanism.

UNIT I

Water supply System: Attributes of water supply systems, Issues of rural water supply, Various techniques for rural water supply, National rural drinking water program, Rural water quality monitoring and surveillance, Operation and maintenance of rural water supplies, Drinking water quality, Relationships between diseases and water quality. **11 Hrs**

Hygiene and sanitation: Occupational hazards- schools- public buildings- hospitals- eating establishments- swimming pools – cleanliness and maintenance and comfort, Industrial plant sanitation.

UNIT II

Water treatment: Need for water treatment, low-cost water treatment, Epidemiological aspects of water quality- methods for low-cost water treatment, Specific contaminant removal systems. **10 Hrs**

Water treatment systems: Point of use water treatment systems, filters, bio-sand filters, disinfection systems for rural areas, chlorination, and Solar disinfection systems, removal of arsenic, fluoride and iron.

UNIT III

On-site sanitation systems: Nexus between water quality and sanitation, Importance of hydrogeology on selection of onsite sanitation systems. Design of Septic tanks, single pit and double pit toilets, Small bore systems, bio digesters, reed beds, constructed wetlands **10 Hrs**

UNIT IV

Rural sanitation: Introduction to rural sanitation, Community and sanitary latrines, Planning of wastewater collection system in rural areas, Rural health, Other specific issues and problems encountered in rural sanitation. **11 Hrs**

Sludge/septage management systems: Disposal of Solid Wastes, stabilization ponds - septic tanks - Imhoff tank- soak pits- low-cost excreta disposal systems, Effluent disposal. Composting- land filling- incineration

Textbooks:

1 Eulers, V.M., and Steel, E.W., Municipal and Rural Sanitation, 6th Ed., McGraw Hill Book Company, 1965

2 Park, J.E., and Park, K., Text Book of Preventive and Social Medicine, Banarsidas Bhanot, 1972

Reference Books:

3 Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York, 1977.

4 Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, Iwa Publishing (intl Water Assoc), 2007

ADVANCED SURVEYING

Course Code	CV 545	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To familiarize with concepts of photogrammetry used for surveying and topographic mapping and measuring distance between objects.
2. To understand sounding methods for gauging seabed levels
3. To establish leveling datum for reducing sounding, location of under water works and volumes of underwater excavation.
4. To acquaint students with GPS positioning and data processing.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Acquainted with use of aerial camera, aerial photographs and procedure of aerial surveys
CO2	Identify the method for carrying out hydrographic survey
CO3	Analyze the GPS observables and process
CO4	Plan a survey using modern instruments /techniques

UNIT I

Photogrammetry Surveying : Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning, Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes. **12 Hrs**

Drone Surveying: Use of drone for surveying, advantages of drones, drone mapping.

UNIT II

Hydrographic Surveying -History and Overview of Hydrographic Surveying -Working on the Water: small boat safety, sound waves and the decibel, definition of sounding,sounding equipment, Underwater Acoustics, Echo ranging and the Sonar Equation, Tides, Water Levels, **08 Hrs**

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Vertical Control and Datums. Nautical Charts and Other Applications Uncertainty, Standards/Specs, and Calibration.

UNIT III

Global Positioning System- Introduction to GPS , GPS signals , user segment , positioning of control unit , GPS receiver , software and positioning of control point , software and position of control point , Principles of GPS positioning and GPS observables, errors in GPS observables, GPS data pre-processing ; differencing, GPS data pre-processing ; point positioning, GPS data processing ; Base line processing , GPS data pre-processing ; Network adjustment, Quality assessment of GPS surveying. **11 Hrs**

UNIT IV

Advanced Instruments in Surveying- Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat. Introduction to Total Station, parts of Total Station, accessories of Total station, handling and setting of Total Station, measurement of distance using Total Station, measurement of horizontal angle, vertical angle and height using total station, errors in total station, errors and quality of surveying measurement, error propagation and survey specification, basics of vertical representation, contouring, mapping fundamentals, mapping basics, mapping softwares, automated mapping. **11 Hrs**

Demonstration and usage of Modern surveying instruments like Total station, GPS, Drones, Echo-sounding, Sonars etc.

Textbooks:

1 Paul wolf, Bon Dewitt, Benjamin Wilkinson., Elements of Photogrammetry with Application of GIS, Fourth Edition, Mc-Graw-Hill Education, January 2014.

2 J Paul Guyer., Introduction to Hydrographic Surveying, independently published (November 1, 2018)

3 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

4 Elliott D. Kaplan, Christopher Hegarty., Understanding GPS; Principles and Applications, Second Edition (Artech House Mobile Communications) Publishing, Nov 2005.

Reference Books:

5 Lillesand T.M & Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.

6 Photogrammetric Engineering & Remote Sensing ; Science Direct , Copyright 2020 American Society of Photogrammetry and Remote sensing Hosting by Elsevier B.V.

7 Web resource - https://www.opendronemap.org/

8 Web resource - https://dronemapper.com/software_downloads/.

CONCRETE TECHNOLOGY AND TRANSPORTATION ENGINEERING LAB

Course Code	CV560	Credits		1	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	2	28 Hrs/Sem	
Scheme of Examination TOTAL = 50 marks	IA	TW	TM	P	O
	25	00	00	50	0

Course Objectives:

1. To perform tests on various materials used in construction
2. To understand the relevant Codal provisions in performing the tests.
3. To interpret test result in selecting appropriate material for construction purpose.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Determine engineering properties of cement, concrete, aggregate and bituminous materials.
CO2	Classify and characterize the materials based on the results of the tests performed.
CO3	Suggest the suitability of materials for construction purpose, based on the results of the tests.

PRACTICALS

(At least 8 experiments should be conducted from the list of experiments, with at least four from Each Domain)

CONCRETE TECHNOLOGY LABORATORY

1. Test on Cement as per BIS Codes (Physical and Chemical)
2. To determine the physical properties of Aggregates as per BIS Codes
   a) bulk density and voids of aggregates
   b) silt content in fine aggregate
   c) bulking of fine aggregate
3. Determination of particle size distribution of fine, coarse and all in aggregate by Sieve analysis (grading of aggregate)
4. To determine workability by slump test:
   a) To verify the effect of water, fine aggregate/coarse aggregate ratio and Aggregate/ Cement ratio on slump
   b) To test compressive strength of concrete cubes with varying water Cement ratio

5. Compaction factor test for workability
6. Non-destructive test on concrete by:
   a) Rebound Hammer Test
   b) Ultrasonic Pulse Velocity Test
7. Conducting Mix design trials, using admixtures

TRANSPORTATION LABORATORY

1. To determine the various properties of Aggregates as per BIS Codes (Any two)
   a) Flakiness and elongation index test on aggregates
   b) To determine Aggregate impact value
   c) To determine Aggregate crushing value

2. To determine the various properties of Bituminous materials as per BIS Codes (Any two)
   a) Ductility value
   b) Softening point test
   c) Penetration value
   d) Flash and fire test

3. Tests on bituminous mixes (Any two)
   a) Determination of binder content
   b) Marshall stability and flow value
   c) Density

4. To determine Los Angeles abrasion value of aggregates

5. To determine CBR value method

Reference Books:

1 C.E.G.Justo and S.K. Khanna; Highway Engineering; Nem Chandand Brothers.

2 Shetty,M.S, “Concrete Technology”, S.Chand and Company Ltd, New Delhi, 2016

3 IS 2386-1963, IS 516-1959, IS 456-2000, IS 10262-2019, IS 1201 to IS 1220 -1978 etc.

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING LAB

Course Code	CV560	Credits		1	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	2	28 Hrs/Sem	
Scheme of Examination TOTAL = 50 marks	IA	TW	TM	P	O
	0	0	0	50	0

Course Objectives:

1. To understand soil as an engineering material.
2. To understand the laboratory tests for determination of physical, index and engineering properties of soil.
3. To assess the water quality based on the test parameters.
4. To assess the waste water quality based on the test parameters.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	To classify and to determine different properties of soils based on different tests.
CO2	Able to interpret engineering behavior of soil based on test results.
CO3	Identify, analyse and interpret the water quality parameters for potable use.
CO4	Identify, analyse and interpret the waste water quality parameters for treatment.

PRACTICALS

(At least 8 experiments should be conducted from the list of experiments, with at least four from Each Domain)

GEOTECHNICAL ENGINEERING LABORATORY

1. Field Density (Core Cutter method and Sand replacement method)
2. Grain size distribution (Sieve Analysis and Hydrometer Analysis)
3. Consistency limits (Liquid limit, Plastic limit and Shrinkage limit)
4. Compaction test (Standard Proctor test/Modified Proctor test)
5. Permeability test (Constant-head test method/Falling-head method)
6. Shear Test (Direct Shear Test/Triaxial Test/ Vane shear test) ANY TWO
7. Unconfined Compression Strength Test

8. Consolidation Test

ENVIRONMENTAL ENGINEERING LABORATORY

1. Determination of pH and Turbidity for Water Sample.
2. Determination of Total Suspended and Dissolved Solids for Water Sample.
3. Determination of Dissolved Oxygen for Water Sample.
4. Determination of Optimum Dosage of Coagulant by Jar Test Apparatus for a Water Sample.
5. Determination of Acidity and Alkalinity for Wastewater Sample.
6. Determination of Chlorides for Wastewater Sample.
7. Determination of BOD for Wastewater Sample.
8. Determination of COD for Wastewater Sample.

Reference Books:

1 Alam Singh, G R Chowdhary, "Soil Engineering in Theory and Practice Vol 2, Geotechnical Testing and Instrumentation" Paperback

2 IS 2720 Part (2, 3,4, 5, 6, 7, 8, 10, 11, 13, 15, 17, 28, 29, 30, 36) etc.

3 Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

4 Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

ENTREPRENEURSHIP & INTELLECTUAL PROPERTY RIGHTS

Course Code	HM005	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:

1. To introduce fundamental aspects of entrepreneurship, financial management and Intellectual Property Rights.
2. To learn about conducting Social cost benefit analysis, project financial management, principles of budgeting.
3. To familiarize with various aspects of intellectual property rights
4. To acquaint with preparation of project report and strategy to protect inventions and innovations of new ventures

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Explain the basic concepts in the area of entrepreneurship, financial management and Intellectual Property Rights
CO2	Apply the concepts of financial management for project appraisal, principle of budgeting &finance and intellectual property rights for entrepreneurial success.
CO3	Analyze the business environment in order to identify business opportunity. Interpret & communicate the information contained in basic financial statements. Explain the nature, scope and differences of IP, its utilities and approaches
CO4	Prepare project report, business plan, summarize & interpret the accounting data for managerial decision. Evaluate the different Intellectual Property strategy to protect inventions and innovations of new ventures.

UNIT I

Definition and clarification of concept of entrepreneurship: Qualities and skills required for entrepreneurship, Functions of an entrepreneur, Importance of entrepreneur in economic development. **10 Hrs**

Theories of Entrepreneurship: Economic theory, Sociological theory, Psychological theory. Types of entrepreneurs: Based on type of business, Based on use of technology, Based on motivation, Based on stages of development, Based on motive, Based on capital ownership,

Danhof's classification.

Project identification: External environment analysis, Meaning and characteristics of a project, Classification of projects, Project life-cycle, Sources and screening of project ideas.

Project formulation: Meaning and significance, Feasibility analysis, Techno-economic analysis, Input analysis, Financial analysis, Social cost benefit analysis. Project feasibility.

Pre-feasibility study: Project feasibility report - Meaning, Importance and Contents.

UNIT II

Project financing and institutional finance: Classification of capital – Fixed capital -Meaning, Factors governing fixed capital requirements, Working capital – Meaning and concepts, Types, Factors determining working capital requirements. Sources of finance – Share capital, Debenture capital, Lease finance and term loans from commercial banks. Financial aspects: Break even analysis, Income statement, Balance sheet, Fund flow statement, Ratio analysis – Liquidity, leverage and profitability ratios. Capital budgeting – Need, Importance, Process, methods of project evaluation: Payback period, Net Present Value Index. **10 Hrs**

UNIT III

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention1952, the WIPO Convention1967, the Patent Co-operation Treaty 1970, the TRIPS Agreement, 1994. **12 Hrs**

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Infringement, Remedies & Penalties - Patent office and Appellate Board.

UNIT IV

Copyright: Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights. **10Hrs**

Trademarks: Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Textbooks:

1 C.B.Gupta and N.P.Srinivasan ; Entrepreneurship; Sultan Chand and Sons; 1997,4/e.

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2 Prassanna Chandra; Fundamentals of Financial Management; Tata McGraw Hill; 2001, 3/e.

3 Neeraj P., &Khusdeep, D. Intellectual Property Rights. India, IN: PHI learning Private Limited (2014).

4 Nithyananda K V. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited (2019)

5 Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill, ISBN 0-07-043506-5.

Reference Books:

6 Ahuja V K. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis. (2017)

7 Pmbuddha Ganguli, Intellectual property right - Unleashing the knowledge economy, TataMccraw HiU Publishing Company Ltd

8 Patents ,copyrights, trademarks and design by B L Wadhera

9 C.B. Gupta and S.S. Khanka; Entrepreneurship and Small Business Management; Sultan Chand and Sons; 1997,2/e.

10 Richard M. Lynch, Robert W. Williamson; Accounting for Management, Planning and Control; Third Edition, Tata McGraw-Hill, New Delhi.

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THIRD YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VI

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV610	Design of Reinforced Concrete Structures	3	1	--	3	100	25	25	--	--	150	4
CV620	Design of Steel Structures	3	1	--	3	100	25	25	--	--	150	4
CV631	Geosynthetics and Application	3	--	--	3	100	25	--	--	--	125	3
CV632	Finite Element Method											
CV633	Air and Noise Pollution and Control											
CV634	Advanced Engineering Geology.											
CV635	Remote Sensing & GIS											
CV641	Bridge Engineering	3	--	--	3	100	25	--	--	--	125	3
CV642	Construction Equipment & Automation											
CV643	Structural Dynamics											
CV644	Advanced Geotechnical Engineering											
CV645	Ground Water Engineering											
CV 670	Structural Engineering Lab	--	--	2	--	--	--	25	50	--	75	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
HM011	Estimation & Costing	3	1	--	3	100	25	25	--	--	150	4
	TOTAL	**18**	**3**	**2**	**--**	**600**	**150**	**100**	**50**	**--**	**900**	**22**

*Term Work marks are to be awarded through continuous evaluation

**Student will have to enter the course code that he/she takes as part of the open elective

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

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DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code	CV 610	Credits		4	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	1	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 150 marks	IA	TW	TM	P	O
	25	25	100	0	0

Course Objectives:|

1. To introduce the theory and applications in designing of reinforced concrete structures.
2. To develop an understanding of the behaviour of reinforced concrete members and systems.
3. To familiarize the students with relevant design codes necessary for designing RCC structures.
4. To analyse and design building components.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Design various RCC members and building components
CO2	Apply the principles, procedures and codal requirements for the analysis and design of RC beams, columns, slabs and footings.
CO3	Detail the building components

UNIT I

Basic Concepts of Reinforced Concrete Design: Working stress and limit state design methods. **11 Hrs**

Design of R.C Beams in Flexure & Torsion: Singly and doubly reinforced rectangular/flanged sections, design for shear, T sections, bond and anchorage of reinforcement, limit states of deflection and cracking. Design and detailing of simply supported, cantilever and continuous beams

UNIT II

Slab & Staircase: Design of One-way and two-way slabs, design of staircases **10Hrs**

UNIT III

Design of compression members: Design and detailing of compression members for axial loads and uniaxial and biaxial bending. **11 Hrs**

Design of footings: Design of isolated footings for axial load, axial load with uniaxial moments

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and biaxial moments, Introduction to design criteria and concept of combined footings.
Load Path in buildings: Load transfer from roof to the footings in building.

UNIT IV

Design of Water Tanks: General design principles, concept of underground water tank. Design of overhead water tanks, general design consideration for circular &Intze tank **10 Hrs**

Retaining walls: Stability analysis of retaining wall, design of cantilever retaining wall and design principles of counter fort retaining wall.

TERM WORK: Term work Shall consist of submission of at least 8 assignment mentioned below. Assignment will be based on the above course as required for submission of assignments.

1. Design of Beams
2. Detailing (Longitudinal and Cross Section) of Beams
3. Design of Slabs
4. Detailing (Longitudinal and Cross Section) of Slabs
5. Design of Columns
6. Detailing (Longitudinal and Cross Section) of Columns
7. Design of Footings
8. Detailing (Longitudinal and Cross Section) of Footings
9. Design of Staircases
10. Detailing (Longitudinal and Cross Section) of Staircases
11. Design of Water Tanks
12. Detailing (Longitudinal and Cross Section) of Water Tanks
13. Design of Retaining Walls
14. Detailing (Longitudinal and Cross Section) of Retaining Walls

Textbooks

1 Shah,V.L. et.al., “Limit State Theory and Design of Reinforced Concrete”, 2007 Structures Publications

2 Pillai ,S.U. and Menon, D., “Reinforced Concrete Design”, Tata McGrawHill.2003

3 Park, R. and Pauley, T., “Reinforced Concrete Structures”, John Wiley1976

4 Jain A.K., “Reinforced Concrete”, Limit State Design, 5th edition, Nem Chand and Bros

Reference Books:

5 Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill

6 Varghese P.C., “Advanced reinforced concrete design”, Prentice hall of India pvt ltd

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7 Gambhir, M.L., “Fundamentals of Reinforced Concrete Design”, Prentice Hall of India

8 Krishna J. and Jain O.P., “Plain and Reinforced Concrete”, Vol. 2, Nem Chand &Br

DESIGN OF STEEL STRUCTURES

Course Code	CV620	Credits		4	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	1	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 150 marks	IA	TW	TM	P	O
	25	25	100	0	0

Course Objectives:|

1. To introduce the theory and applications in designing of steel structures.
2. To develop an understanding of the behaviour of steel members and systems.
3. To familiarize the students with relevant design codes necessary for designing steel structures.
4. To analyse and design residential and industrial building components like roof truss, plate girder and gantry girder.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Design the various structural steel members and connections.
CO2	Apply the principles, procedures and codal requirements for the analysis and design of tension members, compression members, beam column etc.
CO3	Analyse and design components of industrial structures like roof trusses, plate girders and gantry girder.
CO4	Analyse and design column bases and foundations

UNIT I

Introduction: Merits and demerits of steel Rolled steel and cold formed sections, Loads and loading combinations, Permissible stresses, Partial safety factors, Design methods. **12 Hrs**

Bolted Connections: Introduction, Advantages/ Disadvantages, Types of bolts, Types of bolted connections, Design of bolted shear connections, Bolts subjected to tension, Bolted connections subjected to combined shear and moment and shear and tension.

Welded Connections: Introduction, Types of welds, Types of welded joints, Permissible stresses, Design of fillet welds for axial loads and Eccentric loads, Butt welds, Design of axially and Eccentrically loaded butt welds.

UNIT II

Design of Tension Members: Introduction, Permissible stresses, Net sectional areas, Design of axially loaded tension members. **10 Hrs**

Design of Compression Members: Introduction, Effective length of columns, Slenderness ratio, Design of axially loaded compression members, Beam column, Column splicing, Design of angle struts.

Design of Roof Trusses: Introduction, Types of roof trusses, and Components of roof trusses, Roof coverings, Loads and Load combinations, Design of roof truss members, Design of purlins.

UNIT III

Design of Beams: Introduction, Permissible stresses in bending, shear, Bearing, Deflection, Web crippling, Web buckling, Plastic bending of beams, Plastic hinge, Shape factor, Design of laterally supported beams, Design of laterally unsupported beams. **10 Hrs**

Design of Plate Girders: Introduction, Elements of plate girder, Design members, Economic depth and Self-weight, Intermediate vertical stiffeners, Horizontal stiffeners, Bearing stiffeners, Web splice, Flange splice, Design of bolted / Welded plate girders.

UNIT IV

Gantry Girders: Introduction, Permissible stresses, Loads acting on gantry girders, Types of gantry girders, Crane rails, Crane data, Maximum moments and Shears, Design of gantry girders. Design of Built - up Compression Members with Lacings and Battens. **10 Hrs**

Design of Column Bases: Introduction, Design of slab base and Gusseted base, Column bases subjected to moments.

TERM WORK: The term work shall be completed during tutorial hours and marks to be awarded based on the assessment of assignments conducted. At least one assignment on each unit based on the above syllabus comprising of design, detailing and preparing working drawings.

Textbooks

1 M.R. Shiyekar; Limit State Design in Structural Steel; 3rd Edition; PHI Learning Pvt. Ltd.

2 S.S. Bhavikatti; Design of Steel Structures By Limit State Method as per IS 800:2007; I.K. International Publishing House Pvt. Ltd.

3 S. K. Duggal; Limit State Design of Steel Structures; Tata McGraw hill.

4 M. L. Gambhir; Fundamentals of Structural Steel Design; Tata McGraw hill.

Reference Books:

5 Frederick Merritt and Roger Brockenbrough., Structural Steel Designer's handbook;.

6 Design Manual for Designing Steel Structures According to New IS: 800; INSTITUTE FOR STEEL DEVELOPMENT & GROWTH.

7 IS 800:2007.

8 IS 875:2015 (Part 1, 2, 3).

9 Steel Tables.

GEOSYNTHETICS AND APPLICATIONS

Course Code	CV 631	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To understand the emerging trends of Geosynthetics in geotechnical Engineering
2. To evaluate the different properties and understand different tests
3. To analyse the functions of Geosynthetics and its suitability
4. To design different structures using Geosynthetics

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the emerging trends of Geosynthetics in Geotechnical Engineering
CO2	Evaluate different properties based on different tests on Geosynthetics
CO3	Analyze Functions of different forms of Geosynthetics and its suitability
CO4	Design different structures using Geosynthetics according to various applications

UNIT I

An overview of Geosynthetics in Geotechnical Engineering: Historical development **12 Hrs**
Types of Geosynthetics: geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geocomposites, geocells and geofoam.

Raw materials: polyamide, polyester, polyethylene, polypropylene, polyvinyl chloride , Types of Geosynthetics based on manufacturing woven, monofilament, multifilament, slit filament, non-woven, Different bonding process: Mechanically bonded, Chemically bonded, and Thermally bonded.

UNIT II

Properties of Geosynthetics: Physical Properties: Mass per unit area, Thickness, Specific **10 Hrs**

gravity ,Hydraulic properties: Apparent open size, Permittivity, Transmissivity
Mechanical Properties: Uniaxial Tensile Strength, Burst and puncture Strength, Soil Geosynthetics friction tests.

Durability: Abrasion resistance, Ultraviolet resistance.

Functions of Geosynthetics: Reinforcement, Separation, Filtration, Drainage, Barrier Functions Confinement

UNIT III

Applications of Geosynthetics: Use of Geosynthetics inroads, Use of reinforced soil in Retaining walls, Improvement of bearing capacity, Geosynthetics in environmental control and landfills, Ground Improvement by geo drains, Use of Geosynthetics in lining of canals. Use of geosynthetics in geoenvironmental, hydraulic structures, airfields, railroads, erosion control, sediment control, mining and agriculture. Accelerated preconsolidation using Geosynthetics, Electrokinetiks using geosynthetics **10Hrs**

UNIT IV

Design with Geosynthetics: Slopes, soil walls, MSEW, Pavements, landfills **10 Hrs**

Suggested List of Experiments :

1. Tensile strength of geotextile/geogrid/geonet
2. Puncture resistance of geomembrane
3. In-plane and cross-plane permeability of the Geotextiles

Textbooks

1 Robert M. Koerner ., Designing with Geosynthetics, Prentice Hall, New Jersey, UAS,1989

2 Reinforced Earth: T. S. Ingold

3 G.VenkatappaRao and G.V.S SuryanarayanaRaju Engineering with Geosynthetics– Tata McGraw Hill, New Delhi, 1990.

4 Geosynthetics: State of the Art Recent Developments" by P H Delmas and A Girard

Reference Books:

5 Sanjay Kumar Shukla, Jian-Hua Yin ., Fundamentals of Geosynthetic Engineering by, CRC Press

6 Sanjay Kumar Shukla, Thomas Telford ., Handbook on Geosynthetics and their applications, , 2002

7 Web Resources
1. http://nptel.ac.in/courses/105106052 Geosynthetics and Reinforced Soil Structures (Video): (NPTEL Course)
2. http://nptel.ac.in/ courses /105101143

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FINITE ELEMENT METHOD

Course Code	CV632	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To equip the students with fundamentals of Finite Element Methods (FEM).
2. To enable the students to analyse problems using FEM.
3. To apply FEM and its applications to real life problems.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand the basics of the Finite Element METHODS, a numerical tool for the solution of different classes of problems in Engineering.
CO2	Demonstrate the ability to invoke appropriate assumptions, select proper elements and develop FEM models that adequately and efficiently represent physical systems.
CO3	Apply the mathematical and physical principles underlying the FEA.
CO4	Analyse beam element for dynamic considerations

UNIT I

Introduction to Finite Element method (FEM): General description of the method, Steps involved, Advantages, Range of applications. Basic Equations from linear theory of elasticity; Equilibrium equations, Compatibility equations, Strain displacement equations. Generalized Hooke's law; Constitutive laws for plane stress and Plane strain problems, Potential energy approach, Rayleigh-Ritz method. **12 Hrs**

Matrix algebra and Solution of simultaneous equations using Crout's reduction and Cholesky's decomposition methods.

UNIT II

Types of Elements, Discrete Systems: Analysis of one dimensional stress deformation problems; Generation of matrix displacement equations for spring element, 1-D bar element using direct and energy approach. Assembly of global stiffness matrix and Load vector, Treatment of boundary conditions and Solutions. **10 Hrs**

Co-ordinate System: Global, Local and Natural co-ordinate. Convergence requirement on displacement field. Shape functions for linear, Quadratic and Cubic 1-D element.

Analysis of Plane Trusses: Introduction, Plane trusses, Formulation of problem, Generation of element stiffness matrix, Assembly of global stiffness matrix and Load vector, Boundary conditions and Solution. Band width of a matrix.

UNIT III

Shape functions for Constant Strain Triangle (CST), Linear Strain Triangle (LST) and 4noded rectangular element. 2-D stress deformation, Finite element formulation, Derivation of element equation, Problem solution for two dimensional stress deformation problems using CST **10 Hrs**

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Introduction to Isoparametric element and its formulation; Jacobian matrix. Numerical integration; Guass Legendre quadrature technique

UNIT IV

Stiffness matrix for a beam element. Hermite shape function. Applications to determinate and Indeterminate beams; Finite element formulation, Load vector, Boundary conditions, Shear force and Bending moment, Problem solution. **10 Hrs**

Dynamic Considerations in FEM: Introduction, Formulation of element mass matrix; beam element, Evaluation of Eigenvalues and Eigenvectors.

Textbooks :

1 J. N. Reddy; An Introduction to the Finite Element Method; McGraw-Hill.

2 T. R. Chandraputla, A. D. Belegundu, Introduction to Finite Elements in Engineering; Prentice Hall.

3 K. J. Bathe; Finite Element Procedure; Prentice-Hall of India.

4 C. S. Krishnamoorthy; Finite Element Analysis-Theory and Programming; Tata McGraw-Hill.

Reference Books:

5 Desai and Abel; Introduction to the Finite Element Method; CBS Publishers.

6 Singiresu and Rao; The Finite Element Method in Engineering; Butterworth-Heinemann.

7 Daryl L. Logan, A First Course in the Finite Element Method; Cengage Learning.

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AIR & NOISE POLLUTION AND CONTROL

Course Code	CV633	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To impart knowledge of effects of air pollutants on the environment.
2. To understand various air-pollution, noise pollution control methods.
3. To enable students for using appropriate technologies for effective control of air pollution.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Identify the effects of pollutants on the environment
CO2	Understand noise pollution, its effects and basic control measures
CO3	Plan strategies to control, reduce and monitor pollution
CO4	Select the most appropriate technique for the treatment of contaminated air

UNIT I

Air pollution sources & effects: Air pollutants, Sources, Classification, Effects on Health, vegetation and materials. Reactions of pollutants in the atmosphere and their effects-Smoke and Smog. Greenhouse effect. Ozone layer disturbance. Acid Rain. **08 Hrs**

UNIT II

Meteorological aspects of air pollutant dispersion: Temperature lapse rates and stability, Wind velocity and turbulence, Dispersion of air pollutants, Plume behaviour, Heat island effects. **12Hrs**

Air pollution sampling and measurement: Air sampling and pollution measurement methods, principles and instruments. Laboratory analytical methods of particulate concentration. Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations.

UNIT III

Control Technologies: Plume rise Calculation of effective stack height Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation etc. **12 Hrs**

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UNIT IV

Introduction to Noise Pollution: Basics of acoustics and specification of sound sound power, sound intensity and sound pressure, outdoor and indoor noise propagation. **10 Hrs**

Effects of Noise Pollution: Effects of noise on health, noise standards and limit values; noise instrumentation and monitoring procedure. Measurement and various control methods. Noise indices.

Textbooks :

1 Rao and Rao, Air Pollution; Tata McGraw-Hill Education, 1st edition, 2013

2 H S Peavy, D.R Rowe, G. Tchobanoglous, Environmental Engineering; McGraw-Hill, 1st edition, 2017

3 Muralikrishna KVSG, Air Pollution and Control, Laxmi Publications, 2015

Reference Books:

5 H.C Perkins; Air Pollution; Mcgraw-Hill

6 Crawford and Martin, Air Pollution Control Theory; McGraw-Hill Inc.

ADVANCED ENGINEERING GEOLOGY

Course Code	CV 634	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To understand the different types of geological structures and weathering effect on rocks.
2. To understand sea wave processes to adopt protective measures to stabilize them.
3. To understand Engineering Seismology and Plate tectonics.
4. To select proper method and equipment for excavation in different geological materials.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	To understand methods of seismic investigation and interpretation of seismic data for engineering structures and understand plate tectonics.
CO2	Evaluate rock-mass quality, calculate the bulk properties of rocks and perform a kinematic analysis.
CO3	To suggest measure in order to protect ports and harbours as well various coastal structures.
CO4	To propose methods of excavation in different type of formation and study weathering of rocks.

UNIT I

Study of Rock Structures: folds - classification and geometry; faults - classification and geometry; Origin of joints, joints- classification and significance; foliation - types and relation with major structures; lineation - types and relation with major structures; basic concepts of shear zones. Cleavage, Schistosity, Significance of rock cleavage. **12 Hrs**

Coastal Engineering: Waves and tides; Wave motion, Force and Height of waves, Beach zones, Wave refraction, Tides, and Changes in sea level. Coastal erosion and deposition; Coastal erosion, Beaches, Long shoe drift, Offshore bars. Shoreline investigation and Data acquisition: Recording devices, Topographic surveys, Measurements of water levels, Movement of sediments.

Methods of Shoreline Protection: Sea walls, Wave breakers, Cohesive and Embankments,

Revetments, Bulkheads, Methods of stabilisation of long shore drift; Groins, Beach replenishment.

UNIT II

Excavation in Rocks and Soils: Excavation in Igneous, Metamorphic and Sedimentary rocks, Cohesive and Non-cohesive soils. **10 Hrs**

Methods of Open (Surface) Excavation: Drilling and Blasting, Ripping, Digging, Factors influencing rock slope stability, Analysis of stability of rock slopes and Soil slopes (any one method each), Methods of slope control.

Excavation of Tunnels (Sub Surface Excavation): Machine tunneling in soft ground, Machine tunneling in hard rocks, Drilling and Blasting, Control of over breakage.

Rock Weathering: Rate of weathering, Engineering classification of weathering (any three), Assessment of the degree of weathering.

UNIT III

Engineering Seismology: Introduction, Intensity and Magnitude of Earthquakes, Ground condition and Seismicity. Methods of seismic investigation, Dynamic analysis, Seismic zoning, structural interpretation of seismic data, Structural damage and its prevention. Induced seismicity; Earthquakes and Dams. **10 Hrs**

Tectonics-historical perspective; types of plate boundaries and motions; Tectonic movements**:** epeirogeny and orogeny; types of mountain belts; characteristics and origin of fold mountains with special reference to the Himalayan fold belt; brief outline of the structural features & tectonics of NE India.

UNIT IV

Rock Mechanics: Introduction, Application, Definition and Introduction to engineering and general properties; Porosity, Density, Void index, Permeability, Water absorption, Slake durability index. Strength properties, Jointing in rocks classification systems in rock engineering. **10 Hrs**

Mining Geology: Outlines of surface methods of mining, Underground mining, Stoping methods, Principles of sampling and sampling methods, Core drilling (wet and dry), Type of core bits, Casing and their applications, Mine ventilation, Mine gases and Mine diseases. Slope stability in open cast mines, Dewatering techniques in open cast and underground mines.

Textbooks :

1 N. ChennaKeavalu; Text book Engineering Geology; McMillan India.

2 F. G. Bell; Engineering Geology and Geotechnics; Newness Butterworths, London.

3 M. P. Billings; Structural Geology; Prentice Hall of India Pvt. Ltd, New Delhi.

Reference Books:

5 B. P. Verma; Rock Mechanics for Engineers; Khanna Publishers.

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6 R. B. Gupte; A Textbook of Engineering Geology; Pune Vidyarthi GrihaPrakashan

7 R. N. P. Arogyaswamy; Course in Mining Geology; Oxford and IBH Publishers.

REMOTE SENSING AND GIS

Course Code	CV 635	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To introduce fundamentals of Remote sensing and GIS
2. To understand various application of remote sensing & GIS.
3. To interpret satellite images

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Select the type of remote sensing technique / data for required purpose
CO2	Identify and interpret the earth surface features from satellite images
CO3	Analyse the energy interactions in the atmosphere and earth surface features
CO4	Analyse the basic components of GIS

UNIT I

Introduction to Remote Sensing: Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface(Absorption, scattering: Raleigh, Mie, Non Selective absorption), Radiation- Target Interactions, Passive Vs Active Sensing, Basic Image processing concepts: Image as matrix, B&W and Colour(RGB) **10 Hrs**

Sensors: RS Platforms**,** Ground and Air, Satellite Characteristics: orbits, swaths, Spatial Resolution, Pixel Size (IFOV, resolution cell), Spectral, Radiometric, Temporal Resolution, Cameras and Aerial Photography, Multispectral and Hyperspectral Scanning, Thermal Imaging, Geometric Distortion, Different Satellites: All Weather Satellites, Land Observation, Marine Observation, LIDAR, GPR,FLIR, RADAR, Side looking Radar

UNIT II

Microwave Remote Sensing: Introduction, RADAR Basics, Viewing Geometry, RADAR Image Distortions, Target Interaction and Image Appearance, RADAR Image Properties, RADAR Polarimetry (Polarization, Signatures, Backscatter, Parameters Affecting Backscatter, Applications), Synthetic Aperture RADAR (SAR), Airborne and Spaceborne Radars. Comparison of Optical and Microwave Remote Sensing Techniques. **11 Hrs**

Image transforms: Visual Image Analysis (tone, shape, size, pattern, texture, shadow, and Association), Digital Image Processing steps (Pre-processing, Enhancement, Transformation and Classification), Contrast Enhancement: Global, Local Techniques, Filtering, Image Transformations: Arithmetic Operations (Subtraction, Spectral Ratio, NDVI, PCT, FT, Color, Hough Transforms)

UNIT III

Image Classification and Analysis: Visual Interpretation, Image Classification: Optimum band selection, Supervised and Unsupervised Classification techniques, Assessment of Classification Accuracy, Visual Interpretation of satellite imagery, thermal images and aerial images. **09 Hrs**

Application of Remote Sensing: Agriculture, Forestry, Geology, Sea/Ice, Hydrology, Land cover/Land use, Ocean and Coastal Monitoring, Atmosphere Monitoring

UNIT IV

GIS: Introduction to GIS – definition, concept and history of developments in the field of information systems, Hardware and software requirements for GIS, Coordinate system and projections in GIS – conic, cylindrical and planner, Data structure and formats, Spatial data models – raster and vector, data inputting & GIS, Spatial data quality and uncertainty, Integration of RS and GIS data, Digital elevation model, GIS Software and its applications, Demo on ArcGIS/ QGIS **12 Hrs**

Textbooks :

1 James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.

2 Charles Elach& Jakob van Zyl., Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons publications, 2006.

3 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

4 Thanappan Subash., Geographical Information System, Lambert Academic Publishing, 2011.

5 S. Kumar; Basics of remote sensing and GIS; Laxmi Publications (P) Ltd.

Reference Books:

6 Paul Longley., Geographic Information systems and Science, John Wiley & Sons, 2005

7 Lillesand T.M & Kiefer R.W., Remote Sensing and Image Interpretation, John Wiely and Sons, 2008.

8 Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

9 Guha Pradeep Kumar; Remote Sensing for the Beginner; Affiliated East-West Press Pvt. Ltd.

BRIDGE ENGINEERING

Course Code	CV641	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To introduce various types of bridges, components and IRC classes of loading
2. To acquaint the student with recent construction techniques
3. To introduce principles of designing various components of bridges
4. To enable the student to design basic components of bridge structures like bridge deck slabs longitudinal girders, transverse girders, piers and well foundations

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand fundamental concepts of bridges, types, alignment, IRC loading classes, recent innovative construction techniques.
CO2	Analyse box & slab culverts and slab girder type bridges, piers and abutments for IRC loading classes.
CO3	Apply the above concepts in analysing box & slab culverts and two way slab-girder type bridges.
CO4	Design box & slab culvert bridges, slab-girder type bridges, piers, abutments, piles and well foundations.

UNIT I

General Types and Classification of Bridges: Arch, Slab, Box Culvert, Beam and Slab, Plate Girder, Composite Bridges, Components of bridges, Investigation and Planning for bridges, Design flood discharge, Linear waterways. **10 Hrs**

Loads for Bridges: IRC loadings, Dead load, Live load, Impact load, Wind load, Longitudinal and Horizontal forces.

UNIT II

Bridge Construction Techniques: Advancement in bridge construction techniques, Incremental launching, Segmental construction, rotating bridges, openable bridges, cable stayed bridges, examples of innovative bridges in India and abroad **10 Hrs**

Prof. Annapurna Sakhardande Member- BOS Civil Engg | Dr. Shwetha Prasanna Member- BOS Civil Engg | Dr. Nisha Naik Member- BOS Civil Engg | Dr. Ganesh Hegde Chairman- BOS Civil Engg

UNIT III

Design of Concrete Bridges: Superstructure, Design of box culvert, Introduction, Design method and Design example. **10 Hrs**

Design of Beam and Slab Bridges: Design of interior panel of slab. Pigeauds method, design of longitudinal girder, Calculation of longitudinal moment design example.

Design of Reinforced Concrete Solid Slab Bridges: General design features, Effective width method. Simply supported slab bridge analysis and Design.

UNIT IV

Stability Analysis of Abutments and Piers: General scour at abutments and Piers, Grip length, calculation of scour depths, Types of abutments and Piers, Loadings on abutment and piers, stability of abutments and Piers for different loading combinations. **12 Hrs**

Bridge Bearings: Types, functions, selection of type of bearings

Bridge Foundations: Types of bridge foundations, Stability of different types of foundations, Design of shallow, Pile, Well foundations and Pneumatic caissons.

Textbooks :

1. N Krishna Raju ., Design of Bridges, 4th Edition, Oxford IBH Publishing Company Pvt. Ltd., New Delhi, 2014
2. by Johnson Victor ., Essential of Bridge Engineering; 6th Edition, Oxford IBH Publishing Company Pvt. Ltd., New Delhi, 2014
3. T. R. Jagadeesh, M. A. Jayaram; Design of Bridge Structures 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2014
4. IRC-6, IRC-22, IRC-37

Reference Books:

5. S. Ponnuswamy, Bridge Engineering 2nd Edition, Tata McGraw Hill Education, New Delhi, 2008
6. V K Raina, The World of Bridges Shroff Publishers and Distributors Pvt. Ltd., Navi Mumbai, 2006.

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CONSTRUCTION EQUIPMENT & AUTOMATION

Course Code	CV642	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To familiarize with the current scenario in construction methods, equipment & automation
2. To develop an understanding of the necessity and benefits of mechanization
3. To enable the student to mechanize various construction activities.
4. To Design for minor automation mechanisms

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand and appreciate the current industry practices
CO2	Appreciate the benefits of mechanisation in construction
CO3	Recommend use of a particular type of equipment in projects.
CO4	Design small scale automation in Civil Engineering projects.

UNIT I

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering. Dredging for land reclamation. Directional drilling **10 Hrs**

UNIT II

Automation In: Concrete mixing, transporting & placing; plastering machines; Prestressing jacks and grouting equipment, Shotcreting, Sand blasting. **10 Hrs**

UNIT III

Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Pile driving, sheet piling, ground densifying. Demolition equipments. Basics of demolition of structures. **10 Hrs**

UNIT IV

Equipment Productivities, Use of Drones for spread out sites, Use of robots for repetitive activities. RMC yard, and Bituminous Pre Mix / 'hot mix' plant functioning. Prefab Steel workshop unit. **12 Hrs**

Textbooks :

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1 S C Sharma, ‘Construction Equipment and Its Management’, Khanna Publishers,

2 Javad Majrouhi Sardroud ., Peurifoy Robert, ‘Construction Planning, Equipment, and Methods’, Tata McGraw-Hill Education.

3 Leonhard E. Bernold ., Construction Equipment and Methods: Planning, Innovation, Safety Hardcover – Import, 11 February 2013.

Reference Books:

5 Carlos Balaguer and Mohamed Abderrahim; Robotics and Automation in Construction , Carlos III University of Madrid, Spain. ISBN: 978-953-7619-13-8 eBook (PDF) ISBN: 978-953-51-5736-6.

6 Mr. Ballary Vishwanath Gangadara, Prof C. Prasanna Kumar ., Research article “ Trends in robotics and automation in construction , IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X, PP 01-05

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Dr. Shwetha Prasanna Member- BOS Civil Engg

Dr. Nisha Naik Member- BOS Civil Engg

Dr. Ganesh Hegde Chairman- BOS Civil Engg

STRUCTURAL DYNAMICS

Course Code	CV643	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To define various dynamic properties and dynamic loads acting on the structure
2. To introduce modeling of free and forced vibration systems
3. To formulate fundamental equation of motion for SDOF and MDOF systems
4. To identify the behavior of structure especially buildings to various dynamic loads such as wind, earthquake, and machine vibration

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Identify and define key concepts related to structural dynamics, such as natural frequencies, mode shapes and damping of structures.
CO2	Develop mathematical Model of structures for dynamic analysis using relevant codal provisions and methods.
CO3	Formulate the equation of motion for dynamics analysis of structures.
CO4	Solve field engineering problems related to structural vibrations.

UNIT I

Equation of Motions, Problem Statement, Solution Methods of Single Degree of Freedom Systems (SDOF) **08 Hrs**

Basic concepts of structural dynamics; various types of dynamic loads, single degree of freedom system, force displacement relationship, damping force, equation of motion, mass-spring-damper system, methods of solution of differential equation.

Free and forced Vibration (SDOF): Undamped free vibration viscously damped free vibration, energy in free vibration. Damped forced vibration

UNIT II

Response to Harmonic and Periodic Excitations (SDOF) : Harmonic vibration with viscous damping, vibration generator, natural frequency and damping from harmonic test, force transmission and vibration isolation, vibration measuring instruments, energy dissipated in **10 Hrs**

viscous damping. Response to periodic force. , systems with distributed mass and elasticity, lumped mass system-shear building.

Earthquake Response to Linear Systems (SDOF) Earthquake excitation, equation of motion, response quantities, response history, response spectrum concept, deformation, pseudo-velocity and pseudo acceleration response spectra, peak structural response from the response spectrum, response spectrum characteristics, elastic design spectrum, comparison and distinction between design and response spectra. Design spectra as per IS codes

UNIT III

Numerical Evaluation of Dynamic Response for SDOF : Time stepping methods, methods based on interpolation of excitation, central difference method, newmark's methods, stability and computational error, Recurrence formulae for a displacement and velocity under-damped system, Response to base excitation, Response due to ground excitation using Wilson-Theta method **12 Hrs**

UNIT IV

Multi -degree of freedom systems (MDOF) : Equation of motions: simple system-two storey shear building, general approach for linear systems, static condensation, and symmetric plan systems: ground motion. Multiple support excitations, methods of solving the equation of motions. **12 Hrs**

Free and forced Vibration (MDOF): Natural frequencies and modes: systems without damping, modal and spectral matrices, orthogonality of modes, normalization of modes. Solution of undamped free vibration systems, solution methods for eigenvalue problem. Forced vibration responses using modal analysis and response spectrum methods.

Recommendation : Demonstration of shake table is recommended

Textbooks :

1 Anil K Chopra Dynamics of structures; Prentice-Hall of India Limited, New Delhi.3rd edition 2006.

2 Mario Paz and leigh; "Structural dynamics" CBS Publishers, 1st edition 1985

3 by G. C. Hart & K. Wang; Structural Dynamics for Structural Engineers John Wiley & Sons.1st edition 1991.

Reference Books:

5 R.W. Clough and P.E. Penzien Dynamics of Structures, McGraw-Hill. 1st edition 1975

6 IS 1893 (Part I), 2002: Indian Standard Criteria for Earthquake Resistant Design of Structures

7 IS 4326, 1993: Indian Standard Code of Practice for Earthquake Resistant Design & Construction of Buildings

8 IS 13920, 1993 Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.

ADVANCED GEOTECHNICAL ENGINEERING

Course Code	CV644	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To understand the state of stress in soils under various loading conditions and failure mechanisms of soil mass
2. To understand the techniques of forensic geotechnical investigation
3. To estimate earth pressure behind retaining walls using different theories
4. To familiarize with soil structure interaction and physical modeling aspects of geotechnical structures

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand the stress state of soil mass
CO2	Analyse the stability of a soil slope and soil mass behind a retaining wall
CO3	Design a centrifuge/ numerical model for geotechnical structures.
CO4	Propose a plan for forensic investigation of geotechnical failures

UNIT I

Shear strength of soils - Stress state, Mohr's circle analysis and Pole, Principal stress space, Stress paths in p-q space, drained and undrained shear strength of soils, Significance of pore pressure parameters Determination of shear strength; Drained, Consolidated Undrained and Undrained tests; Interpretation of triaxial test results, multi stage testing. Concept of mobilized strength and residual shear strength, Critical void ratio; dilation in soils. **12 Hrs**

Failure criteria- Soil models for interpreting the shear strength of soils- Coulomb's Failure Criterion, Taylor's Failure Criterion, Mohr–Coulomb Failure Criterion, Tresca Failure Criterion, Practical Implications of Failure Criteria, Failure envelope for unsaturated soils.

UNIT II

Earth pressure: Active, Passive and At rest condition of earth pressure, Earth pressure theories, Basement walls, Stress relief walls, Seepage analysis of retaining walls with and without weep **10 Hrs**

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holes.

Slope stability Analysis: Stability analysis of a slope and finding critical slip surface; Sudden Draw down condition, effective stress and total stress analysis; Reliability based design of slopes, Methods for enhancing stability of unstable slopes. Rainfall induced slope failure.

UNIT III

Forensic Geotechnical investigation: Introduction and need for forensic geotechnical investigation. Types of distress, Diagnostic tests: Field and laboratory tests. Case histories-typical cases of performance failure of representative of soil engineering projects namely shallow and deep foundations, slope stability, earth dams and retaining structures. **10 Hrs**

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems, Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Elastic plastic behaviour, Time dependent behaviour,

UNIT IV

Geotechnical Physical Modeling: **10 Hrs**

Physical modeling methods; Application of centrifuge modeling and its relevance to geotechnical engineering; Centrifuge modeling of geotechnical structures.

Familiarization with geotechnical software

Textbooks :

1 Bowles J. E., Foundation analysis and design, McGraw Hill, NY

2 Terzaghi Karl and Peck R. B., Soil Mechanics in Engineering Practice, John Wiley and Sons, NY

3 S Prakash, Analysis and Design of Foundations and Retaining Structures, Sarita Prakashana, Meerut

4 Rao V. V. S. and Sivakumar Babu G. L., Forensic Geotechnical Engineering, Springer India

Reference Books:

5 Day Robert W., Forensic Geotechnical and Foundation Engineering

6 Bell F. G., Foundation in difficult ground, Butterworths & Co

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GROUND WATER ENGINEERING

Course Code	CV645	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	00	100	00	0

Course Objectives:|

1. To understand the mechanism of ground water movement.
2. To impart knowledge of design, construction and recharging of wells.
3. To interpret field data of surface and sub-surface investigation of ground water.
4. To design salt water ingress mitigation mechanisms.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Model regional groundwater flow and design water wells
CO2	Formulate and solve conjunctive use of surface water and groundwater resource utilization problems
CO3	Identify methods for artificial recharge of groundwater
CO4	Select suitable Geophysical exploration methods for groundwater source identification

UNIT I

OCCURRENCE OF GROUND WATER: Groundwater in hydrological cycle, Properties of rocks and water bearing formations affecting ground water flow, Ground water basins, Vertical distribution of ground water, Ground water potential and its exploitation in India. **12 Hrs**

GROUNDWATER MOVEMENT: Darcy's law, Permeability and its determination, Flow rates and directions of flow of ground water, Dispersion of tracers in ground water, Unsaturated flows, General equations governing steady/unsteady flow through confined and unconfined aquifers.

UNIT II

HYDRAULICS OF WATER WELLS: Flow in confined aquifers towards wells in steady and unsteady state. Flow through leaky or semi confined aquifers into wells, Dupuits assumption for unconfined aquifers, Steady and unsteady flows into wells, Theis and Jacob's methods of solution of unsteady flows. **10 Hrs**

DESIGN AND CONSTRUCTION OF WELLS: Selection of Aquifer, well depth and well

diameter, selection of screen-type and design of well screen, Provision of artificial gravel pack and shrouded wells, Test holes and well logs, Method of construction of shallow and deep wells including drilling, Completion and development of wells, Pumping equipment, resting the wells for yield, Maintenance and protection of wells, Rehabilitation of old and abandoned wells

UNIT III

SURFACE INVESTIGATIONS OF GROUNDWATER: Geological methods, Remote sensing, Geophysical exploration, electrical Resistivity method, Seismic Refraction method, Gravity and magnetic methods. **10 Hrs**

SUBSURFACE INVESTIGATION OF GROUNDWATER: Test drilling measurement of water levels, Geophysical logging, Resistivity logging, Spontaneous potential logging, Radiation logging, Temperature logging, Caliper logging, Fluid conductivity logging, Fluid Velocity logging

UNIT IV

ARTIFICIAL RECHARGE OF GROUNDWATER: Concept of artificial recharge: Methods of artificial recharge-water spreading, Wastewater reclamation and reuse, Recharge mounds, Induced recharge, Artificial recharge for energy purposes. **10 Hrs**

SALINE WATER INTRUSION IN AQUIFERS: Occurrence of saline water intrusion, Ghyben-Herzberg Relation between fresh and saline water shape and structure of fresh water and salt water interface, upcoming saline water, fresh water and salt water relations on oceanic islands, Control of salt water intrusion, Recognition of sea water in the ground water.

QUALITY OF GROUND WATER: Sources of salinity, Measures of water quality, Chemical analysis-graphical representation, physical and Biological analysis, water.

Textbooks :

1 Karamouz, M, Ahmadi, A, and Akhbari, M, Groundwater Hydrology: Engineering, Planning and Management, CRC Press, 2011.

2 Todd, D.K., and Mays, L. W., Groundwater Hydrology, John Wiley & Sons, Singapore, 2011.

3 Raghunath H. M, Groundwater Hydrology, New age international (P) Limited, New Delhi,2010

4 Todd D.K, Groundwater Hydrology, John Wiley and Sons, New York, 2000

Reference Books:

5 Davis, S.N., and De Weist, R.J.M., Hydrogeology, John Wiley & Sons, New York, 1966.

6 Domenico, Concepts and Models in Groundwater Hydrology, McGraw Hill Inc. New York, 1972

7 Fitts R Charles, Groundwater Science, Elsevier, Academic Press, 2002

8 Ramakrishnan, S, Ground water, K.J. Graph arts, Chennai,1998

STRUCTURAL ENGINEERIN LAB

Course Code	CV670	Credits		1	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	2	28 Hrs/Sem	
Scheme of Examination TOTAL = 75 marks	IA	TW	TM	P	O
	0	25	0	50	0

Course Objectives:|

1. To perform several laboratory experiments in structural engineering
2. To analyze data, interpret results, and write technical reports
3. To analyze and design RCC multi storey buildings using relevant IS codes
4. To give students hands on experience of structural engineering and FEM software

Course Outcomes:

The student after undergoing this course will be able to:

CO1	To install strain gages on structural components and systems, and collect data from the strain gages
CO2	To compare experimental results to the theoretical results and write technical reports
CO3	Compute the loads on a multi-storeyed building and Decide column location and structural framing plan for simple residential buildings
CO4	Analyze and design a multi storey building using structural engineering software

PRACTICALS

.Carry out any 5 experiments from each part and submit lab report at the end of the semester for evaluation under term work. Practical examination can be conducted on any of the experiments from PART I and PART II by Viva-Voce & Model/experiment Demonstration

PART I

1. Experiment on a 2 hinged arch for horizontal thrust and influence line for horizontal thrust – or equivalent numerical problem **OR** equivalent numerical problem

2. To verify moment area theorem regarding the slope and deflection of the beam experimentally or Analytically **OR** equivalent numerical problem

3. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally

4. To experimentally verify the clerk Maxwell's reciprocal theorem **OR** equivalent numerical problem

5. To study the behavior of struts and column with various end conditions **OR** equivalent numerical problem **OR** equivalent numerical problem

6. To experimentally find out the elastic properties of a beam. **OR** equivalent numerical problem

7. To determine the horizontal thrust in a three hinged arch for a given system of loads experimentally and verify the same with calculated values. **OR** equivalent numerical problem

8. To plot stress –strain curve for concrete. Use of mechanical and electrical strain and stress gauge. **OR** equivalent numerical problem

PART II

Carry out software lab exercise using any of the software STAAD PRO, MIDAS,/ETABS,/REVIT,/ANSYS,/SAP2000- introduction to any one structure analysis software and any one FEM software is compulsory

1. Analysis of continuous beam
2. Analysis of multi-storey frame
3. Design of multi-storey frame
4. Analysis of multi-storied building
5. Design of multi-storied building
6. Wind load analysis on RCC building
7. Analysis and design of steel truss
8. Analysis and design of isolated footing
9. Analysis and design of combined footing
10. Analysis of bridge deck

Reference Books:

1 Subramanian N, "Design of Reinforced Concrete Structures",Oxford University Press, New Delhi, 2014.

2 Varghese P. C, "Limit state Design of Reinforced Concrete", PHI Learning, 2013.

3 IS 875 (Part 1 and Part 2): 1987, "Code of practice for design loads – Dead loads (other than earthquake for buildings and structures)"

4 IS 456: 2000, "Plain and reinforced concrete – code of practice"

5 SP 16: 1980, "Design aids for reinforced concrete to IS 456: 1978."

6 SP 34: 1987, "Hand book on concrete reinforcement and detailing"

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ESTIMATION & COSTING

Course Code	HM600	CREDITS		4	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	1	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 150 marks	IA	TW	TM	P	O
	25	25	100	00	0

Course Objectives:|

1. To provide in-depth knowledge of professional practice in quantity surveying.
2. To understand the process of tendering and bidding
3. To understand and work out rate analysis for scheduled items of civil works
4. To acquaint with the concepts of valuation in civil works.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand the technical specifications for various civil works.
CO2	Draft detailed specification and carry out rate analysis for works related to civil engineering.
CO3	Valuate a structure.
CO4	Prepare and evaluate Contract documents and bids.

UNIT I

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, market survey of basic materials. Use of Computers in quantity surveying **12 Hrs**

UNIT II

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. **10 Hrs**

Valuation: Definition, Importance and Necessity of valuation, Factors affecting valuation, Methods of valuation, Book value, Market value, Single and Dual rates year's purchase,

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Depreciation, Sinking fund, Rent fixation, Valuation for various purposes, Numericals on valuation

UNIT III

Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. **10 Hrs**

Bar Bending Schedule- Detail bar bending schedule with quantity of steel for slabs, Beams, Footings, Columns, Retaining wall.

UNIT IV

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. **10 Hrs**

Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, Bid process management

TUTORIAL :

1. An approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate along with the required material survey for the Ground floor RCC/ load bearing structure building with block work walls.
3. Detailed estimate along with material survey for the road work
4. Preparation of valuation report in standard Government form.
5. Numerical on rate analysis (Any 5)
6. Preparation of Specification (Any 2)
7. Preparation of bar bending schedule for the building in tutorial 2
8. Numerical on Valuation (Minimum 4)

Textbooks :

1 M Chakravarty, Estimating, Costing Specifications & Valuation

2 Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

Reference Books:

4 Typical PWD Rate Analysis documents.

5 UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016

6 IS 1200 (Part 1) : 1892 reaffirmed 2002, Methods of measurement of building and civil engineering works ,

7 THE MINIMUM WAGES ACT, 1948, India

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FOURTH YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV710	Construction Engineering and Management	3	1	--	3	100	25	25	--	--	150	4
CV721	Structural Repair and Retrofitting	3	--	--	3	100	25	--	--	--	125	3
CV722	Design of Prestressed Concrete structures											
CV723	Soil dynamics and Machine Foundations											
CV724	Advanced Steel Structures											
CV725	Biological Processes for Contaminant Removal											
CV730	Advanced Materials Testing Lab	--	--	2	--	--	--	--	50	--	50	1
**	Open Elective	3	--	--	3	100	25	--	--	--	125	3
CV740	Internship#	--	--	6		--	--	50	--	50	100	3
CV750	Project Work - Phase I	--	--	6		--	--	50	--	75	125	3
	TOTAL	**09**	**01**	**14**		**300**	**75**	**125**	**50**	**125**	**675**	**17**

#at 7th Semester 8 weeks internship/training// Research Assistantship-(in the month of September & October)

*Term Work marks are to be awarded through continuous evaluation, **Student will have to enter the course code that he/she takes as part of the open elective,

LEGEND

L	T	P	O	Th	TW	IA

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Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

CONSTRUCTION ENGINEERING AND MANAGEMENT

Course Code	**CV710**	**Credits**		**4**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**1**	**0**	**42 Hrs/Sem**	
Scheme of Examination TOTAL = 150 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**25**	**100**	**0**	**0**

Course Objectives:|

1. To understand the techniques of construction management.
2. To understand optimal utilization of resources in construction industries.
3. To familiarize with construction quality assurance and control.
4. To acquaint with working and operation of various construction equipment.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand theory of construction project management with precise knowledge of its execution.
CO2	Apply the concepts of construction project management like work breakdown structure, network and scheduling techniques to real time construction projects.
CO3	Implement the project management techniques to identify requirement of construction resources and machinery appropriate to tasks and analyze its productivity and cost.
CO4	Create management plans to have control over resources and cost.

UNIT I

Basics of Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution. **10 Hrs**

Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail, Process of development of plans and schedules

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UNIT II

Time planning: work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion. **10 Hrs**

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipments for lifting; Equipment for transportation of materials. Equipment Productivities

UNIT III

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; **12 Hrs**

Manpower: planning, organizing, staffing, motivation;

Materials: concepts of planning, procurement and inventory control;

Funds: cash flow, sources of funds; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling.

Project Monitoring - Supervision, record keeping, periodic progress reports, and periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures.

UNIT IV

Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modeling (BIM) in project management; **10 Hrs**

Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control.

Construction Costs: Make-up of construction costs: Classification of costs, time cost trade-off in construction projects, compression and decompression.

TERM WORK: Term work shall consist of at least 8 Assignments covering entire syllabus. Student shall submit assignment for evaluation

Textbooks

1 K. K. Chitkara ; Construction Project Management; Tata Mc Graw Hill, 2011

2 Robert L. Peurifoy; Construction Planning, Equipment and Method; Tata Mc Graw Hill Publishing Ltd.

3 Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

4 Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books:

5 Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

6 Gautam V. Desai, Erik W. Larson, Clifford F. Grey; Project Management – The Managerial Process; Tata Mc Graw Hill

7 V. K. Raiva; Construction Management Practice; Tata Mac-hill publication, New Delhi.

STRUCTURAL REPAIRS AND RETROFITTING

Course Code	CV 721	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To impart knowledge about various distress and damages to concrete and masonry structures.
2. To highlight the importance of maintenance of structures.
3. To study the various types of repair materials and repair techniques.
4. To assess the damage to structures using various tests

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand all the terminologies and concepts associated with deterioration of concrete structures
CO2	Carry out the damage assessment of a building/structures
CO3	Recommend suitable techniques of quality control in construction
CO4	Propose repair methods for different types of damages

UNIT I

Introduction: Overview of distress, deterioration in concrete structures, Scenario of distressed structures world over, need for repairs and upgrading of structures, General introduction to process (Road-map) to a durable concrete repair. **10 Hrs**

Protection & maintenance of structures: Importance of protection & maintenance, Categories of maintenance, Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring/Structural health monitoring (SHM)– Definition and motivation for SHM, Basic components of SHM and its working mechanism, SHM as a tool for proactive maintenance of structures.

UNIT II

Deterioration of concrete structures: Types of deterioration, Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete. Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure. Chemical deterioration due to corrosion of **11 Hrs**

reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack. Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc.

Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of crack.

UNIT III

Conditional/damage assessment & Evaluation of structures: Structural assessment, Conditional evaluation / Structural Appraisal of the structure – Importance, objective & stages, Conditional/damage assessment procedure. **11 Hrs**

Preliminary & Detailed investigation: Scope, Objectives, Methodology & Rapid visual inspection of structures Damage Assessment allied Tests (Destructive, Semi-destructive, Nondestructive), Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability. Interpretation of the findings of the tests.

UNIT IV

Repairs, rehabilitation & Retrofitting of concrete structures: Repair materials - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. **10 Hrs**

Retrofitting/Strengthening: Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and advanced techniques. Seismic retrofit of concrete structures Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, advanced techniques for making seismic resistant structures

Textbooks

1 Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India. - Recommended

2 Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001.

3 Earthquake resistant design of structures by Pankaj agarwal, Manish shrikande, PHI, 2006.

Reference Books:

4 S.Champion ., Failures and repair of concrete structures, John Wiley and Sons, 1961.

5 R.N.Raikar Diagnosis and treatment of structures in distress Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.

6 A. Chakrabarti et.al ., Handbook on seismic retrofit of buildings, , Narosa Publishing House, 2010.

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Course Code	CV722	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To introduce the concepts of prestressed concrete.
2. To acquaint students to the analysis and design principles of pre-stressed concrete components.
3. To design pre-stressed circular members.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand types of stresses in pre-stressed concrete structural components
CO2	Analyse stresses in pre-stressed concrete beam.
CO3	Design pre-stressed concrete members.
CO4	Design pre-stressed concrete tanks and pipes.

UNIT I

Introduction: Theory and Behaviour, Basic concepts, Advantages, Materials required, Systems and Methods of prestressing, Analysis of sections, Stress concept, Strength concept, Load balancing concept, Effect of loading on the tensile stresses in tendons, Effect of tendon profile on deflections, Factors influencing deflections, Calculation of deflections, Short term and Long-term deflections, Losses of prestress, Estimation of crack width. **12 Hrs**

UNIT II

Analysis of Members: Analysis of members under axial load, analysis at transfer, service load, analysis of ultimate strength, analysis under flexure, cracking moment, kern point, pressure line. Variation of stress in steel, condition of ultimate limit state. Analysis of Rectangular sections. **10Hrs**

UNIT III

Design Concepts: Calculation of demand, design of members for axial tension, design of member for flexure. Design for shear and torsion. **10 Hrs**

UNIT IV

Composite sections: Analysis and design of composite sections **10 Hrs**
Analysis and design of Slabs: Design concepts of one-way and two-way slabs

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Circular Pre-Stressing: Design concepts of pre-stressed concrete tanks, Pipes.

Textbooks

1 N. Krishna Raju; Pre-stressed Concrete; Tata McGraw Hill Company, New Delhi. 2. 3. 4. 5. 6.

2 S. K. Mallic and A. P. Gupta; Pre-stressed Concrete; Oxford and IBH publishing Co. Pvt. Ltd.

3 N. Rajagopalan; Pre-stressed Concrete; Alpha Science, 2002.

Reference Books:

4 G. S. Ramaswamy; Modern Pre-stressed Concrete Design, Arnold Heinimen, New Delhi.

5 T. Y. Lin; Design of Pre-stressed Concrete Structures; Asia Publishing House, Bombay.

6 David A. Sheppard, R. Wi lliam and Philips; Plant Cast Precast and Pre-stressed Concrete – A Design Guide; McGraw Hill, New Delhi.

SOIL DYNAMICS AND MACHINE FOUNDATIONS

Course Code	CV723	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To familiarise with the design principles of machine foundation.
2. To assess the dynamic soil properties and bearing capacity.
3. To design foundations for reciprocating, rotary and impact type of machines.
4. To recommend techniques for vibration isolation and control.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Identify the suitable foundations for various types of machines.
CO2	Determine dynamic soil properties and soil bearing capacity
CO3	Design foundation for reciprocating, rotary and impact type of machines
CO4	Propose suitable techniques for vibration isolation and control

UNIT I

Theory of Vibration: General, Definitions, Harmonic motion, Vibration of a single degree freedom system, Free-undamped, Free-damped, Forced-undamped and Forced-Damped vibrations, Introduction to multiple degree freedom system. **12 Hrs**

General Principles of Machine Foundation Design: General, Types of machines and foundations, General Requirements of machine foundation, Permissible amplitudes, Allowable soil pressure, Permissible stresses.

UNIT II

Dynamic Soil Properties: Natural frequency, mass parameter, damping factor, spring constant, dynamic elastic constants, coefficient of elastic uniform compression, coefficient of elastic uniform shear. Laboratory techniques-Resonant column test, Ultrasonic pulse test, cyclic simple shear test. Field Tests: Vertical and Horizontal block resonance tests Cyclic plate load test. **10Hrs**

Dynamic Bearing Capacity: General generalized bearing capacity equation, Factors affecting bearing capacity, Factor of safety.

UNIT III

Foundation for Reciprocating Machines: General, Modes of vibrations of a rigid foundation block, Methods of analysis-Linear elastic weightless spring method, Elastic half space method, Effect of foundation shape on vibratory response, Design of block foundation. **10 Hrs**

Foundation for Rotary Machines: General, Special considerations, design criteria, Loads on foundation, Methods of analysis, design of foundation for rotary machines.

UNIT IV

Foundation for Impact Type Machines: General, Arrangement of anvil on foundation, Dynamic analysis of foundation for impact type of machines, Design of hammer machine foundation. **10 Hrs**

Vibration Isolation and Screening: General, Force isolation technique, Motion isolation technique, Screening of vibration by use of open trenches, Passive screening of vibration.

Textbooks

1 Swami Saran, Galgotia ., Soil Dynamics and Machine Foundations, publications Pvt. Ltd., New Delhi, 2016.

2 P Srinivasalu and C V Vaidyanathan, Handbook of Machine foundations McGraw Hill Education, 2017

Reference Books:

4 by Bharat Bhushan Prasad ., Fundamentals of Soil Dynamics and Earthquake Engineering, PHI Learning Pvt. Ltd., New Delhi, 2011.

5 Dynamics by Braja M Das and G V Ramana ., Principles of Soil, CI Engineering, 2016

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ADVANCED STEEL STRUCTURES

Course Code	CV724	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To introduce design concepts for moment connections, portal frames, beam-column, plate girders and gantry girders.
2. To familiarize with fire and corrosion protection systems for steel structures.
3. To understand use of cold-formed sections, hollow steel sections in steel construction.
4. To study principles of composite construction methods and multi-storey buildings**.**

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand the importance of moment connection, analysis, design and detailing.
CO2	Perform plastic analysis and design of beam, column, portal frames.
CO3	Analysis and design of steel truss girder bridges and tanks for wind and earthquake actions.
CO4	Understand cold-formed sections, hollow steel sections and multi-storey building systems.

UNIT I

Design of moment connections: classification of connections- flexible, semi rigid and rigid connections, framed connections, seated connections, light moment connections, heavy moment connections. **10 Hrs**

Fire and corrosion protection of steel structures: Types of corrosion, corrosion protection method. Fire curves, fire protection methods.

UNIT II

Plastic analysis and design of portal frames: Determination of collapse load for portal frames, loading combinations, design of beam and column (beam-column concept), design of stiffened corner connection. **10 Hrs**

UNIT III

Design of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self-weight of truss girders, design of bridge compression members, tension members, wind load on truss girder bridges, design of bracings. **12 Hrs**

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Tanks: Types of tanks, Loads and load combination, circular and rectangular tanks, wind and earthquake effects, staging design, column and foundation design.

UNIT IV

Cold-formed sections: Advantages, applications, section properties, connections. **10 Hrs**

Hollow steel sections: Advantages, applications, section properties, connections

Multistorey buildings: Structural configurations, steel concrete composite floor system, lateral load resisting systems, analysis for gravity and lateral loads.

Recommendation: Complete design of industrial shed considering wind as well as earthquake loads.

Textbooks

1 M. R. Shiyekar; Limit State design in Structural Steel, 3rd Edition, Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2017.

2 S. S. Bhavikatti,, Design of Steel Structures 4th Edition, I. K. International Publishing House, New Delhi, 2015.

3 M. L. Gambhir, Fundamentals of Structural Steel Design Tata McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.

4 Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company

5 Design Manual for Designing Steel Structures According to New IS: 800; INSTITUTE FOR STEEL DEVELOPMENT & GROWTH.

Reference Books:

6 N. Subramanian ., Design of Steel Structures, Oxford University Press

7 V. L. Shah and Veena Gore ., Limit State Design of Steel Structures, Structures Publications, 2019.

8 IS 800-2007 - General construction in Steel Code of Practice. IS 875-1987 (Part 1, 2); IS 875-2019 (Part -3), Steel Tables

9 by S. K. Duggal, Limit State Design of Steel Structures Tata McGraw Hill.

BIOLOGICAL PROCESSES FOR CONTAMINANT REMOVAL

Course Code	CV725	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42 Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To educate the students on the principles and process designs of various treatment systems for water and wastewater
2. To acquaint students with process employed in design of treatment systems and the components
3. To develop competency, leading to the selection of specific process for water and waste water treatment.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	To develop conceptual schematics required for biological treatment of water and wastewater
CO2	An ability to translate pertinent criteria into system requirements
CO3	To able to decide various process required based on site conditions
CO4	To design treatment process based on site specific requirements

UNIT I

INTRODUCTION, PROCESS ANALYSIS AND SELECTION Biological treatment processes – objectives - Choice of treatment method – Environmental impact and other considerations in planning the treatment – Cost of Water and Wastewater treatment – Removal of iron , manganese and fluoride in water, removal of pathogenic bacteria and viruses from water , disinfection of water, design of filters Reactors used for the waste water treatment – mass balance analysis – Reactions, Reaction rates – Enzyme reaction **12 Hrs**

UNIT II

FUNDAMENTALS OF PROCESS KINETICS : Role of microorganisms – Microbial growth kinetics - Biological oxidation process - loading – MCRT - F/ M ratio – Design of trickling filters, advantages and disadvantages of trickling filters. Determination of biokinetic coefficients – suspended growth treatment process – Description, Design and operating parameters. **10 Hrs**

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UNIT III

SUSPENDED GROWTH TREATMENT PROCESS - ACTIVATED SLUDGE PROCESS AND PONDS **10 Hrs**

Treatment Process Loading – Biological & solids retention time – F/M ratio – Determination of Bio-kinetic constants – application of kinetics to Biological Treatment - Suspended Growth Treatment Process

Design of Activated Sludge Process – Modifications (only theory) – Oxidation pond – Aerated lagoons – Oxygen requirements – arrangement for transfer of oxygen – Secondary clarifier - design features.

Stabilization ponds – Classification – Application – Process design, flow pattern and analysis of Aerobic ponds – Facultative ponds – Anaerobic ponds – maturation ponds – Construction and performance.

UNIT IV

SUSPENDED GROWTH TREATMENT PROCESS - DIGESTION PROCESS **10 Hrs**

Sludge Digestion – Sources of sludge – Characteristics – Quantities – Anaerobic digestion – Process – Kinetic relationship – gas production – design considerations.

Anaerobic treatment of liquid wastes – Anaerobic sludge blanket process – design considerations. Aerobic Digestion – Kinetics – Oxygen requirements – Design considerations

ATTACHED GROWTH TREATMENT PROCESS

Attached Growth Treatment Process – Substrate Removal in Attached Growth Treatment Process - – Classification - design based on popular design equations .Rotating Biological contactors – Anaerobic attached growth treatment processes – upflow packed bed – upflow expanded bed – Fluidized bed – Down flow bed.

Textbooks

1 Metcalf and Eddy, "Waste Water Engineering – Treatment and reuse", Tata McGraw-Hill, New Delhi, 2003.

2 Arceivala S. J., "Waste Water Treatment and disposal, Marceldekker publishers,1981

3 Larry D. Benefield and Clifford W. Randall, "Biological process design for Wastewater Treatment", 1980.

4 Howard S. Peavy, Donald R. Rowe and George Techobanoglous, "Environmental Engineering", McGraw – Hill co., 1987

5 .K Garg Water supply engineering Khanna Publisher New Delhi

6 S.K Garg Sewage disposal engineering Khanna Publisher New Delhi

Reference Books:

7 Arceivala S. J., "Wastewater Treatment and Pollution control", Tata McGraw-Hill Co., New Delhi, 1998.

8 Linvil G. Rich., "Low-Maintenance, Mechanically simple wastewater treatment Systems" , McGraw-Hill Co., 1980.

ADVANCED MATERIALS TESTING LAB

Course Code	CV730	Credits		1	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	02	28 Hrs/Sem	
Scheme of Examination TOTAL = 50 marks	IA	TW	TM	P	O
	0	0	0	50	0

Course Objectives:|

1. To perform various experiments on different building materials.
2. To measure properties of various materials used in Civil Engineering constructions.
3. To provide physical observations to compliment concepts learnt.
4. To familiarise with a variety of established material testing procedures and techniques

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand various testing methods on different building materials
CO2	Conduct Non-Destructive Tests on concrete members and derive conclusions
CO3	Suggest acceptability criteria for materials based on test results and applicable codal provisions
CO4	Interpret relevant Indian and International testing standards.

PRACTICALS

At least 8 experiments should be conducted from the list of experiments

1. RCPT test on Concrete
2. Flexure test on concrete
3. Hardness test on metals. (Brinell's and Rockwell)
4. Ultrasonic Pulse Velocity and Rebound Hammer Test on Concrete.
5. Fatigue test on reinforcement.
6. Compressive strength of cement grout and mortar
7. Shear test on masonry
8. Bituminous mix design and tests on bituminous mixes.
9. Crushing test of aggregates

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10. Impact test on different materials.

11. Durability test on concrete

12. Tensile strength of geotextile/ geogrid/geonet

13. Puncture resistance of geomembrane

14. In-plane and cross plane permeability of geotextiles

Reference Books:

1 M.L. Gambhir and Neha Jamwal; Building and Construction Materials: Testing and Quality Control (Lab Manual Series) (2017), McGraw Hill (India) Pvt. Ltd.

2 Varghese P.C.; Building Materials; PHI Learning Pvt. Ltd.

3 Kyriakos Komvopoulos (2011); Mechanical Testing of Engineering Materials; Cognella.

4 Khanna, S.K. Justo, C.E.G. and Veeraragavan A.; Highway Materials and Pavement Testing, Nem Chand and Bros, Fifth Edition.

5 Various related and updated recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering Applications.

6 Related papers in International Journals.

7 Robert M. Koerner, Designing with Geosynthetics Prentice Hall, New Jersey, UAS,1989

8 G.VenkatappaRao and G.V.S Suryanarayana Raju Engineering with Geosynthetics– Tata McGraw Hill, New Delhi, 1990.

Prof. Annapurna Sakhardande
Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Nais
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

OPEN ELECTIVE

Course Code	**	**Credits**		**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**42 Hrs/Sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**00**	**100**	**0**	**0**

** Course code of the subject taken from the list of open electives decided by the College/Departments

Every student has to earn 3 credits by choosing one of the elective courses from the list of courses declared by the college as Open elective from time to time. Such notification by the departments is made one semester in advance so that Students have sufficient time to explore their field of interested subjects. The student shall consult HOD/faculty coordinator before opting for an open elective course.

. The open elective course offered will be subjected to availability of time table slot, faculty member, class rooms and minimum class strength specified from time to time. The list of open elective courses and syllabus be made available in the department for student to choose the subject with in first week of the semester

Open Elective Courses Introduction has come up with the Choice Based Credit System (CBCS) in which the students have a choice to choose from the prescribed courses, which are referred as core elective, open elective courses and they can learn at their own pace and the entire assessment is graded-based on a credit system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. Choice Based Credit System (CBCS) is promoted in such a way that different open elective courses should be offered by every department in engineering to other departments. This interdisciplinary of learning open elective courses by other department students will have learning awareness and job oriented benefits. Students require the opportunity to choose any open elective course from different departments and apply their knowledge to acquire jobs in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses

5. The CBCS offers a 'cafeteria' approach in which the students can choose open elective courses of their own choice.
6. They can also opt for an interdisciplinary approach to learn a subject.

7. The students have more scope to enhance their skills and more scope of taking up case studies, projects and assignments, vocational training including entrepreneurship.
8. The system improves the job opportunities of students
9. The system will help in enabling potential employers assess the performance of students on a scientific scale

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INTERNSHIP

Course Code	CV740	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	06	84 Hrs/Sem	
Scheme of Examination TOTAL = 100 marks	IA	TW	TM	P	O
	00	50	00	0	50

Course Objectives:|

1. To undergo a practice-oriented and 'hands-on' working experience in the real world or industry and to enhance the student's learning experience.
2. To provide opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organizational setting.
3. To develop and enhance operational, customer service and other life-long knowledge and skills in a real world work environment.
4. To provide Pre-employment training opportunities and an opportunity for the company or organization to assess the performance of the student and to offer the student an employment opportunity after his/her graduation, if it deems fit.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s
CO2	Solve real life challenges in the workplace by analysing work environment and conditions, and select appropriate skill sets acquired from the course.
CO3	Articulate career options by considering opportunities in company, sector, industry, professional and educational advancement;
CO4	Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means and exhibit professional ethics by displaying positive disposition during internship.

GUIDELINES FOR INTERNSHIP

Guiding Principle behind internship/training would be improvement in knowledge/skills and employability of the students and emphasis would be on core companies and practical/field work on any project

1. Students would be allowed internships in research institutes if they indicate academics/research as their career choice
2. As far as possible Departments to follow internship guidelines issued by the regulatory bodies

AICTE/UGC whichever is applicable

3. Students who undergo internship would in general be monitored through emails/telecalls/Skype/Video Conferencing
4. For non-core companies, each department would frame a policy by constituting a department level committee chaired by the HOD. There would be no blanket ban on training/internship in non-core organizations and for each student choosing to go to such an organization, the department level committee would review the case on merit after receiving the views/justification from the student.
5. The concerned Department and TPO shall arrange for internship seats
6. They shall tie up with the companies and renowned academic institutes and also look for placing students for training purpose in various PSUs like PWD, Electricity Board, Irrigation, private consultancy companies etc. Paid internships may be allowed in renowned companies
7. If sufficient numbers of seats are not arranged at the institute level then the students on their own can arrange training as per the guidelines given under title "as per point 1 to 4" above. However, the same must be approved by the Department. The students who are arranging their own training should give the confirmation to department before the start of the training
8. The students going for internships are required to get themselves registered with the Department/TPO before leaving for training. This may be done latest by the date specified for the normal semester registration for course work.
9. **At 7th Semester 8 weeks internship/training/ Research Assistantship-(in the month of September & October). If required additionally at 8th Sem (before start of semester or during vacation) 4 weeks of Internship/ Training/ Research Assistantship can be provided to deserving students to enhance their employability -(in the month of January)**
10. The institute shall ask the companies to allocate mentors to the students so that they can interact with each other before joining the internship and do ground work to make it more effective
11. The institute shall maintain a database of all mentors. Departments shall send information of all the mentors with their complete details to the Training and Placement Office/faculty in charge in the prescribed format provided by the TPO
12. Students are to ensure that their Joining reports are received by the department within 15 days of joining
13. The visits of faculty coordinators to industries shall not be necessary. Email/Skype/facetime/ Video Conferencing interactions shall be done by the faculty with the students and mentors. In case the faculty is interested in visiting the companies/institutes, they can visit. They shall be required to interact with the management of the companies/institutes visited in addition to interacting with the student mentors. All visit / monitoring reports are to be submitted to the respective departments by the faculty
14. Faculty-Industry Interaction: In addition to making evaluations based on email/Skype/facetime/ Video Conferencing interactions with the students or based on visits to the industry, the faculty coordinator will contact the industry coordinator fortnightly via e-mail/phone, to keep a close watch on the students progress
15. Every student shall submit the Internship certificate issued by company after completion and prepare an internship report as per the specified guideline. The Faculty Coordinator shall collect the feedback from the industry.

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16. Faculty coordinator and the industry coordinator will directly access and award marks for under the heading Term work (out of 50) based on their assessment of the work done by a student.
17. The final Evaluation by Department including Presentations/ Viva Voce will be made before faculty panel and efforts should be made to invite one external expert from industry or research institute for evaluations (out of 50 ORAL Marks).

GUIDELINES FOR REPORT

Contents of the Report

1. Cover page – on hard paper
2. Inner page – same as cover page but on the soft paper
3. Declaration
4. Acknowledgement (if any)
5. Content
    A. Summary
    B. Introduction
    C. Work
    D. Industry
    E. Review
    F. Details of the work including work programme carried out & results
    G. Conclusions and Future Scope of Work
    H. Impediments/difficulties faced during project semester on project work; Suggestions related to work/project semester
    I. References (if any)

A total of THREE copies may be prepared – one for the student, second for the faculty coordinator and third for the institute.

DECLARATION

I hereby declare that the project work entitled ("Title of the project") is an authentic record of my own work carried out at (Place of work) as requirements for the award of degree of B.E. (Relevant Engineering), of ------ Goa University, under the guidance of (Name of Industry coordinator) and (Name of Faculty coordinator), during _____to_____, 20).

(Signature of student) Name of Student Student I D

Date: _____

Certified that the above statement made by the student is correct to the best of our knowledge and belief.

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(Name & Designation) **Faculty Coordinator**	**(Name & Designation)** **Industry Coordinator**

INDUSTRY FEEDBACK FORM

Department of ---------- Engineering

Industry Feedback Form for 7 th semester Internship

Internee's Information	
Name	
Student ID	
Date of Joining (Internship)	
Date of Completion (Internship)	

Evaluator's Information

Name	
Designation	
Company's/ Organization's Name	
Company Address	
Phone	
Mobile No.	
Email ID	
Fax. No.	

To be filled by the Evaluator

Please tick mark in the relevant box in the following grade chart for the Internee

Sr. No.	Parameters					
		Excellent	Very Good	Good	Satisfactory	Unsatisfactory
1	Intelligence/Learning aptitude					
2	Professional Skill/Knowledge					
3	Work Output/Performance					
4	Expression					
5	Initiative & Drive					
6	Punctuality/Regularity					
7	Honesty/Integrity					
8	Co-operation & Tact					
9	Discipline					
10	Interpersonal Skills					
11	Dedication towards work					
12	Overall performance					
13	Did the Intern meet your expectations?					Yes/No
14	Would you like to take PEC students again in next year?					Yes/No
15	Do you think that the Institute can interact with the Industry/ organization in some other way also? Please specify					Yes/No

A+=Excellent, A=Very Good, B= Good, C=Satisfactory & D=Unsatisfactory

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Did you offer your intern any further employment?
If yes, Package & Joining Details_____
Any other suggestions/feedback: _____

Following parameters may be kept in mind while evaluating the student

i	JOB KNOWLEDGE (refers to knowledge clarity of fundamentals, and latest development	ix	ADAPTABILITY TO NEW ENVIRONMENT (refers to ability to acclimatize himself/herself to new work environment/culture.
ii	CREATIVITY (refers to the ability to generate new and practical ideas for improvement of systems and operations related to the	X	PROBLEM FORMULATION (refers to initiative shown in converging to project formulation)
iii	PLANNING SKILLS (refer to the ability to conceptualize all aspect of the project and to systematically plan the series of activities to achieve the goals)	xi	TECHNIQUES/TOOLS used at various stages
iv	ORGANISING SKILLS (refers to the ability to mobilize co-ordinate, integrate various activities/resources to achieve fast completion)	xii	EXECUTION OF THE PROJECT)(S) (refers to (a) Setting Time frames (b)Efforts put into complete the project. Maintenance of work diary.
v	APPLICATION SKILLS (refer to the ability to apply knowledge to real life situations)	xiii	PROJECT REPORT & DEFENCE
vi	JOB INVOLVEMENT (refers to the concern and diligence shown in execution of the project)	xiv	PRESENTATION (Refers to style and effectiveness)
vii	INTERPERSONAL RELATIONSHIP (refers to ability to work harmoniously with superiors and subordinates)	xv	Written Expression
viii	REGULARITY & PUNCTUALITY (refers to (i) Sanctioned authorized leave, absence without permission (ii) late coming & leaving work place early)	xvi	Oral Expression

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Dr. Ganesh Hegde
Chairman- BOS Civil Engg

PROJECT WORK - PHASE I

Course Code	CV750	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	06*	84 Hrs/Sem	
Scheme of Examination TOTAL = 125marks	IA	TW	TM	P	O
	00	50	0	00	75

Course Objectives:|

1. Indentify and undertake problems related to chosen engineering domain
2. To collect relevant literature on the problems identified
3. To decide a methodology and work-plan.
4. To present progress report.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Work in a team on identified project topic
CO2	Review and evaluate the available literature on the chosen problem
CO3	Formulate the methodology and work schedule to solve the identified problem
CO4	Apply the principles, tools and techniques to solve the problem and submit report

* Project work should be considered in faculty load calculation

GUIDELINES FOR PROJECT WORK:

1. Project can be undertaken in-house or in an industry or in a research /service organization.
2. Project batch will consist of maximum 4 students.
3. The Project Title / Synopsis should be prepared in the beginning of the term and approved by a designated departmental committee.
4. The topic of the project may be in the area related to civil engineering. It may involve investigation/ analytical study / experimental work / fabrication /Statistical study / simulation etc. The project should be preferably being taken in the latest trends in Engineering and Technology.

Project Report:

The Project (Interim) report shall consist of the following:

a. Problem identification.

b. Statement of problem.

c. Formulation of the objective and Scope of the study.

d. Literature review.

e. Methodology to be adopted.

Review:

Monthly review to assess the progress of the project work will be conducted by the Guide.
Students shall submit project reports to the department and make a presentation before the departmental committee at the end of Semester.

FOURTH YEAR CIVIL ENGINEERINGENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VIII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination							
		L	T	P	Duration (Hrs)	Marks						Credits
						Th	IA	TW*	P	O	Total	
CV810	Hydrology and Water Resources Engineering	3	--	--	3	100	25	--	--	--	125	3
CV821	Architectural Engineering	3	--	--	3	100	25	--	--	--	125	3
CV822	Earthquake Engineering											
CV823	Structural design of Foundations											
CV824	Solid & Hazardous Waste Management											
CV825	Port and Harbour Engineering											
CV830	Elective - NPTEL / MOOC / SWAYAM	3	--	--	--	--	--	50	--	50	100	3
CV840	Project Work - Phase II	--	--	18	--	--		200	--	200	400	9
	TOTAL	**9**	**0**	**18**	**--**	**200**	**50**	**250**	**--**	**250**	**750**	**18**

If required additionally at 8th Sem (before start of semesteror during vacation) 4 weeks of Internship/ Training/ Research Assistantship can be provided to deserving students to enhance their employability -(in the month of January), *Term Work marks are to be awarded through continuous evaluation

LEGEND

L	T	P	O	Th	TW	IA
Lecture	Tutorial	Practical	Oral	Theory	Term Work	Internal Assessment

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HYDROLOGY AND WATER RESOURCES ENGINEERING

Course Code	CV810	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To understand the basic principles of Irrigation Engineering.
2. To understand the design parameters of reservoir and dams.
3. To apply the flow principles in canal and design of other associated units.
4. To apply and analyze hydropower aspects of water resources engineering.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand the irrigations systems and water requirements for crops.
CO2	Acquaint with the principles of hydrology for estimation of flood discharge
CO3	Evaluate potential of any hydro power plants.
CO4	Appreciate Design criteria for reservoirs, dams, spillways, Energy dissipaters and canal systems

UNIT I

Introduction: Necessity, Planning, C-B ratio, Inter and Intra basin transfer, Different methods of irrigation, Irrigation from ground water. **11Hrs**

Water Requirement of Crops: Duty and Delta, Base period of crops, Factors affecting duty, Methods of improving duty, Crop seasons in India.

Basic Hydrology: Hydrological cycle, Precipitation, Analysis of data, Consistency of record, Hyetograph, Mass curve analysis, Measurements of rainfall, evaporation and Evapo-transpiration, Infiltration and Soil moisture, Stream flow measurement; Runoff, Factors affecting runoff, Catchment classification, Flood estimation, Hydrograph, Unit hydrograph, S- curve. Computation of peak flow, Flood Routing.

UNIT II

Storage Reservoirs: Physical characteristics of reservoirs, Reservoir capacity for a given yield, Mass curve, Reservoir reliability, Sedimentation control, Reservoir leakage, Ideal site for reservoir. **11Hrs**

Dams: Types of Dams, Suitability of a type of dam. Forces acting on dams, Failure of dams and criteria for structural stability, Stability analysis, Elementary profiles, Design criteria, Causes of failures, Control of Seepage, Stability of slopes, Design considerations, for Gravity, Earth dams. High and Low gravity dams, Openings in dams, Functions and Effects of opening, Joints, Keys and Water stops in gravity dams, Foundation treatment for various dams.

Spillways and Energy Dissipaters: Introduction, Essential requirements of a spillway, Spillway capacity, Components, Types of spillways, Energy dissipation below spillways.

UNIT III

Diversion Headworks: Introduction, Types of diversion works, Location and Components, Weir and Barrage, Effect of construction of weir on the river regime, Causes of failures of Weirs on permeable foundations, their remedies, Exit gradient, Principles of weir design on permeable formations, Bligh's creep theory and Khosla's theory. **11Hrs**

Distribution Systems: Classification of canals, Design of irrigation canals by Kennedy's and Lacey's theories, Canal FSL, Losses of canal water, Silting and Scouring of canals, Method of design of unlined section of irrigation canal, Lined canals, IS standard for Design of canal lining, Problem of water logging and Environmental concerns Regulation Works: Introduction, Definition of falls, Necessity and Location of falls, Comparative study of the main types of falls, Cross regulator and Distributary regulator. Hydraulic Gates Control equipment's for out-lets, Spillway gates, Types, Design criteria for radial gates, Air vents, Canal escapes.

Cross Drainage Works: Introduction, Types, Suitability, Design of various types of C-D Works, Aqueduct, Syphon aqueduct, Super Passage, Syphon, Level crossing, Inlets and Outlets, Site selection.

UNIT IV

Hydropower Engineering: Introduction, Components of hydropower, Classification of hydropower plants, Run-of-river plants, Valley dam plants, High head diversion plants, Diversion canal plants, Pumped storage plants, Tidal power plants, Environmental considerations, Estimation of hydropower potential, General load curve, Load factor, Capacity factor, Utilization factor, Diversity factor, Water conveyance system. **09Hrs**

Textbooks

1 Punmia, Pande, Lal, A. K. Jain; Irrigation Engineering; Laxmi Publications (P) Ltd.

2 P. N. Modi; Irrigation and Water Power Resources Engineering; Standard Book House

3 R. K. Sharma and T. K. Sharma; Irrigation Engineering; S Chand Publications Pvt. Ltd.

4 R. S. Varshney; Hydropower Structures; Nem Chand and Bros

Reference Books:

5 Basak; Irrigation Engineering; Tata McGraw Hill Publishing Ltd.

6 S. K. Garg; Irrigation Engineering and Hydraulic Structures; Khanna Publishers, Delhi

7 Larry W. Mayas; Water Resources Engineering; John Wiley and sons.

8 K. R. Arora; Irrigation, Water Power and Water Resources Engineering; Standard Publishers, New Delhi.

Recommended Exercise:

Submission of Report based on a Field Visit to a Dam site, and any other Irrigation Project.

ARCHITECTURAL ENGINEERING

Course Code	CV821	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. Developing Competency to plan a building complying with existing regulations.
2. Project management including scheduling, manpower, materials and fund
3. On Site planning and coordination for various construction activities.
4. Identify and execute corrective measures on site.

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand prevalent bye laws and regulations for project approval
CO2	Understand the basic concept of site planning.
CO3	Comprehend architectural drawings/layouts/bar charts
CO4	Communicate and coordinate for project execution

UNIT I

Introduction to the concept of Architectural drawings, Interpretation of typical building drawings, layout and Scales; Principles of planning. FAR, Coverage, Building Bye laws. Symbols and sign conventions. **10Hrs**

Specifications and details and sequence of activities and construction co-ordination – Site Clearance – Marking.

UNIT II

Definition of Project; Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, Role of Client, Engineer, Architect and Contractor. Process of development of plans and schedules. **12Hrs**

Functions of Panchayat/Municipality, Town and Country Planning, Health etc.
Project approval and requirements.

UNIT III

Updating of plans: purpose, frequency and methods of updating. Common causes **10Hrs**

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of time and cost overruns and corrective measures.

Site layout including enabling structures, developing site organization, Documentation at site; Manpower, planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control. Sequence of activities, activity utility data; Techniques of planning- Bar charts, Detailed drawings

UNIT IV

Interior design and detailing of major building components: Modular kitchen, False ceilings, air conditioning/ plumbing/ electrical layouts etc **10 Hrs**

Textbooks

1 M.G. Shah , C. M. Kale and S.Y. Patki; Building Drawing;Tata McGraw Hill Publication

2 S. S. Bhavikatti and M. V. Chitawadagi ; Building Planning and Drawing; I K International Publishing House

3 Sushil Kumar; Building Construction; Standard Publishers Distributors

4 Joseph De Chiara, Lee E Koppelman; Time – Saver Standards for Site Planning;Mc Graw Hill Book Company.

Reference Books:

5 Nancy Temple; Home Space Planning;Mc Graw Hill Book Company

6 Town and Country Planning; The Goa Regulation of land Development and Building Construction; Government Printing Press

7 Joseph De Chiara, Julius Panero, Martin Zelnik; Time – Saver Standards for Housing and Residential DevelopmentPlanning;Mc Graw Hill Education

8 National Building Code of India, 2016 Volume – I and II; Bureau of Indian Standards.

EARTHQUAKE ENGINEERING

Course Code	CV822	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To understand causes and effects of Earthquakes.
2. To learn about analysis of structure subjected to earthquake loads.
3. To study the design criteria of earthquake resistant structures.
4. To get acquainted with ductile detailing requirements of earthquake resistant structures

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Explain the causes & effects of earthquake, architectural features on the seismic behaviour of structures.
CO2	Apply codal provisions in solving problems related to dynamic analysis of structure.
CO3	Perform dynamic analysis of structure subjected to earthquake load
CO4	Design earthquake resistant structures for controlling dynamic response.

UNIT I

Engineering Geology of earthquakes - Elements of seismology, Causes of Earthquake - Geologicalfaults - Tectonic plate theory - Elastic rebound – Epicentre; Hypocentre - Primary, shear and Raleigh waves - Seismogram - Magnitude and intensity of earthquakes - Magnitude and Intensity scales - Spectral Acceleration - Information on some disastrous earthquakes; Microzonation, Concept of seismic hazard analysis. Importance of architectural features in earthquake resistant design, Indian seismic codes. **11Hrs**

UNIT II

Introduction to methods of analysis - Theory of Vibrations, Concept of inertia and damping - Types of Damping - Difference between static forces and dynamic excitation - Degrees of freedom -SDOF idealization - Equations of motion for SDOF systems for mass as well as base excitation- Free vibration of SDOF system - Response to harmonic excitation - Impulse and response to unit impulse - Duhamel integral. **11Hrs**

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UNIT III

Design spectra **- Design earthquake**-concept of peak acceleration - Site specific response spectrum - Effect of soil properties and damping - Liquefaction of soils. Behaviour of masonry structures during earthquakes.**- response of** Multiple Degree of Freedom System - Normal modes of vibration - Natural frequencies - Mode shapes, Decoupling of equations of motion - Concept of mode superposition (No derivations), Response of multistoried building subjected to earthquake forces, Equivalent Static Load Method & Response Spectrum Method. **10Hrs**

UNIT IV

Design and Detailing of structural members subjected to earthquake - Design of flexural members and compression members for earthquake load cases. Design of shear wall Importance of ductility - Methods of introducing ductility in to RC structures, Design Methodology IS 1893, IS 13920 and IS 4326 - Codal provisions -Design as per the codes - Base isolation techniques - Vibration control measures – Important points in mitigating effects of earthquake on structures. ..P-Delta effects, Soil structure interaction. **10Hrs**

Detailing of beams, columns, footings, beam-column junction as per IS 13920.

Textbooks

1 Pankaj Agarwal and Manish Shrikande, Earthquake resistant design of structures, PHI India

2 S.K. Duggal, Earthquake Resistant Design of Structures, Oxford University Press

3 Anil K. Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, Pearson Education, Inc

4 T. K. Datta, Seismic Analysis of Structures, John Wiley & Sons (Asia) Ltd

Reference Books:

5 David Dowrick, Earthquake resistant design and risk reduction, John Wiley and Sons Ltd

6 C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, Some Concepts in Earthquake Behaviour of Buildings, Published by Gujarat State Disaster Management Authority, Government of Gujarat

7 IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi

8 IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi

9 IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.

10 IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.

11 IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

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STRUCTURAL DESIGN OF FOUNDATIONS

Course Code	CV821	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. Understand correlation of geotechnical properties of soil for foundation design
2. Understand codal provisions for design of various types of foundations and earth retaining structures
3. Impart knowledge about design principles of various types of foundations
4. Familiarize with Soil foundation interaction

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Comprehend the importance of soil exploration, sampling, testing and estimation of geotechnical properties of soil.
CO2	Co-relate geotechnical properties of soil with soil design and structural design of foundation/earth retaining structures
CO3	Recommend appropriate type of foundations for given soil and exposure condition.
CO4	Design and detailing of retaining wall , shallow and deep foundations

UNIT I

Introduction: Soil exploration, Analysis and Interpretation of soil exploration data, Estimation of soil parameters for foundation design. Methods for bearing capacity estimation, Total and Differential settlements of footing and raft, Codal provisions. **11Hrs**

Shallow Foundations: Design of individual footings, Strip footing, Combined footing – Rectangular slab and slab-beam type, Trapezoidal, Strap, rigid and Flexible mat, Buoyancy raft, Basement raft.

UNIT II

Pile Foundations: Estimation load carrying capacity of single and Pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), Settlement of pile foundation, Code provisions, Design of single pile and Pile groups, and Pile **11Hrs**

caps.

Well Foundations: Types, Components, Construction methods, Design methods (Terzaghi, IS and IRC approaches), Check for stability, Base pressure, Side pressure and Deflection.

UNIT III

Retaining Walls: Types (Types of flexible and Rigid earth retention systems; Counterfort, Gravity, Diaphragm walls, Sheet pile walls, Soldier piles and Lagging). Support systems for flexible retaining walls (struts, anchoring), Construction methods, Stability calculations, Design of flexible and Rigid retaining walls, Design of cantilever and Anchored sheet pile walls. **11Hrs**

UNIT IV

Soil-Foundation Interaction: Idealized soil, Foundation and Interface behaviour. Elastic models of soil behaviour; Elastic, Plastic and Time dependent behaviour of soil. Beams and Plates on elastic foundation; Numerical analysis of beams and Plates resting on elastic foundation. **09Hrs**

Textbooks

1 P C Varghese ., Design of Reinforced Concrete Foundations; PHI Learning Pvt. Ltd.,

2 Swami Saran., Analysis and design of Sub Structures Limit State Design, Oxford IBH publishers,

3 P Varghese; Foundation Engineering PHI Learning Pvt. Ltd.,

4 Joseph Bowles, Foundation Analysis and Design McGraw-Hill Book Company

Reference Books:

5 A. P. S. Selvadurai, Elastic Analysis of Soil-Foundation Interaction Elsevier Scientific Publishing Company.

6 Braja M. Das., Principles of Foundation Engineering, PWS Publishing Company

7 Nainan Kurian., Design of Foundation Systems, Narosa Publishing House, New Delhi.

8 V. N. S. Murthy, Advanced Foundation Engineering CBS Publishers and Distributors.

9 Indian Standards: IS 1904, IS 2911: Part I: Section 1 to 4, IS 2911: Part III, IS 2950: Part I and IS 2974: Part I to V

SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Code	CV824	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. Introduce sources and disposal techniques of municipal solid wastes.
2. Understand classes and disposal methods of different types of hazardous wastes.
3. Familiarize regulations involved in municipal and hazardous waste disposal.
4. Acquaint with environmental audit and impact assessment

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Identify sources and propose disposal methods of municipal solid wastes
CO2	Identify classes and propose disposal methods for hazardous wastes
CO3	Recognize regulations for municipal and hazardous waste management
CO4	Execute environmental audit and impact assessment of a given project.

UNIT I

Solid Wastes: Origin, Analysis, Composition and Characteristics of MSW. **12Hrs**

Integrated Solid Waste Management System: Collection, Storage, and Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal.

UNIT II

Relevant Regulations for Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules **10Hrs**

Landfill design for solid waste; leachate collection and removal; landfill covers. Incineration of hazardous wastes.

UNIT III

Hazardous waste management: Definition and sources, Hazardous waste classification, Treatment methods, Disposal methods. E-waste: Sources, environmental and social issues, **10Hrs**

management practices
Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment.

UNIT IV

Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives. **10Hrs**

Environmental Risk Assessment Defining risk and environmental risk; methods of risk assessment; case studies.

Textbooks

1 Tchobanoglous, Theissen& Vigil ., Integrated Solid Waste Management,. McGraw HillPublication

2 S.C. Bhatia, Solid and hazardous waste management, Atlantic edition,2008

3 Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.

Reference Books:

4 Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985

5 Rao and Sultana, Solid and Hazardous Waste management, BS Pubications,2012

6 John Pichtel, Waste Management Practices CRC Press, Taylor and Francis Group 2005

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PORT AND HARBOUR ENGINEERING

Course Code	CV825	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 125 marks	IA	TW	TM	P	O
	25	0	100	0	0

Course Objectives:|

1. To impart knowledge of port and harbor planning
2. To familiarize with various components and functions of the harbor and port
3. To acquaint students with various forces acting on the harbor and port structures
4. To understand the Importance of harbor maintenance

Course Outcomes:
The student after undergoing this course will be able to:

CO1	Understand the basic principles of planning port and harbour structures.
CO2	Apply the fundamental principles of wave hydrodynamics.
CO3	Recommend suitable site investigation and survey methods
CO4	Design, and integrate port and harbour infrastructure including maintenance

UNIT I

Harbour Planning: Types of water transportation, water transportation in India, Environmental Impact Assessment, Port Authorities and Associations, Port Development in India, Maritime Policy, Requirements of ports and harbours, classification of harbours, selection of site and planning of harbours, location of harbour- Harbour size, Harbour Entrance, study of Hydraulic models, traffic estimation, master plan, ship characteristics, harbour design, turning basin, harbour entrances. **12Hrs**

Site investigations – Hydrographic survey, topographic survey, soil investigations, current observations, tidal observations- Basic definitions , Use of tides , study of waves –Wave action on vertical walls, piles

UNIT II

Marine Structures: General, breakwaters - function, types, general design principles, wharves, Quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories -function, types, suitability, design and construction features. **10Hrs**

Docks and Repair Facilities: Tidal basin, wet docks-purpose, design consideration, operation of lock gates and passage, repair docks - graving docks, floating docks, slipways ,marine railway

UNIT III

Navigational Aids: Requirements of signals, fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar; Modern trends in navigational aids. **10Hrs**

Dredging: Classification, types of dredgers, choice of dredger, uses of dredged materials ,disposal of dredged material , Trends in development of dredging equipment

UNIT IV

Coastal erosion and protection – Littoral Drift , coastal protection structures- seawall, revetment, bulkhead, cathodic protection to submerged metal structures **10Hrs**

Port facilities: Port development, port planning, port building Facilities, transit sheds warehouses, cargo handling facilities, shipping terminals, inland port facilities. Inland waterways, Inland water transportation in India, Environmental concern of Port Operations – Coastal Regulation Zone

Textbooks

1 Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013

2 Gregory Tsinker,"Handbook of Port and Harbor Engineering: Geotechnical and Structural Aspects", Springer US, 1997

3 Gautam H. Oza and Hasmukh Pranshanker Oza,"Dock and Harbour Engineering"Charotar Publishing House PVT LTD.,8th Edition 2016

Reference Books:

4 Amit Gupta, B.L.Gupta "Roads, Railways, Bridges, Tunnels & Harbour Dock" Jain book agency , 2018

5 R. Srinivasan, HARBOUR, DOCK AND TUNNEL ENGINEERING" Charotar Publishing House Pvt. Limited, 2009

6 Per Bruun "Harbor Planning, Breakwaters, and Marine Terminals (v. 1) (Port Engineering)"Gulf Publishing Co; 4th edition , 198

NPTEL / MOOC / SWAYAM COURSE

Course Code	CV821	Credits		3	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	3	0	0	42Hrs/Sem	
Scheme of Examination TOTAL = 100 marks	IA	TW	TM	P	O
	0	50	0	0	50

Course Objectives:|

1. To facilitate the competitiveness of students in the global markets by improving the quality and reach of engineering.
2. To Make use of high quality learning material available online to learn latest in domain area including inter disciplinary subjects
3. To simulates actual tasks from classrooms by comprehending a lecture to participating in discussions and extracurricular activities.
4. To enable students obtain certificates for courses and make students employable in the industry or pursue a suitable higher education programme.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Demonstrate competitiveness and participate in discussions and extracurricular activities
CO2	To seek employment in the industry or pursue a suitable higher education programme.
CO3	Appreciate lifelong self learning to improve quality of professional life

The main objective of the National Programme on Technology Enhanced Learning (NPTEL) is to enhance the quality of engineering and science education in the country by developing contents for undergraduate and postgraduate curricula using video and web based courses. These courses cover the syllabi prescribed by universities and approved by AICTE. Course contents will be useful for improve the quality of students. These courses can be used by professionals for updating their academic background.

Massive Open Online Courses (MOOC) is essentially an asynchronous platform and a process for teaching through pre-recorded lectures, resource video materials, lecture notes, assignments and quizzes which are usually online and provide self assessment in regular intervals during

learning.
The learning, through scheduling of fixed time duration for completion of courses and, therefore, the simultaneous participation of teachers and a large number of students may be termed synchronous and is thus similar to a classroom, albeit on the internet and being much larger in size.
These courses are open for anyone to access – at no cost. So anyone who is interested in learning gets access to quality content, which also includes discussion with the content creator and access to assignments for self testing.

NPTEL Online Certification Courses

Since 2013, through an online portal, 4, 8 or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. The enrolment to and learning from these courses involves no cost. An in-person, proctored certification exam (optional) will be conducted at Rs. 1000/- per course and a certificate is provided through the participating institutions and industry.
The features are:

1. The course enrollment and learning is free while the exam comes for a nominal fee.
2. The courses are offered by the faculty of IITs, CMI, IISc which are of duration 4, 8 or 12-week duration.
3. Lessons and assignments are released every week. Also there is a discussion forum in which students can interact with the faculty members directly.

At the end of the course, an in person proctored exam is conducted (which is optional) and the student gets a certificate

Benefits for a student who participates in an NPTEL online certification course:

1. Students gain tangible end results
2. Students can review and assess their own progress through assignments(weekly)
3. Continuous assessment and interaction with course faculty
4. Discussion forum of like-minds to discuss problem areas

Students get access to mentors , Certificate from the IITs, to improve job prospects

To take this initiative forward and to encourage more students across colleges to participate in this initiative, institutes are advised set up NPTEL chapter in colleges (with the approval of the management) which will be under the headship of a faculty member of the college, who would be Single Point of Contact (SPOC).

NPTEL will keep the SPOC updated about all the latest NPTEL initiatives and give him/her information which he/she can disseminate among the students. He/she can identify suitable

mentors for various courses, who can ensure that students are active in a course, are submitting their assignments on time and also clarify the doubts they may have.

The completion of course/courses totaling to minimum 3 credits offered by NPTEL/SWAYAM which are approved by Goa University time to time is mandatory. The courses can be completed at any stage during the course of degree after undergoing study of first year of engineering. The course credits are decided by Goa University time to time based on course content and course duration. (4 week course- 1 credit, 8 week courses-2 credit and 12 week courses-3 credits). The student shall maintain a file congaing all alignments submitted to NPTEL/SWAYAM. The students are required to make a presentation and submit copy of the credit certificates issued by NPTEL/SWAYAM during the oral examination.

Reference Books:

1 https://swayam.gov.in

2 https://nptel.ac.in

Prof. Annapurna Sakhardande
Member- BOS Civil Engg

Dr. Shwetha Prasanna
Member- BOS Civil Engg

Dr. Nisha Naik
Member- BOS Civil Engg

Dr. Ganesh Hegde
Chairman- BOS Civil Engg

Project Work - Phase II

Course Code	CV840	Credits		9	
Scheme of Instruction Hours/ Week	L	T	P	TOTAL	
	0	0	18	252 Hrs/Sem	
Scheme of Examination TOTAL = 400 marks	IA	TW	TM	P	O
	0	200	0	0	200

Course Objectives:|

1. Review and undertake problems related to chosen engineering domain
2. To perform all indented tasks to fulfill objectives.
3. To prepare technical report for communication
4. To present final project report

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Work in a team on identified project topic
CO2	Review and perform task for chosen problem and derive conclusions
CO3	Apply the principles, tools and techniques to solve the problem and submit report.
CO4	Publish technical/research articles based on the project work.

Guidelines for Project Work:

1. Students shall carry out the required experimental / field/ numerical / analysis/ design / any other work related to the project during the semester.
2. 2. Students shall perform the project work using institute / industry facilities.
3. 3. Students shall maintain a project book including observations, readings, calculations and all other relevant data related to the project.
4. 4. Student shall continuously update the project book and submit the same to the guide.

TERM WORK:

Project Report: It is expected to show clarity of thought and expression, critical Appreciation of the existing literature, and analytical, computational, experimental aptitudes of the student through project report. The Project report shall be submitted in a standard format and shall consist of the following:

1. Statement of problem
2. Objective and Scope of the study
3. Literature review
4. Methodology
5. Results and Discussions
6. Conclusions
7. References

Review:

Regular review to assess the progress of the project work will be conducted by the Guide. Students shall submit final project report to the department in the form of hard and soft copy after answering the final examination.

Recommendation: Publication at national /international conference, workshops and national/international journal are recommended**.**

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