# CIVIL ENGINEERING

# Final Year B. Tech.
# Effective from A. Y. 2014-15

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## List of Abbreviations

| Sr. No. | Abbreviation | Stands for: |
|---|---|---|
| 1 | DEC | Departmental Elective Course |
| 2 | PSC | Professional Science Course |
| 3 | PCC | Program Core Course |
| 4 | LC | Laboratory Course |
| 5 | HSSC | Humanities and Social Science Course |
| 6 | MLC | Mandatory Learning Course |
| 8 | LLC | Liberal Learning Course |
| 9 | BSC | Basic Science Course |

**Programme Educational Objectives (PEOs):**

I. Have successful career in the diversified sectors of the engineering Industry and/or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.

II. Analyze and design Civil engineering systems with social awareness and responsibility.

III. Exhibit professionalism, ethical approach, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

**Program Outcomes (POs):**

Graduates will be able to

a) apply knowledge of mathematics, science and engineering to civil engineering problems.

b) identify, formulate, research literature and solve complex civil engineering problems.

c) design various structures or particular system that meets desired specifications and requirements.

d) design and conduct experiments, interpret and analyze data, synthesize the information to provide conclusion.

e) select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of limitations.

f) assess local and global impact of societal issues on civil engineering profession.

g) able to understand the impact of engineering solutions on society and demonstrate the knowledge of, and need for sustainable development.

h) demonstrate their professional and ethical responsibilities.

i) able to function as a member or a leader on engineering and science laboratory teams, as well as on multidisciplinary teams.

j) communicate effectively in both verbal and written forms.

k) understand engineering and management principles and apply to their work as a member and/ or leader in a team to manage projects.

l) adapt transform in industry by understanding the need of independent and lifelong learning.

# B.TECH. RULES and REGULATIONS

## For the Award of B. Tech. Degree
## (Applicable from the academic year 2013-14)

1. **Short Title and Commencement:**

   (a) These Regulations shall be called the "College of Engineering, Pune Regulations for the Award of B. Tech. Degree".

   (b) They shall come into effect from the date of getting approval from the Board of Governors of the College.

   (c) They shall be applicable for all students enrolling for B. Tech. Degree programmes at the College from Academic year 2013-14.

2. **Definitions:**

   (a) "B. Tech." means Bachelor of Technology, an Under Graduate Degree awarded from the University;

   (b) "Board" means Board of Governors of the college;

   (c) "College" means College of Engineering, Pune;

   (e) "Dean" means Dean of the College, with the specific functions also indicated along with the title;

   (g) "Director" means Director of the College;

   (h) "Government" means Government of the Maharashtra;

   (j) "Regulations" means College of Engineering, Pune Regulations for the Award of B. Tech. Degree;

   (k) "Senate" means Senate of the College;

   (l) "University" means University of Pune;

3. **Preamble:**

The Regulations prescribed herein have been made by the College, an autonomous institution under the University, to facilitate the smooth and orderly conduct of its academic programmes and activities at the B. Tech level. It is expected that the Regulations will enable the students to take advantage of the various academic opportunities at the College and prepare themselves to face the challenges in their professional careers ahead. It may be noted that:

(a) The provisions made herein shall be applicable to all the B. Tech. Programmes offered at the College, at present;

(b) They shall also be applicable to all the new B. Tech. Programmes which may be started at the College in the future;

(c) Academic and non-academic requirements prescribed by the Senate have to be fulfilled by a student for eligibility to the B. Tech. Award;

4. **Academic Calendar:**

**Table 1: Suggested Breakdown of Academic Year into Semesters**

| | |
|---|---|
| 1. No. of Semesters/ Year | Three; Two being Main Semesters (Odd and Even) and One being a Supplementary Semester;<br>(Note: Supplementary Semester is primarily to assist weak and/or failed students through make up courses, wherever possible.However, the College may use this Semester to arrange Add-On Courses for other students and/or for deputing them for practical training elsewhere.) |
| 2. Semester Durations: | Main Semesters: 19 Weeks each;<br>Supplementary Semester: 8 Weeks; |
| 3. Academic Activities (Weeks): | Main Semester (Odd or Even)<br>Registration of Courses- 0.5; Course work- 15.5; Examination Preparation-1.0; Examinations- 1.0; Declaration of Results- 1.0; Total: 19;<br>Supplementary Semester (only for makeup Courses): Registration of Courses- 0.1; Course Work- 7.0;<br>Examination Preparation-0.2; Examinations- 0.2; Declaration of Results- 0.5; Total: 8;<br>Inter-Semester Recess:<br>After each Main Semester- 2; After Supplementary Semester- 2; Total: 14 (for good students) and 6 (for weak students)<br><br>*(Note: In each Semester, there shall be provision for students for Registration of Courses at the beginning, Dropping of Courses in the middle under the advice of Faculty Members and approved by Departmental Undergraduate Programme Committee (DUPC).* |

| | |
|---|---|
| 4. Examinations: | Continuous Internal Evaluation (CIE) and Semester End Examination (ESE), both having weightage in the students performance in Course Work/Laboratory Work and other activities;<br>(Note: The CIE shall be conducted throughout the Semester on dates announced in advance and its results made known to the students from time to time. This would be of help to the students to decide on Dropping or Withdrawal from Courses in consultation with their Advisors. However, the dates for the ESE shall be fixed at the College level. |
| 5. Other Items: | • Care shall be taken to ensure that the total number of days for academic work are > 180/year;<br>• Academic schedules prescribed shall be strictly adhered to by all the Departments;<br>• Supplementary Semester shall be mainly for Make up Courses, to benefit weak or failed students to the extent possible;<br>• Students failed in a course after re-examination shall attend a Course fully when it is offered again, and appear for all components of evaluation;<br>• Specified Min. /Max. Course load per Semester shall be followed at all times. |

(a) Each academic year shall be divided into two main semesters, each of 19 weeks, viz., odd semester (Jul. – Dec.) and even semester (Dec. – Apr.), and an 8-week supplementary semester (Apr.-Jun.).

(b) The College shall arrange regular academic activities for the students during the two main semesters and makeup and other courses for the students during the supplementary semester;

(c) The academic activities in a semester shall normally include course registration, course work, continuous internal evaluation, dropping/withdrawal from courses, semester-end examination, and declaration of results.

(d) The College shall announce the schedule for all the academic activities well before the commencement of the academic year and take all the necessary steps to follow them scrupulously.

(e) The college shall also announce adequate intra-semester and inter-semester breaks for the students and ensure that a minimum of 180 academic working days are available during the academic year.

(f) A typical breakdown of the academic year for the B. Tech programme at the College shall be as suggested in Table 1.

5. **Admissions:**

(a) The intake capacity of each programme, including the number of seats to be reserved for students of different categories shall be decided by the Board by following the Government directives and Council approvals.

(b) Admissions to the first year of all the programmes shall be made before the start of each academic year, through the Maharashtra Combined Entrance Test (MHCET) conducted by the Government.

(c) The College shall also admit to first year of the programmes, a limited number of students of Non-Resident Indian (NRI), Persons of Indian Origin (PIO) and Foreign National categories, as per Government rules.

(d) There shall also be a merit-based, lateral admission of students having Diploma qualification to the second year of all the programmes at the College in accordance with the Government rules applicable for such admissions.

(e) The College reserves the right to revoke the admission made to a candidate, if it is found at any time after admission that he/she does not fulfill all the requirements stipulated in the offer of admission.

(f) The College also reserves the right to cancel the admission of any student and discontinue his/her studies at any stage of studentship for unsatisfactory academic performance and/or undisciplined conduct.

6. **Residence:**

(a) Interested students may apply for hostel accommodation at the time of admissions, as the College is partially residential and it can admit a limited number of men and women students in the hostels.

(b) The method of admission to students' hostels, rent payable per each seat allotted and the discipline to be followed by the residents shall be governed by "rules and regulations" framed by the College in this behalf.

(c) Each student selected for hostel admission shall be provided a seat in one of the hostel rooms identified for this purpose and there shall be no family accommodation available in the hostel for married students.

(d) Students residing in the hostels shall adhere to the prescribed hostel discipline and pay the hostel/mess charges regularly, as any failure to do so, may lead to withdrawal of hostel facilities to such students.

(e) Hostel residents shall apply for leave of absence and get the same approved before leaving the hostel even for a few days, as any failure to do so may lead to cancellation of hostel admission to such students.

(f) Students residing in the hostels shall be required to clear all the hostel dues and vacate their rooms at the end of each academic year, as they will be considered for hostel admission afresh for the New Year.

7. **Attendance:**

(a) Each student shall be required to attend at least 75 per cent of all the classes arranged like, lectures, tutorials, laboratories, studios and workshops for

being permitted to attend the semester-end examination.

(b) Extra Academic Activities (EAC) like Yoga, NSS, Physical Training, NCC and, Boat Club shall be compulsory for students of the first year, with at least a minimum attendance of 75 percent in each of them.

(c) Students shall also be required to take part in any other academic and non-academic activities and attend the camps, as and when arranged by the College during the academic year.

(d) Students desirous of leave of absence for less than two weeks during a semester shall apply for it in advance to the Head of the Department giving reasons & supporting documents, if any and get it approved.

(e) Absence due to illness or any other reason for a period less than two weeks in a semester, for which a student could not make prior application, may be condoned by the Head of the Department after proper verification.

(f) The Dean, Academic Affairs shall be the Authority for sanctioning the leave of students outside clauses (4) and (5) above, after receiving their applications along with recommendations of the Heads of Departments.

(g) In the case of long absence of a student in a semester with prior approval or otherwise, the Dean, Academic Affairs shall decide whether the student be asked to withdraw from the programme for that particular semester.

(h) In all the cases of leave of absence as per Clauses (4)-(6) above, the period of leave taken shall not be condoned for the purposes of fulfilling the attendance requirements stipulated in the Clauses (1) and (2).

(i) It shall be the responsibility of a student residing in the hostel to intimate the Warden of his/her hostel and also the concerned course instructors regarding his/her absence before proceeding on leave.

8. **Conduct and Discipline:**

(a) All students shall be required to conduct themselves in a manner befitting the students of a national institution of high reputation, within and outside the precincts of the College.

(b) Unsocial activities like ragging in any form shall not be permitted within or outside the precincts of the College and the students found indulging in them shall be dealt with severely and dismissed from the College.

(c) The following additional acts of omission and/or commission by the students within or outside the precincts of the College shall constitute gross violation of code of conduct punishable as indiscipline:

i. Lack of courtesy and decorum, as well as indecent behaviour;
ii. Willful damage of property of the College/Hostel or of fellow students;
iii. Possession/consumption/distribution of alcoholic drinks and banned drugs;
iv. Mutilation or unauthorized possession of library material, like books;
v. Noisy and unseemly behaviour, disturbing peace in the College/Hostel;
vi. Hacking in computer systems, either hardware or software or both;

vii. Any other act considered by the College as of gross indiscipline.

(d) In each case above, the punishment shall be based on the gravity of offence, covering from reprimand, levy of fine, expulsion from Hostel, debar from examination, rustication for a period, to outright expulsion.

(e) The reprimanding Authority for an offence committed by students in the Hostels and in the Department or the classroom shall be respectively, the Rector of the Hostels and the Head of the concerned Department.

(f) In all the cases of offence committed by students in jurisdictions outside the purview of Clause (5), the Dean, Students Affairs shall be the Authority to reprimand them.

(g) All major acts of indiscipline involving punishment other than mere reprimand, shall be considered and decided by the Chairman, Students Disciplinary Committee appointed by the Senate.

(h) All other cases of indiscipline of students, like adoption of unfair means in the examinations shall be reported to the Dean, Academic Affairs, for taking appropriate action and deciding on the punishment to be levied.

(i) In all the cases of punishment levied on the students for any offence committed, the aggrieved party shall have the right to appeal to the Director, who shall constitute appropriate Committees to review the case.

9. **Change of Branch:**

(a) Change of branch shall be permissible for a limited number of special cases in the third semester as per following regulations.

(b) Only those students who have completed the common credits required in the first two semesters in their first attempt with a minimum CGPA of 8.5 shall only be eligible for making application for a change of branch. The students whose admission is based on Tuition Fee Waiver Scheme, PIO's, and BTech. Planning are not allowed for the branch change.

(c) There shall be a maximum number of only two students admitted in any discipline in the third semester through the branch change rule.

(d) Intending students eligible for change of branch shall apply for the same to the Office of Academic Affairs of the College before the closing date notified at the beginning of odd semester of each academic year.

(e) Such students shall be required to indicate up to three branches, in order of preference to which they wish to change over, as the change shall be strictly based on their merit, subject to availability of vacancies.

(f) The change of branch shall be permitted purely on inter-se merit of all the eligible applicants. The CGPA of students at the end of the second semester shall be considered for rank ordering of the applicants seeking change of branch and in the case of a tie, the MHCET ranks shall also be considered.

(g) All the changes of branch permitted for intending students as per the above clauses shall be effective from their third semester only and no further change of branch shall be permitted after this.

(h) All the changes of branch permitted at this stage shall be final and binding on the applicants and no student shall be permitted, under any circumstances, to refuse the change of branch offered.

(i) The candidates who have sought admission under Tuition Fee Waiver Scheme are not eligible for the branch change.

10. **Course Structure:**

a) Each course offered in the B. Tech. curriculum at the College shall be listed by using a total of five/six digits, the first two being letters and the remaining being numerals, as follows:

i. The first two letters to represent the Department offering the Course in abbreviated form, e.g., CE for Civil Engineering;

ii. The first numeral that follows to represent the year of the programme, such as 1, 2, 3 and 4, leading to 100,- 400 series;

iii. The next two numerals to represent the Course Number allotted for the subject by the Department, i.e., 01, 02, 03, up to 99;

iv. Thus, as an example, courses offered at the Department of Civil Engineering could be listed from CE 101 up to CE 499 or based on the automated subject numbering system implemented in MIS;

b) All the courses in the B. Tech. Curriculum shall be unitized, with one credit being assigned to each unit of course work, after the student completes its teaching-learning process successfully.

c) The assignment of credits to course work shall follow the well accepted practice at leading institutions, with one credit being defined to mean:

1. Lecture course conducted for one hour per week in a semester;
2. Tutorial conducted for one hour per week in a semester;
3. Laboratory/Practical conducted for two/three hours per week in a semester;
4. Project work conducted for two hours per week in a semester;

d) Each student for the B. Tech, Degree award shall be required to earn a total of 180 credits during his/her studentship at the College. While a student can register for more than 180 credits at the College, only 180 credits shall be reckoned for the Degree award. On the other hand, a student having less than 180 credits shall have to earn the remaining credits to make up the total to 180 credits so as to qualify for the Degree award. The total number of credits earned to complete the course depends on the academic schema for which the student has enrolled for.

e) In addition to the credit requirement prescribed above for the Degree award, each student shall have to complete the requirements of Extra Academic Activities (EAA) as referred to earlier in Clause 2 of Section 7, during the first two semesters of the programme. All the students shall receive certification as PP (for Passed), and NP (for not passed) in EAA, in the Grade Card. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this shall not be taken

into account for computing the final Grade Point Average.

1. Each student shall register for an average of 22 credits per semester during his/her studentship at the College, with the minimum and maximum credits being fixed as 16 and 28 credits per semester respectively. The exact number of credits to be registered by a student in a semester in a particular Department shall be decided by his/her Faculty Advisor based on the student's academic performance in the preceding semester and approval by the Departmental Undergraduate Programme Committee (DUPC).
2. The medium of instruction for course work and examinations at the College shall be English. The course work for the Programme shall be broadly divided into six main subject groups, as follows:
    - Humanities & Social Sciences;
    - Professional Science Courses
    - Basic Sciences including Mathematics;
    - Basic Engineering Sciences & Practice;
    - Professional Subjects;
    - Liberal Learning Courses
3. The total course package for the Programme at a Department shall have the following components:
    - Institutional Core subjects
    - Departmental Core subjects
    - Departmental Elective subjects
    - Other Elective subjects

f) The DUPC shall be responsible for planning the curriculum and syllabi for all the courses included for the Programme for approval by the Senate However, the Institutional Undergraduate Programme Committee (IUPC) shall be in charge for College wide implementation of course work, time tables and related requirements for the Programme.

g) Each Department shall have the flexibility to include industrial training and/or field work of 8 weeks for all its students as a compulsory requirement for the Degree award and this can be assigned credits, as approved by the Senate. However, these shall be arranged during the supplementary semester period following the sixth semester of studies at the College.

h) Each Department shall assign Faculty Advisors for all its students in consultation with the Dean, Academic Affairs and Dean, Students Affairs. It shall be the responsibility of the Faculty Advisors to help the students in planning their course work and other academic activities at the Department and also to regularly monitor and advise them on their academic and other performance at the College. For students of the first two semesters in any Department, the Dean, Students Affairs may assign Faculty Advisors from among the faculty of Basic Science including Mathematics and HSS Departments.

11. **Registration of Courses:**

(a) Each student shall be required to register for course work by following the advice of the Faculty Advisor at the commencement of each semester on the day fixed for such registration and notified in the Academic Calendar.

(b) Students who fail to register for course work on the notified day may be permitted by the Department for late registration on another day announced in the Academic Calendar after payment of an additional fee fixed by the College.

(c) Only those students shall be permitted to register for course work who have:

i. Cleared all dues of the College, Hostel and Library including fines (if any) of the previous semester,

ii. Made all the required advance payments towards the College and Hostel dues for the current semester before the closing date, and

iii. Not been debarred from registration of courses on any other specific ground.

(d) Each student shall fulfill the following conditions at the time of registration of course work in any semester:

i. Each student of the first year shall register for all the courses in the first two semesters, with flexibility to drop one/two courses up to the minimum permissible limit of 18 credits in each case. Similarly Direct Diploma students will also register for all courses in third and fourth semester.

ii. A student shall be permitted to register for more than the average course load, i.e., up to a maximum of 28 credits, if he/she has shown outstanding performance in course work in the previous semesters, i.e., CGPA>=8.0.

iii. On the other hand, a student whose performance is not so good in the preceding semesters, i. e., =<5.0, shall be permitted to register 18 credits, the students who have secured CGPA in between 5 and 6 are allowed for normal credits ( i.e. The credits offered by the department in that semester) and the students who have secured more than 6 CGPA are allowed to register for one additional course. The students are mandatorily required to register for backlog subjects first. The faculty advisor is required to check for the pre-requisites if any at the time of registration.

iv. Students having CGPA less than 5 at the time of admission to 7th Semester, shall not be allowed to register for the next year subjects / project work till their CGPA/SGPA improves above 5 respectively.

- In case of student clearing all subjects till sixth semester of B. Tech with CGPA < 5, he/she will be allowed for grade improvement in odd semester of final year.
- For grade improvement, student will have to take 3 subjects in which he/she has secured DD or CD grades from the same semester in one stretch.
- Student can choose three subjects from a particular semester offered for T.Y B.Tech (odd semester) in which he/she has secured DD or CD grade. Student will have to register for these subjects in VII semester in which

those subjects are offered. He/she will not be allowed to take up project work.

- In such cases if student improves his/her CGPA he/she will be allowed to register as a special case, for the project work in odd/even semester of Final Year of B. Tech.

(e) All the students shall note the following special features of the credit system, which shall be strictly followed at the College:

i. ESE shall be conducted for the course once in a semester, except to meet the needs of students specially permitted by the College.

ii. A student shall have to re-register in all the failed courses (i.e., Getting Grade FF after summer term/re-examination) at any further semester when they are offered again, freedom being given to the student to change the course only if it is an elective.

iii. Also, a student getting certification as NP in the Extra Academic Activities (EAC), shall re- register for them in a following semester/s until he/she obtains certification as PP.

(f) A student shall have the possibility to drop a course in the middle of a semester as per the Academic Calendar, without mention in the Grade Card, with the concurrence of the Faculty Advisor, and after intimating the concerned course instructor/s and the academic section. However, it shall not be possible for a student to register for an alternative course in that semester.

12. **Supplementary Semester:**

(a) Departments shall have the flexibility to conduct supplementary semesters for **FY BTech. courses** only during summer months, as per the Academic Calendar. Such a semester shall be offered on the recommendation of DUPC and with the approval of the Dean, Academic Affairs. A student shall be allowed to register for a maximum of three subjects in a supplementary semester. There is re-examination for the FY BTech. Students. No summer term or re-examination will be floated for the laboratory courses.

(b) The supplementary semester shall be utilized primarily to facilitate the failed students to attend the courses in which they have failed and not for launching any new courses for credit. However, a Department shall be free to arrange any Add-On courses for its students during this semester.

(c) The academic activity in the supplementary semester shall be at double the rate as compared to a normal semester; e.g., 1 credit of course work shall require two hours/week in the class room, so that the contact hours are maintained the same as in a normal semester. It shall also be necessary to fulfill the requirements of CIE and ESE for all the courses like in a normal semester.

(d) Courses planned for the supplementary semester shall be announced by the Dean, Academic Affairs in each year, well before the conclusion of the even semester. Students intending to avail of this facility shall have to register for the courses offered by paying the prescribed fees within the stipulated time.

(e) It shall be the responsibility of the Department to plan in advance the faculty and non-teaching staff requirements to conduct the supplementary semester and take necessary steps including the institutional approvals for organizing the same.

(g) The student who are either dropped or detained in the course/s during regular semester is not allowed to register for that course/s in summer.

(h) Re-exam (ONLY for 60 marks equivalent to end semester exam) shall be conducted for all other classes three weeks after grade approval by DUPC. The re exam shall be conducted after every semester, for all subjects offered in that semester. For final grading, T1, T2 scores of respective semester shall be used. Grade ranges shall be same as that of regular semester for that subject.

(i) The students those who have passed in the re-examination will be awarded grade report with * marked on the subjects passed in re-examination.

13. **Programme Duration:**

(a) The Programme duration for a student to complete the academic and other requirements at the College and qualify for the award of Degree by the University shall be normally 8 semesters.

(b) However, it shall be possible for an outstanding student to qualify for the Degree award in less than eight semesters, by registering for more number of credits i.e., up to the maximum permissible limit of 28 credits per semester from the third semester onwards to complete the Programme requirements of 180 credits. In such a case, the College shall issue a Provisional Certificate to the student who shall await the completion of eight semesters for the Degree award by the University.

(c) This flexibility shall also enable academically weaker students to conduct their studies at a slower pace and complete their Degree requirements in more than eight semesters. The maximum duration for the course completion will be 12 semesters.

(d) Clause (3) above shall be applicable to two types of students at the College:

i. Those wishing to complete the Degree requirements comfortably without encountering failure in any course;

(e) In both the above cases, a student shall have to complete the Programme requirements for the Degree of 180 credits within 12 semesters. Failure to complete the Programme requirements by any student in this period shall lead to the cancellation of his/her admission to the College forthwith. The Senate on case to case basis on the recommendations of the Director and Dean-Academics can extend the term.

(f) A student will not be awarded degree if his/her CGPA at the end of the course is less than 5. For such students the performance improvement scheme is recommended wherein he/she is eligible to take any three subjects for the improvement.

14. **Temporary Withdrawal**:

(a) Student shall be permitted to withdraw temporarily from the College on the grounds like prolonged illness, grave calamity in the family or any other serious happening. The withdrawal shall be for periods which are integral multiples of a semester, provided that

i. He/She applies to the College within at least 6 weeks of the commencement of the semester or from the date he/she last attended the classes, whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.

ii. The College is satisfied that, even by taking into account the expected period of withdrawal, the student has the possibility to complete the Programme requirements of 180 credits within the time limits specified earlier.

iii. The student shall have settled all the dues or demands at the College including those of Hostel, Department, Library and other units.

(b) A student availing of temporary withdrawal from the College under the above provision shall be required to pay such fees and/or charges as may be fixed by the College until such time as the students name appears on the Roll List. However, it shall be noted that the fees/charges once paid shall not be refunded.

(c) Normally, a student shall be entitled to avail of the temporary withdrawal facility only once during his/her studentship of the Programme at the College.

15. **Termination from the Programme**:

A student shall be required to leave the College on the following grounds

i. Absence from classes for more than six weeks at a time in a semester without leave of absence being approved by the competent authorities, shall result in the student's name being struck off the College rolls.

ii. Failure to meet the standards of discipline as prescribed by the College from time to time shall also result in the student being recommended by the Students Disciplinary Committee to leave the College.

16. **Performance Assessment**:

(a) There shall be achievement testing of all the students attending a course, like lecture course, laboratory/design/drawing course or a combination of the two. This shall be in two parts, as follows, both of them being important in assessing the students performance and achievement in the particular course:

1. Sessional, involving Continuous Internal Evaluation (CIE), to be normally conducted by the subject teacher all through the semester; This shall include mid-term tests, weekly/fortnightly class tests, home work assignments, problem solving, group discussions, quiz, seminar, mini-project and other means. The subject teacher shall announce the detailed

methodology for conducting the various segments of CIE together with their weightages at the beginning of the semester.

2. Terminal, often designated as End Semester- Examination (ESE), to be conducted by the subject teacher, preferably jointly with an external examiner; This shall include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.
3. CIE and ESE shall have 40:60 weightage. A student's performance in a subject shall be judged by taking into account the results of CIE and ESE together.

- From the Academic Year 2013-14 there will be only two continuous evaluation examinations and ESE. The weightage for these evaluations will be T1 (20%), T2 (20%) and End-Semester (60%). Dean academics will declare the tentative schedule of these examinations in the academic calendar. Exact dates for ESE and common subjects/Open electives for T1 and T2 will be declared by Controller of Examination in consultation with Dean Academics. The administration of T1 and T2 (except common subjects/Open electives) will be at department level.
- In case of absentee for T1, T2, and End-Semester Examination, student will have to seek permission of Dean Academics to appear for Re-examination. This permission will not be a privilege and will be decided on a case to case basis. If any student participates in any of the events on behalf of the institute, he/she will inform in advance in writing to Dean Academics with recommendation from Dean Students Affairs.
- If any of the students misses T-1 or T-2 for genuine reasons and re-examination is not to be conducted, then his/her end-Semester performance will be appropriately weighted to account for the loss of T-1 or T-2. If any student misses both T-1 and T-2 then no proportionate ratification in marks will be done and his marks in end-semester examination will be considered for final grades.
- Legitimate reasons for re-examination will be as follows:

  Illness on or immediately before the exam date (may include the critical illness of a close family member); bereavement i.e. death of someone in a close relationship with the student; or a sufficiently crowded exam schedule (technically, 3 or more End Sem exams in one day).

4. The evaluation of the project work shall be based on Sessional Work assigned by the project supervisor, seminar presentation, project report and assessment by Project Evaluation Committee, as covered in Clause(7) later in this Section.
5. In the case of other requirements, such as, seminar, comprehensive viva voce and EAA the assessment shall be made as determined by the Grade Awarding Authority of the College.
6. While the conduct of CIE for a course shall be the responsibility of the subject teacher and the Department concerned, and ESE shall be conducted centrally by the Examination Section of the College. The records of both CIE and ESE

shall be maintained by the Examination Section.

7. The performance of students at every stage of the CIE shall be announced by the concerned subject teacher within a fortnight of the date of the particular assessment. The subject teacher shall also show the assessed answer books to the students before submission of the final marks to the Controller of Examinations.
8. The concerned subject teacher shall also be responsible to award letter grades to the students after the ESE is completed and to submit the final results of the course within one week of the last date of ESE to the Controller of Examinations through the Head of his/her Department.

(b) Question Papers: For being able to conduct achievement testing of the students in an effective manner, good question papers shall be used as the principal tool, making it necessary for the question papers at CIE and ESE to:

i. Cover all sections of the course syllabus uniformly;
ii. Be unambiguous and free from any defects/errors;
iii. Emphasize knowledge testing, problem solving & quantitative methods;
iv. Contain adequate data/ other information on the problems assigned;
v. Have clear and complete instructions to the candidates.

(c) Therefore, the question papers, particularly at ESE, shall be set covering the entire syllabus and the students given opportunity to answer questions from the full syllabus of the course by restricting their choice out of each unit in the syllabus.

(d) Besides, the course syllabi shall be well drafted, be defect-free and properly unitized (or modularized) to enable the distribution of questions in the question papers to cover the whole syllabus. These aspects shall have to be taken into account, in particular, by the concerned DUPCs.

(e) There shall be two types of questions to be set by the subject teacher for the question papers at both CIE and ESE, viz.,

i. Multiple Choice Questions, having each question to be answered by tick marking the correct answer from the choices (commonly four) given against it. Such a question paper shall be useful in the testing of knowledge, skills, comprehension, application, analysis, synthesis, evaluation and understanding of the students. Usually, no more than 15- 20% of the questions in a paper for CIE or ESE shall be of this type.
ii. Comprehensive Questions, having all questions of the regular type to be answered in detail. Such a question paper shall be useful in the testing of overall achievement and maturity of the students in a subject, through long questions relating to theoretical/practical knowledge, derivations, problem solving and quantitative evaluation.

(f) Examinations: The College shall maintain a high standard in both CIE and ESE and ensure the declaration of final results including SGPA and CGPA of the courses attended by a student in a semester before the end of the semester as per the Academic Calendar. For meeting these requirements, the College shall take the following steps:

i. CIE shall be conducted exclusively by the subject teacher, who shall spell out the components of CIE in advance, maintain transparency in its

operation, declare the evaluation results in time and return the answer scripts and assignment sheets to the students on a regular basis after the evaluation is completed. The teacher shall also solve the questions asked in the tests at the tutorial sessions for the benefit of weak students.

ii. ESE shall be preferably conducted jointly by the subject teacher and an external examiner appointed for this purpose by the College. In this case, considering the tight time schedule for the various tasks connected with ESE, the external examiner shall be associated with the teacher only in the setting of the question paper.

iii. The answer scripts of ESE shall be evaluated by the subject teacher only; but, an external review of the entire ESE shall be conducted under the aegis of the Board of Examiners of the College before declaring the results. This step shall be useful to the College to gain the confidence of the University on the fairness and transparency in the system.

iv. Suggested passing standard for each of the courses shall be 50 % of the topper marks from the CIE and ESE taken together.

v. Attendance at all examinations, both CIE and ESE of each course shall be compulsory for the students. Students having the following deficiencies shall not be permitted to attend the ESE:

A. Disciplinary action by the College pending against him/her;

B. Irregular in attendance at lecture/laboratory and other classes; C. Failure to meet the standards of attendance prescribed;

D. CIE Performance far below the passing standard

(g) In the event of a final year student failing in a Laboratory course or scoring very low marks in the CIE of a subject or falling seriously ill during ESE, the subject teacher concerned shall have the discretion to grant the student extra time, not exceeding 12 weeks for satisfactorily completing the concerned course after awarding an I grade. If no such extra time is sought/granted, the concerned student shall have to re-register for the same in a succeeding semester and take steps to fulfill the requirements for the Degree award. The I grade shall be required to be converted into a regular grade within stipulated period indicated in the academic calendar.

(h) There shall be make- up examination for a course to take care of students with the I or X grades in ESE.

(i) Make Up Examination: This facility shall be available to students who may have missed to attend the ESE of one or more courses in a semester for valid reasons and given the I grade; also, students having the X grade shall also be eligible to take advantage of this facility. The makeup examination shall be held as per dates notified in the Academic Calendar. However, it shall be possible to hold a makeup examination at any other time in the semester with the permission of the Dean, Academic Affairs. The standard of conducting this examination shall be the same as the normal ESE.

(j) Evaluation of Project work: The project work shall be normally conducted in two stages, spread over one or two sequential semesters.

i. At the end of first stage, the student shall be required to submit for evaluation, a preliminary report of the work done before a prescribed date to the Project Coordinator, DUPC and present the same before an Internal Project Evaluation Committee. This shall be followed by taking up the second stage of work either in the same or the following semester.

ii. The Controller of Examinations shall receive a panel of names from the Chairman, DUPC for identifying the project examiners for the student, at least two weeks before the submission of the second stage of project work. This shall comprise of three unbound, typed copies of the project report (one for each examiner), prepared according to the prescribed format to be submitted to the Department at least one week before the date of oral examination.

iii. The Department shall record the date of submission of the project report and arrange to send copies of the same to the examiners a few days before the date fixed for the oral examination. The project coordinator shall notify the date of the oral examination to the examiners and also the student, with a copy marked to the Controller of Examinations. Then the project report shall be evaluated by the Project Evaluation Committee and the result submitted to the Project Coordinator, who in turn shall forward it to the Controller of Examinations.

iv. On successful completion of the oral examination, the student shall be required to submit two bound copies of the final, corrected project report, one being for the Department and the other for the project supervisor(s).

v. A student desirous of extension of time, up to a maximum of 3 months from the prescribed date for submission of the project report, shall seek permission for the same from the Project supervisor(s) and Head of the Department. The DUPC shall consider such requests, case by case, before giving the permission.

vi. If the DUPC is convinced that the progress of a student in project work is insufficient, the concerned students shall be temporarily awarded the I grade. Further, if the project report of the student is not submitted within the extended time period, the I grade shall be automatically converted to the FF grade.

vii. Such of the students who fail in the first stage assessment of project work shall be required to re-register for the first stage in the following semester. Likewise, those who obtain the FF grade in the second stage assessment shall be required to re-register for the same in the subsequent semester(s).

(k) The evaluation of performance in EAA's shall be done by the concerned faculty members, who shall communicate the student's performance to the Examination Section, soon after the examination is conducted.

17. **Grading System**:

(a) The College shall follow the award of letter grades and the corresponding grade points to the students based on their performance at the end of every semester, as given in Table 2, In addition to the grades given in the Table 2, the instructors shall use two transitional grades I and X as described in Clause (3) in this Section.

**Table 2: Letter Grades and Grade Points**

| Grade | Grade Points |
|---|---|
| AA | 10 |
| AB | 9 |
| BB | 8 |
| BC | 7 |
| CC | 6 |
| CD | 5 |
| DD | 4 |
| FF | 0 |
| PP (Only for Compulsory Non Credit Subjects) | 0 |
| AU (Audit Subject) | 0 |
| NP (Only for Non Credit Subjects) | Not Passed |

(b) A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than I, 'X' or FF in that course. Letter grade FF in any course implies failure in that course.

(c) The Transitional Grades I and 'X' shall be awarded by the teachers in the following cases:

i. Grade I to a student only on satisfactory attendance at classes and performance in other components of assessment, but absence from ESE in a semester for valid and convincing reasons acceptable to the Department, such as,
   A. Illness or accident, which disabled him/her from appearing at the examination;
   B. A calamity in the family at the time of the examination, which required the student to be away from the College;

ii. Grades X to a student on his/her overall performance in the course during the semester, highly satisfactory, i.e., high CIE rating, but a very low ESE performance resulting in an overall FF Grade in the course.

iii. All the I and X grades awarded to the students shall be converted by the teachers to appropriate letter grades and communicated to the Academic Section (through Head of the Department) within two days of the respective make-up ESEs. Any outstanding I and X grades two days after the last scheduled make-up ESEs shall be automatically converted to FF grade.

(d) A Semester Grade Point Average (SGPA) shall be computed for all the students in a Department for each semester, as follows:

$$SGPA = (C_1 * G_1 + C_2 * G_2 + C_3 * G_3 + \ldots + C_n * G_n) / (C_1 + C_2 + C_3 + \ldots + C_n)$$

where, n is the number of courses registered during the semester, $C_i$ is the number of credits allotted to a particular course, and $G_i$ is the grade points corresponding to the grade awarded for the course.

(e) A Cumulative Grade Point Average (CGPA) shall be computed for all the students in a Department at the end of each semester by taking into consideration their performance in the present and the past semesters as follows:

$$CGPA = (C_1 * G_1 + C_2 * G_2 + C_3 * G_3 + \ldots + C_m * G_m) / (C_1 + C_2 + C_3 + \ldots + C_m)$$

where, m is the number of courses registered upto that semester, $C_i$ is the number of credits allotted to a particular course, and $G_i$ is the grade points corresponding to the grade awarded for the course.

(f) Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such for ease of presentation. Whenever the CGPAs are to be used for the purpose of determining the merit ranking in a group of students, only the rounded off values shall be made use of.

(g) When a student gets the grade I or X for any course during a semester, the SGPA for that semester and the CGPA at the end of that semester shall be tentatively calculated ignoring the I and X graded course(s). The SGPA and CGPA for that semester shall be finally recalculated after conversion of I and X grade(s) to appropriate grade(s), taking into account the converted grade(s).

(i) Other academic requirements for the Programme include the following two certifications as indicated earlier in clause (5) of Section 10, viz., PP (Passed) and NP (Not Passed) for EAA. However, there shall be no grade points are associated with these certifications and they do not figure in the calculation of SGPA or CGPA. But, obtaining a PP shall be a mandatory requirement to qualify for, the Degree award.

(j) It shall be open to each student to take additional courses for audit from the fifth semester onwards, with the concurrence of the Faculty Advisor. Students having CGPA >= 8.0 shall be normally encouraged to take such courses. While the performance of the student in audited courses shall be included in the Grade Card, they do not contribute to SGPA or CGPA of the concerned student.

18. **Method of Awarding Letter Grades:**

(a) The subject teacher(s) shall award the letter grade(s) to students based on the marks secured by them in both CIE and ESE together in the course(s) registered. This shall be done by following a relative grading system based on the use of statistics, for which the IUPC shall make available an appropriate software package.

(b) The subject teacher(s) shall submit two copies of the result sheet for each course, giving both the marks and the grades awarded to the Head of the Department, before the due date specified in the Academic Calendar. This shall be forwarded to the Controller of Examinations soon thereafter by the Head of the

Department, after preliminary scrutiny and moderation (if necessary) at the DUPC level.

(c) All the evaluated answer scripts of CIE in a subject shall be returned to the students from time to time during the semester. However, the answer scripts of ESE shall only be shown to the students during the specified period after the evaluation and the detailed marks sheets together with ESE answer scripts and any other relevant papers connected with ESE shall be submitted by the subject teacher(s) to the Controller of Examinations who shall hold it for a period of at least one semester. Steps shall be taken to destroy the same only after obtaining permission from the Dean of Academic Affairs at the end of the prescribed period.

(d) Appeal: A student shall have the possibility to appeal to the Director against a subject teacher for awarding lower grade in a course than that expected by him/her, on payment of prescribed fees, before the commencement of the next semester. In such a case, the DUPC shall arrange a meeting of the aggrieved student together with a Committee comprising of the subject teacher, another subject expert from the College and the Head of the Department, who shall reconsider the evaluation done, show the answer script to the student. If the student is satisfied, the matter shall be closed at this stage. On the other hand, if a revision of marks allotted is called for, the same shall be carried out and all the records, including the Grade Card, corrected soon thereafter. In the latter case, the prescribed fee paid by the student shall be returned.

(e) Withholding of Grades: The Grades of a student in a semester shall be withheld and not declared if the student fails to pay the dues to the College or has disciplinary action pending against him/her.

19. **Eligibility for the Award of Degree**:

(a) A student shall be eligible for the award of B. Tech. Degree from the College and the University provided:

i. Completed all the prescribed credit requirements for the award of Degree with grade DD or higher, in each of the courses, like Theory, Laboratory, Studio, Workshop, Seminar and Project Work;
ii. Satisfactorily completed all the non-credit requirements with PP certification, covering EAA and Industrial Training, Field work, (if any);
iii. Obtained a CGPA of >= 5.00 at the end of the semester in which he/she completes all the requirements for the award of Degree;
iv. Paid all the dues to the College including the Department, Hostels, Library and other units; and,
v. No case or disciplinary action pending against him/her.

(b) The Senate shall be the Recommending Authority for the award of B. Tech. Degree to students fulfilling the requirements specified under Clause (a) above and the Board shall be the Approving Authority.

(c) The Degree award shall then be granted by the University.

## 20. Eligibility for the CGPA improvement after completion of pre-requisite credits for the award of Degree:

Students who secure CGPA between 5 and 6.75 after completing the pre-requisite credits for the award of degree, and wish to improve their CGPA are permitted for CGPA improvement. Such students be permitted to withdraw their grade in a given course with poor grade and permitted to reappear for the examinations for improving the grade and in turn CGPA.

a) Student can appear for grade improvement examination within one year from the date of passing his/her PG or UG Examination. He should not have taken (i) Leaving Certificate from the Institute and ii) Degree from University of Pune through convocation. He/she will submit a written application to dean academics seeking his/her permission to register for class improvement within one month from the date of declaration of result or one week before the date of convocation of University of Pune whichever is earlier. This application will be forwarded to dean academics through the Head of the Department from where he/she has graduated. No student will be admitted once the subject registration process of that semester ends.
b) For grade improvement student will have to take maximum 3 subjects in which he/she has secured DD or CD grades from the same semester in one stretch.
c) Student can choose maximum three theory courses from a particular semester offered for T.Y and B. Tech (either odd or even) in which he/she has secured DD or CD grade. Student will have to register for these courses in a particular semester in which those subjects are offered.
d) At the time of registration student will surrender all the original mark lists given to him by the institute He will have to give an affidavit on 100 Rs. judicial stamp paper that he/she will not do any use of surrendered mark lists till he/she gets official result of the subjects for which he/she wishes to appear for grade improvement. No change of subjects or drop of subjects will be allowed after registration.
e) Student wishing to improve his/her grade will have to pay appropriate fees as laid down by the institute time to time.
f) Student wishing to appear for grade improvement is exempted from attending regular classes as he/she has already undergone the course instructions but he/she will have to appear for all the evaluation tests conducted for the particular subjects. No re-exam or retest will be allowed for the class improvement, in case of such students misses any of the tests or examinations. Absentee for End-semester examination will automatically lead to award of FF grade in that subject.
g) The grading process as used for the regular students appearing for that subject will be applicable and no concession of any sort will be granted on account of absentee for any of the examinations.
h) Student wishing to use the facility of grade improvement will have to pass in all the three subjects at a time for which he/she has registered for. He/she will not be entitled for the summer term or re-examination in such cases.

i) Only one attempt will be permissible for any candidate wishing to use the facility of grade improvement. If the student fails to secure higher grades resulting in reduction in overall CGPA then the original result of the student before registering for grade improvement will be retained.

j) Student who improves his/her CGPA will be issued fresh mark lists by the institute. These mark lists will have star against the subjects for which he/she has appeared for grade improvement and will state "Grade Improvement". The date on the new mark lists will be that as issued for other students appearing in those subjects. Name of the student will be communicated to Pune University and he/she will have to apply for degree certificate from University of Pune thereafter.

## CURRICULUM STRUCTURE OF FINAL YEAR B.TECH (CIVIL)

Effective from A. Y. 2014-2015

**I-Semester:**

| Sr. No | Course Type/ code | Subject Title | Contact hours L | T | P | Credits |
|---|---|---|---|---|---|---|
| 01 | OEC or SEC | **Open Elective/Science Elective Course/HSSC** | 3 | - | - | 3 |
| 02 | PCC/CE 401 | Waste Water Engineering | 3 | - | - | 3 |
| 03 | PCC/CE 403 | Dams and Hydraulic structures | 3 | - | - | 3 |
| 04 | PCC/CE 405 | Introduction to Earthquake Engineering | 3 | - | - | 3 |
| 05 | DEC | **Departmental Elective I** | 3 | - | - | 3 |
| 06 | PW/ CE 407 | **PROJECT-I** | - | - | 6 | 3 |
| 07 | LC/ CE 409 | Waste Water Engineering Laboratory | - | - | 2 | 1 |
| 08 | LC/CE 411 | Water Resources Engineering-Lab | - | - | 2 | 1 |
| 09 | LC/CE 413 | Design of RCC Structures Lab | - | - | 2 | 1 |
| 10 | LLC | Liberal learning course | 1 | - | - | 1 |
| 11 | MLC | Intellectual Property rights | 1 | - | - | 1 |
| | | | | | | |
| | | **Total** | **17** | **-** | **12** | **23** |

**II-Semester:**

| Sr. No | Course Type/ code | Subject Title | Contact hours L | T | P | Credits |
|---|---|---|---|---|---|---|
| 01 | OEC or SEC | **Open Elective/Science Elective Course/HSSC** | 3 | - | - | 3 |
| 02 | PCC/CE 402 | Quantity Surveying and Valuation | 3 | - | - | 3 |
| 03 | PCC/CE 404 | Highway, Airport and Bridge Engineering | 3 | - | - | 3 |
| 4 | DEC | **Departmental Elective II** | 3 | - | - | 3 |
| 05 | PW/CE 406 | **PROJECT-II** | - | - | 12 | 6 |
| 06 | LC/CE 408 | Quantity Surveying and Valuation- Lab | - | - | 2 | 1 |
| 07 | LC/CE 410 | Transportation Engineering Lab | - | - | 2 | 1 |
| | LC/CE 412 | Construction Techniques & Machinery Lab | - | - | 2 | 1 |
| | | **Total** | **12** | **-** | **18** | **21** |

| | **List of Open Electives** |
|---|---|
| 1 | Numerical Methods using Sci-Lab |
| 2 | Systems Approach in Engineering |
| 3 | Plumbing and Pipe Design |
| 4 | Sustainable Development |
| 5 | Environmental Pollution |

**List of Departmental Electives I and II**

| | |
|---|---|
| 1 | Advanced Design of Structures |
| 2 | Advanced Environmental Engineering |
| 3 | Human Resource Management in construction |
| 4 | Advanced Geotechnical Engineering |
| 5 | Water Resources Planning and Management |
| 6 | Introduction to Finite Element Analysis |
| 7 | Advanced Foundation Engineering |
| 8 | Fiber Reinforced Cement Composites |
| 9 | Advanced Analysis of Structures |
| 10 | Matrix Analysis of Structures |
| 11 | Advanced Engineering Geology and Rock Mechanics |
| 12 | Construction Equipment and Management |
| 13 | Green Buildings |
| 14 | Plumbing Services |

## CE- Waste Water Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Introduction**
Objective, Basic design considerations like Engineering, Environmental, process and cost, flow diagrams, design period, population Forecasting.

**Characteristics of wastewater**
Physical, Chemical and Biological characteristics. Waste water sampling and analysis, interpretation and practical Significance of test results. Important microorganisms in wastewater and their importance in wastewater treatment system.

**River Sanitation**
Self-purification of natural streams, Stream standards, effluents Standards, Oxygen Sag Curve.

**Unit 2** **(7 hrs)**

**Sewerage Flow**
Sources of sewage, Variations in sewage flow, storm-water runoff, ground water infiltration.
Design of sanitary sewers, Minimum size of sewer, velocities in sewers and gradient of sewers.
Sewer appurtenances i.e. manholes, street inlets, flushing devices, Vent pipes etc. pumping of sewage, types of pumps for sewage pumping.

**Unit 3** **(7 hrs)**

**Wastewater Treatment**
Theory and design of primary treatment units.
**Screens:** Types of screens, design of screen chamber, disposal of Screenings.
**Grit Chamber:** Sources of grit, velocity control in grit chamber, design of grit chambers including proportional flow weir, disposal of grit,
Sources of oil and grease, importance of removal, methods of oil and grease removal, design of skimming tanks.
**Primary Sedimentation:** Necessity, design of PST with inlet and outlet details, Primary Sludge and its disposal

**Unit 4** **(7 hrs)**

**Theory and Design of Aerobic Secondary Treatment Units**
**Activated sludge Process:** Biological principle, modification of ASP, sludge volume index, sludge bulking and control.
**Trickling filter:** Biological principle, different T.F. And their characteristics, Deign of standard rate or High rate filters, single stage and two stage filters, Re circulation Ventilation,

Operational problems, Control measure, Rotating Biological Contactor.
**Low Cost Treatment methods:** Oxidation pond Bacteria - algae symbiosis, design of oxidation pond as per Altitudes, disposal of pond effluent, Advantages and Disadvantages of oxidation ponds. Aerated Lagoons: Principle, aeration method, Advantages and Disadvantages of A.L. Oxidation Ditches: Principle, advantages and Disadvantages. Effluent disposal and reuse, disposal into water bodies, sewage farming, ground water recharge etc.

**Unit 5** **(7 hrs)**

**Theory and Design of Anaerobic Treatment Units**
Septic tanks, suitable conditions and situations, biological Principle, method of treatment and disposal of septic Tank effluent.
Anaerobic Digester, principle of anaerobic digestion, Stages of digestion, Bio-gas production, its Characteristics and application, Factors governing anaerobic digestion, Sludge disposal methods, advantages and disadvantages

**Unit 6** **(7 hrs)**

**Emerging Technologies for Waste Water Treatment**
Centralized sewage treatment systems, Consequences of centralized wastewater treatment, Objectives of small and decentralized wastewater treatment systems Advantages of Decentralized Wastewater Treatment, Applications of decentralized wastewater management to:
a) Root zone Technology Principle, types of plants used, advantages, disadvantages
b) Constructed wastelands process description, advantages and disadvantages
c) Duckweed ponds process description, advantages and disadvantages
d) Fluidized aerobic bed technology Principle, process description, advantages Disadvantages
e) Up flow sludge Blanket Reactors (UASBR)- Principle, design, advantages and disadvantages

**Text Books**

- Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97 ...Ministry of Urban development
- Metcalf and Eddy, Wastewater Engineering, Tata McGraw Hill, 1996
- Wastewater Engineering by S.K.Garg Khanna publication 2000

**Reference Books**

- Water Technology, N. F. Gray, Butterworth-Heinamann 2002
- Environmental Engineering - II. P. Venugopala Rao Tata McGraw Hill Publication, 2003
- Water and Wastewater Technology ,Hammer and Hammer, Prentice Hall Publication, 2008
- Wastewater Treatment For Pollution Control, by Soli J. Arceivala, 1999

**Course Outcomes:**

A. Students will be able to design phase wise sewerage scheme by forecasting population and design flow. (Po-a)

B Students will be able to design sewerage system with different components. (Po-c)

C Students will be able to decide type of treatment based on characteristics of waste water. (Po-d, e)

D Students will be able to design various units in a waste water treatment plant. (Po-d, e, g, j)

E Students will be able to suggest suitable decentralized waste water treatment process. (Po-g, j)

## CE- Dams and Hydraulic structures

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Introduction**
Types of Dam, Choice of dam, height, various components of dam

**Gravity Dam**
Forces acting and design of Gravity Dams, low and high dams, construction of Gravity Dam. Roller compacted concrete dam

**Unit 2** **(7 hrs)**

**Earth Dam**
Elements of Earth Dam, basic design consideration, design of section, design of filters, rock toe, pitching, causes of failures, piping and its prevention

**Unit 3** **(7 hrs)**

**Spillway and Gates**
Spillway capacity, flood absorption and disposal, different types of Spillway, their principles of design and construction, energy dissipation below Spillway. Types and uses, Gates.

**Unit 4** **(7 hrs)**

**Diversion Head Works**
Selection of sites, layout of the work types of weirs and barrages, design of subsurface flow, safety against piping and uplift, Bligh, Lane, and Khosala's Theories, design of weirs on permeable foundations.

**Canal Irrigation**
Types of canal, canal alignment, losses in irrigation channels. Design of lined channels, various types of canal lining, economics of lining.

**Unit 5** **(7 hrs)**

**Preliminary Sediment Transport Theory**
Critical Tractive Force, regimes of flow, resistance of bed forms, suspended and bed load, its effect on channel design. Design of stable channels in alluvium, the regime method, Semi theoretical approached, cross-section of irrigation channels.

**Canal Masonry Works**
Cross drainage works, necessity types and selection, comparative merits and demerits, principles of design of various types of cross drainage work, falls, types and design, regulation, distributory head regulating works.

**Unit 6** **(7 hrs)**

**River Training Works**
Hydraulics of alluvial rivers, meandering, aggradations and degradation, river training, necessity, river training works and bank protection, various measures and their design and construction principles.

**Hydro Power**
General features of Hydro-power, types of development, general layouts of different types, Assessment of power potential, main components of Hydro-power schemes. Types and selection of turbines, setting of turbines, cavitation.

**Text Books**
- Asawa G.L. ,Irrigation and Water Resources Engineering, New Age International (P) Ltd. Publishers, 2006
- Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers Delhi, 2007.
- Modi, P.N.,Irrigation, Water Resource and Water Power Engineering, Standard Book House, Delhi, 2008.

**Reference Books**
- River Behaviour, Management and Training, CBIP Vol-I, 1989
- Varshney R. S., Concrete Dams, Oxford and IBH Publishing Co.
- Goldin, A. L. and Rasskazor, L. N., Design of Earth Dams.

**I.S. Codes**
- I.S. 8605 – 1977 (Reaffirmed 1998), Code of practice for construction of masonry in dams, third reprint, July 1999, B.I.S. New Delhi.
- I.S. 6512-1984 (Reaffirmed 1998), Criteria for design of solid gravity dams, first revision, first reprint, September, 1998, B.I.S. New Delhi.
- I.S. 457 – 1957 (Reaffirmed, 2005), Code of practice for general construction of plain and reinforced concrete for dam and other massive structures, sixth reprint, January 1987, B.I.S. New Delhi.
- I.S. 10135 – 1985, Code of practice for drainage system for gravity dams, their

foundations and abutments, first revision, B.I.S. New Delhi.

- I.S. 14591 – 1999, Temperature control mass concrete for dams – guidelines, B.I.S. New Delhi.
- I.S. 11223 – 1985 (Reaffirmed 2004), Guidelines for fixing spillway capacity, edition 1.2 (1991-09), B.I.S. New Delhi.
- I.S. 6934 – 1998 (Reaffirmed 2003), Hydraulic design of high ogee overflow spillways – recommendations, first revision, B.I.S. New Delhi.
- I.S. 11155- 1994, Construction of spillways and similar overflow structures – Code of practice, B.I.S. New Delhi.
- I.S. 5186 – 1994, Design of chute and side channel spillway – criteria, first revision, B.I.S. New Delhi.
- I.S. 10137- 1982 (Reaffirmed 2004), Guidelines for selection of spillways and energy dissipaters, B.I.S. New Delhi.
- I.S. 4997 – 1968 (Reaffirmed 1995) Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron, sixth reprint, January, 1998, B.I.S. New Delhi.
- I.S. 7365-1985, Criteria for hydraulic design of bucket type energy dissipaters, first revision, B.I.S. New Delhi

**Course Outcomes:**

A. Students will be able to select the appropriate hydraulic structure/ dam/ turbine. (PO- a, e)
B. Students will be able to determine the trial section of earth dam/ gravity dam, and check stability of it. (Po-c, e)
C. Students will be able to design suitable hydraulic structures /dam, canal. (PO c, e)
D. Students will be able to choose and design the appropriate river training works. (PO c, e)

## CE- Introduction To Earthquake Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(5 hrs)**

**Seismology**
Seismic activities of a region-India, local geology and soil condition, quantification, magnitude, energy and intensity of earthquake. Analysis of earthquake data, seismic zoning, cause of earthquake damage, history of past earthquake.

**Unit 2** **(7 hrs)**

**Vibration Theory**

Free and forced vibration of single degree, two degree, damping, response spectra

**Unit 3** **(9 hrs)**

**Structural Form and Response to Earthquakes**
Form of super structure, regular, irregular form of structures, Response of load bearing masonry building and RC building with brick infill, Lateral load resisting system, guidelines for efficient seismic designs.

**Unit 4** **(7 hrs)**

**Concept of Seismic Design**
Evaluation of seismic force as per Indian code, modal analysis techniques, lateral load analysis of building, Torsion

**Unit 5** **(7 hrs)**

**Codal Provisions for Ductile Detailing of RC Structures subjected to Seismic Forces**
Design of Flexural members, Design of columns and frame members subjected to Bending and axial load, Design of joints of frame.

**Unit 6** **(7 hrs)**

**New Techniques in Aseismic Design**
Base Isolation technique, Seismic dampers

**Text Books**

- Thomas Paulay and M. J. N. Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings, ISBN: 978-0-471-54915-4
- Agarwal Pankaj and Shrikhande Manish, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, 2006

**References**

- IS:1893 (2002), Indian Standard Criteria For Earthquake Resistance of Structures (Part I): General Provisions and Building (Fifth Revision), Bureau of Indian Standards, New Delhi
- IS:4326 (1993), Criteria for Earthquake Resistant Design and Construction of Buildings – Code of Practice, Bureau of Indian Standards, New Delhi
- IS: 13920, (1993), Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force – Code of Practice, Bureau of Indian Standards, New Delhi
- IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi

**Course Outcome:**

A. The student will understand basic terminology in seismology and seismicity and will perform simple calculations on recorded ground motions. (PO: a)

B. The student will apply the basics of structural dynamics in analysis of structures subjected to vibrations (up to 2 DOF s). (PO: a,b)

C. The students will be able to analyse and design a two story buildings for earthquake loads and prepare detailing as per codal provisions. (PO: b,c)

## CE- Project -I

**Teaching Scheme**
Practical: 6 hrs./week

**Examination Scheme**
100 marks: Continuous evaluation-
Mid-sem presentation- 40 Marks,
End - Sem Exam – 60 Marks

**Project Topics**

Project Topics should preferably be design, development, design aid type and interdisciplinary socially relevant and application oriented. The project should aim at training the students in going through all important phases of project studies starting from establishing the need through collection of data, analysis, design, development, drawing, cost estimates and project reports, where appropriate some alternatives which meet the same needs should also be considered and evaluated using appropriate evaluation criteria

**Methodology For Project Evaluation**

During the First Stage of the Project Students would identify a project in a area related with engineering and carryout the necessary literature review. Based on the literature review during first stage of the project student would write a report which would give a review of literature, problem formulation and methodology to be adopted. The report would be presented through a seminar which would be evaluated at the end of the term by the committee.

The Work may consist of the following points:

- Problem Formulation
- Survey of Literature
- Experimental investigation/ Data collection
- Design and Fabrication of Model
- Industrial Assignment

**Note:**

Seminar Report for Project-I would cover Literature Review, Project Formulation and Time Scaled Schedule for Project-II. Seminar would be evaluated by the panel of examiners. Preferably same panel of examiners will be maintained during second stage evaluation. Project group will consist of not more than six with minimum three students in a group.

**Course Outcomes:**

A. Students will be able to formulate problem based on literature survey.(PO-a, b. f, g, h, I, k)

B. Students will be able to present their ideas effectively. (PO-j, k)

C. Students will be able to communicate the importance of the selected topic effectively. (Po-j, k)

## CE- Waste Water Engineering Laboratory

**Teaching Scheme** **Examination Scheme**

Practical: 2 hrs./week Term-work: 50 Marks

Oral: 50 Marks

**I) Laboratory Experiments to be conducted for the Determination of (Any Eight)**

1. Dissolved Oxygen
2. Biochemical Oxygen Demand
3. Chemical Oxygen Demand
4. Different Forms of Solids
5. Sludge Volume Index
6. Conductivity and Dissolved Salt Concentration
7. Phosphate
8. Nitrates
9. Heavy Metals
10. Study of Various types of Micro Organisms

**II) Site visit to Wastewater Treatment Plant and Visit Report**

**III) Design of various components of wastewater treatment plant**

**IV) Study of Software or programming for analysis of wastewater collection System or programming for design of wastewater treatment units.**

**Note:**

1. The term work shall consist of record of above practical in Journal.
2. Oral examinations will be based on above exercises.

**Course Outcomes:**

A. Students will be able to know basic concepts of determination of various waste water parameters. (PO-b, e, j)

B. Students will be able to perform various laboratory experiments and decide appropriate technology to treat the waste water. (PO-c, e, j)

C. Students will be able to complete some assignments based on theory and laboratory courses which will assess their skill to design various waste water treatment units. (PO-e, j)

## CE- Water Resources Engineering Laboratory

**Teaching Scheme** **Examination Scheme**

Practical: 2 hrs./week

Term-work: 50 Marks
Oral: 50 Marks

**A) Compulsory Assignments**

i) Marking Catchments area on a Toposheet and working out average annual rainfall and determining yield.
ii) Stability analysis of Gravity dam
iii) Stability analysis of an Earth Dam
iv) Design of a spillway and stilling Basin.
v) Design of canals

**B) Any Two Assignments of The Following**

i. Design and analysis of a weir on permeable foundation
ii. Design of any one type of cross drainage works
iii. Design of any one type of canal fall and standing wave flume
iv. To develop a unit hydrograph and to draw a flood hydrograph for given 2 or 3 successive of a water resources project.
v. Benefit cost analysis of water resources project.
vi. Design of minor irrigation project
vii. A typical layout of a hydropower plant, function of the components

**C) Report on Site Visit**

A report based on visit to any irrigation project during the academic term

**Note :**

1. The term work shall consist of record of the above assignments in Journal.
2. Oral examinations will be based on above exercises.

**Course Outcomes:**

A. Students will be able to select the appropriate hydraulic structure/dam. (PO-a)
B. Students will be able to determine the trial section of earth dam/ gravity dam, and check stability of it. (PO-a, c, e)
C. Students will be able to design suitable hydraulic structures /dam, canal. (PO-a, c, d, e)
D. Students will be able to plan catchment area on a toposheet, and compute average rainfall and runoff of a catchment. (PO-a)

## CE- Design of RCC Structures Laboratory

**Teaching Scheme**
Practical: 2 hrs./week

**Examination Scheme**
Term-work: 50 Marks
Oral: 50 Marks

**Design Assignments Shall Consist of Following:**

- Design of multistoreyed RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group)
- Report of a site visit related to building structure under construction.
- To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad. Four full size drawing sheets would be drawn using drafting software/ Auto CAD
- Bar bending schedule & detailing of reinforcements as per standard professional practice and relevant IS codes.
- Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects
- Prestressed concrete
  For the architectural layouts necessary for the RCC design assignments, buildings designed for the Term Work on Building Design and Drawing and Building Planning would be taken as basis.

**Course Outcomes:**

Students will be able to

A. understand general procedure for design of simple RCC structures using IS codes related to structural design of RCC structures. (PO-a, b, c, d, e)

B. Prepare a general design and drawing showing detailing of a simple RCC structure like building frames. (PO- a, b, c, d, e)

## CE- Quantity Surveying and Valuation

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Estimating**

Definition, importance of quantity surveying for civil engineer, purpose, types of estimates, data required for estimates. Item of work, Description of an item work, units of measurement and principles deciding the units, I.S. & PWD mode of measurements of building. Definition and purpose of approximate estimate, methods of approximate estimating of building and other civil engineering projects like roads, irrigation & water supply and sanitary engineering

**Unit 2** **(7 hrs)**

**Taking out Quantities**
Principles, methods of taking out quantities for different assignments mentioned in term work, Abstracting bill of quantities, provisional and prime cost items, contingencies, establishment charges, Centage charges.

**Unit 3** **(7 hrs)**

**Analysis of Rates**
Factors affecting cost an item of work materials, labour, tools, and plant, overheads and profit. Task work-definition and factors affecting task work, Transportation of material and cost Schedule of materials and labour, schedule of rates(D.S.R).Analysis of rates of different items mentioned in T.W

**Unit 4** **(7 hrs)**

**Specifications**
Definition and purpose, types, drafting specifications, legal aspect, specifications of stone masonry, wood work, earth work, reinforcing brick work of R.C.C. work.

**Unit 5** **(7 hrs)**

**Valuation of Property**
Purpose, nature of value, price, constant value, factors affecting value of a property. Free hold and leasehold property. Depreciation and methods of working out depreciation, sinking fund, years purchase, out goings
**Methods of valuation**
i) Land and building basis
ii) Rental basis
iii) Reproduction and replacement cost basis
iv) Profit basis, fixation of rent.

**Unit 6** **(7 hrs)**

**Contracts and Tenders**
General idea, Types of contracts. Law of contract, definition, objects and essentials of contract conditions specific condition, condition regarding EM, SD, Time limits (its importance). Liquidated damages and other more important condition regarding addition, alteration , extra items, testing and materials, defective work, subletting powers delegated to engineer in charge, regarding the above aspect, defect liability period, retention money, termination of contract, condition regarding payment to contractors , interim payment or running amount bills, advance payment, secure advance ,final bill
**Tenders and tender Notice**
Tender, Types of tenders, invitation of tender notice, documents, methods of preparation and submission of tenders, scrutiny of tenders, acceptance of tenders, general idea of global tenders.
**Methods of Extending Work**
PWD procedure of execution of work, Administrative approval, budget provision technical

sanction, Different methods of execution of work in PWD, like piecework, rate list, day work, daily labour

**Text Books**

- Elements of Estimating and Costing , Rangwala
- Estimating and costing , B.N. Dutta
- Civil Engineering Contracts and Estimates, B.S. Patil, III edition, Universities Press
- Quantity Surveying, Bhasin P.L.
- Estimating, Costing and Specification in Civil Engineering, Chakraborti M.

**Reference Books**

- PWD Hand Book and Red Book
- PWD District Schedule of Rates (DSR) – Latest

**Course Outcomes:**

A. Students will be able to take out of quantities for various construction projects. (PO-a, j)

B. Students will be able to prepare estimates for various civil engineering works. (PO-a, d, i, j, k)

C. Students will be able to calculate rates for various items of construction. (PO-a, d, e, h, l)

D. Students will be able to draft specifications and tender notice. (PO-a, f, g, h, j, k)

E. Students will be able to prepare valuation report for residential building.(PO-a, d, e, f, g, h, i, l)

## CE- Highway, Airport and Bridge Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Highway Engineering**

**Unit 1** **(7 hrs)**

Introduction, Classification of Road, Traffic Engineering, Highway alignment and Geometric Design

**Unit 2** **(7 hrs)**

Highway materials, Pavement Design, Highway Drainage

**Bridge Engineering**

**Unit 3** **(7 hrs)**

Introduction, Afflux, Bridge superstructures

**Unit 4** **(7 hrs)**

Bridge Economics, Design forces , IRC Loading, Bridge substructure , Bearings

**Airport Engineering**

**Unit 5** **(7 hrs)**

Introduction, Airport planning

**Unit 6** **(7 hrs)**

Airport layout, Runways and Taxiways, Heliport

**Text Books**

- S.K.Khanna, C.E.G. Justo, Nem Chand and Bros, Roorkee(U.A), 8th Edition,2001
- S.K.Khanna, C.E.G.Justo, Highway Material Testing, Nem Chand and Bros, Roorkee(U.A),
- S.K.Khanna, M.G.Arora,S.S.Jain, Airport Planning And Design, Nem Chand and Bros
- S.P.Bindra, Bridge Engineering.

**Reference Books**

- O'Flaherty, C.A.:Highways Vol 2, Edward Arnold, London.
- Planning and Design of Airports: 4th Edition, by Robert Horonjeff and Francis McKelvey, McGraw-Hill, 1994.
- Airport Systems: Planning Design and Management, by Richard DeNeufville and Amedeo Odoni, McGraw-Hill, 2003.
- S Ponnuswamy, (2008), Bridge Engineering, Second Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Yang H. Huang, (2008), Pavement Analysis and Design, Second Edition, Pearson Education, Delhi.

**Course Outcome:-**

A. Students will get the feel of fundamentals of highway, airport and bridge engineering from the syllabus under Highway Engineering students get knowledge of Highway geometrics, pavement design, quality control on field, safety measures etc. _PO-a, e)
B. In Bridge Engineering students will study bridge sub-structure and super-structure components, various hydraulic design forces, IRC loadings. (PO-a, e)
C. In Airport Engineering students will get knowledge of Airport planning, layout and runway and taxiway components. At the end students shall be learning introductory part of Heliport. (a, e)

## CE- Project -II

**Teaching Scheme**
Practical: 12hrs./week

**Examination Scheme**
100 marks: Continuous evaluation-
Mid-sem presentation- 40 Marks,
End - Sem Exam – 60 Marks

**Methodology of Evaluation**
During the Second Stage of the Project Students would present their project work completed based on the formulation they have presented during first stage. Based on the literature review and project work carried out during second stage of the project student would write a report which would give a review of literature, problem formulation and methodology adopted and the findings of the project work. The project report would be presented through a seminar which would be evaluated by a panel of examiners.

During evaluation of the project specific attention would be given to find out the contribution of each team member of the project team. Publication of work is desirable.

**Course Outcomes:**

A. Students will be able to design, develop and analyze civil engineering structures and schedule activities. (PO- b, c ,d, e, f, g, h, i, j, k)
B. Students will be familiar with modern analytical tools. (PO-a, e, j)
C. Students will be able to communicate effectively. (PO- j)
D. Students will identify social problems and provide viable engineering solutions. (PO-f, g, h)

## CE- Quantity Surveying And Valuation Laboratory

**Teaching Scheme**
Practical: 2 hrs./week

**Examination Scheme**
Term-work: 50 Marks

Oral: 50 Marks

**A) Working out Detailed Quantities for**

i) A Two storied R.C.C. framed building based on prevailing DSR rates for Pune District
ii) Estimation of quantities of steel reinforcement for an R.C.C. frame structure in (i) above
iii) Detailed Estimate of Residential Drainage and Water Supply Project

**B) Preparation of Estimate using Computer Software**

Detailed estimate of any two of the following

a. One column, column footing, beam and slab panel.
b. Quantities of form work.
c. Pipe culvert and slab culvert.
d. Earthwork (for a road , Railway, Canal or a small dam)

**C) Writing Detail specifications of any two items Work**

Form the items of works in (A) above

**D) Analysis of Rates**

For the two Items of Works in (A) above based on the prevailing market rates of various items and labour involved.

**E) Valuation reports**

Of a residential buildings using the format given in the O-1 form

**F) Preparation of draft of tender notice**

For the Work for which Detailed Estimate is Prepared.

**Note:**

A Laboratory Record based on the laboratory work would be submitted for the term-work. Oral Examination would be based on the term work and theory covered in the class under the course Quantity Surveying and Valuation. Course Teacher for the Laboratory would decide the breakup of Oral Examination. An Objective Multiple Choice Test may be conducted as a part of the Oral.

**Course Outcomes:**

A. Students will be able to take out of quantities for various construction projects. (PO-a, j)
B. Students will be able to prepare estimates for various civil engineering works. (PO- a, d, i, j, k)
C. Students will be able to calculate rates for various items of construction. (PO-a, d, e, h, l)
D. Students will be able to draft specifications and tender notice.(PO- a, f, g, h, j, k)
E. Students will be able to prepare valuation report for residential building. ((PO- a, d, e, f, g, h, i, l)

## CE- Transportation Engineering Laboratory

**Teaching Scheme**
Practical: 2 hrs./week

**Examination Scheme**
Term-work: 50 Marks
Oral: 50 Marks

**Note: Perform at least 10 experiments out of the following list:**

1. Aggregate Impact Value
2. Los Angles Abrasion Test
3. Flaxiness and Elongation Index
4. Demonstration of Core cutting and grinding machine
5. Bitumen Penetration
6. Softening Point
7. Centifuge Extraction Test
8. Flash Point and Fire Point Test
9. Ductility test
10. Viscosity of bitumen
11. Specific Gravity of bitumen
12. Marshall Stability Test
13. Demonstration of Benkelman Beam Apparatus
14. Demonstration of NDT Concrete test Hammer

**Course Outcome:-**

A. Students will get the feel of fundamentals of TRE-II from the syllabus. (PO-a, b, e, f)
B. Students will get knowledge of Highway geometrics, pavement design, quality control on field, safety measures etc. (PO-a, b, e, f)
C. Students will study bridge sub-structure and super-structure components, various hydraulic design forces, IRC loadings. (PO-a, b, e, f)
D. Students will get knowledge of Airport planning, layout and runway and taxiway components. At the end students shall be learning introductory part of Heliport. (PO-a, b, e, f)

## CE- Construction Techniques and Machinery Laboratory

**Teaching Scheme**
Practical: 2 hrs./week

**Examination Scheme**
Term-work: 50 Marks
Oral: 50 Marks

**Collection of Information from Journals on Construction**

Information regarding various equipments, pertaining to the following aspects should be collected from the Journals on Construction.

- Different types of equipment
- Different Characteristic curves of equipments
- Cost, useful life and area of use
- Equipment performance data

**B) Report based on site visit**

Site visits would be arranged for minimum two construction projects where construction activity is under process. These visits will cover minimum two different topics from the above syllabus. Report would cover necessary drawings, sketches and photographs and would be submitted as a part of term work.

**C) Assignments based on selection of any three equipments from the following areas**

- Earth Moving Equipments
- Specialized Equipments in various Civil Engineering structures

**Note :**

Course Teacher would arrange expert lectures / video cassettes and slides showing use of equipment and techniques. Oral Examination would be based on the term work. Course Teacher for the Laboratory would decide the breakup of Oral Examination.

**Course Outcomes:**

A. Students will be well aware of different construction techniques involving underground and underwater construction, grouting, pile driving, components of bridges alongwith launching of girders. (PO-a, b, c, d, e, h, i, j, k)

B. Students will have learnt functions and working of various machinery and equipments alongwith output used for different construction activities. (PO-a, b, d, e, j)

C. Students will be aware of working of specialized equipments which are new to the construction industry. (PO- a, b, c, d, e, g, i, j, k, l)

## DEPARTMENTAL ELECTIVES

### DEC- Advanced Design of Structures

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

Design of Ribbed (voided) Slab and Grid Floors

**Unit 2** **(7 hrs)**

Design and detailing of Deep Beams as per IS 456:2000,
Comparison with design by British code and American code

**Unit 3** **(7 hrs)**

Design of Flat Slabs

**Unit 4** **(7 hrs)**

Design of Shear Walls – RCC slender shear walls

**Unit 5** **(7 hrs)**

Design of UG and OH Tanks

**Unit 6** **(7 hrs)**

Design of Cast-in-Situ Beam-Column Joints

**Text Books**

- Advanced Reinforced Concrete Design – P. C. Verghese, 2nd Edition, PHI Learning Private Ltd, New Delhi, 2009.
- Advanced Reinforced Concrete Design – P. Dayaratnam.

**Reference Books**

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**Course Outcome:**

1. Students will be able to understand the behavior and analyze special structures/ structural components [PO a, b]
2. Students will be able to design and to prepare detailed structural drawing for execution citing IS codes [PO c]

## DEC- Advanced Environmental Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Meteorological Aspects:**
Parameters influencing air pollution, measurement of parameters plume behavior, transport, and diffusion. Formulae for stack heights, Gaussian diffusion models for finding ground level concentration. Design problems of height of chimney and ground level concentration.

**Unit 2** **(7 hrs)**

**Sampling and Analysis:**
Air Pollution survey, Basic and statistical considerations of sampling sites, Devices and methods used for sampling gases and particulars, Stack sampling, Iso kinetic sampling Analysis of air samples, Chemical and instrumental methods, Ambient air quality standards and emission standards

**Unit 3** **(7 hrs)**

**A) Chemistry of air pollution**: Photochemistry of air pollution, Photochemical smog reactions involved in its formation, Factors influencing its reactions.

**B) Effects of Air Pollution:** Effects on man, animals, vegetation and property, Economics of loss due to pollution, Episodes, Air Pollution index. Cost / benefit ratio, optimization
**C) Odors:** Sources, measurement and control

**Unit 4** **(7 hrs)**

**Control of Pollution:** By process modification, Change of raw materials, Fuels, process equipment and process operation by use of air pollution control equipments, For particulate pollutants, Air Pollution control by using Equipments, Design of control equipments as ESP, Scrubber, Bag filter, Cyclones etc Control of gaseous pollutants Absorption devices, Adsorption Devices, Combustion devices, Condensation devices **Land use planning:** As a method of air pollution control

**Unit 5** **(7 hrs)**

**A) Noise Pollution**
Sources, Noise characteristics, measurement of noise, Effects of noise, Control of noise.
**B) Environmental Impact Assessment:** Definition, Broad Goals, Objectives, Phases in EIA, Contents of Application form, Advantages & Disadvantages of EIA, Environmental management plan, Environmental Impact of Industries, Urbanization and Agricultural activities.

**Unit 6** **(7 hrs)**

**A) Advanced Water Treatment**
De fluoridation- Causes of fluorides in water, significance of high and low fluorides in water, methods of de fluoridation
Modification of Rapid Sand Filter- Up flow Filters. Dual Media, Multimedia and mixed bed filters. Diatomaceous filters. Application Membrane Processes, Reverse Osmosis, Ultra filtration, Electrodyalisis,

Adsorption, Adsorption equilibria, Adsorption isotherms, Langmuir, Freundlich,

**Reference Books**

- Air Pollution By M.N. Rao Tata Macgrahill 1989 edition
- Martin Crawford, *Air Pollution Control Theory,* T M H Edition 1980.
- Air Pollution By Perkins McGraw-Hill Edition 2000
- Air Pollution By KVSG Muralikrishnan Kaushal & Company Kakinada A.P.
- Environment Impact Assessment - Canter (Mc Graw Hill)
- Environment Impact Assessment - Analysis Handbook - G. J. Gau, C. D. Wooten (McGraw Hill)

**Course Outcomes:**

A. Students will be able to determine pollution levels in atmospheric air. (PO-a)

B Students will be able to decide sampling process, design sampling system, determine and interpret results. (PO-c)

C Students will be able to decide type of air pollution control technique suitable for given conditions and will be able to design various air pollution control equipments in a industry. (PO-d, e, g, j)

D Students will be able to formulate Environmental Impact Assessment report (PO-e, g, j)

E Students will be able suggest advanced treatment for water and wastewater (PO- e, g, j)

## DEC- Human Resource Management In Construction

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(5 hrs)**

Introduction, Nature & scope of HRM, HRM: functions and objectives of HRM, HRM model, evaluation of HRM, need of HRD in the context of globalization

**Unit 2** **(7 hrs)**

Human Resource Planning: Nature and importance of HRP, Factors affecting HRP, Planning process
Manpower calculations: techniques of manpower planning for company project
Various HRD parameters, functional skills, supervisory skills, entrepreneurship

**Unit 3** **(7 hrs)**

Personnel Management**:** Concept of Personnel Management, Role and function of personnel Manager, Necessity of Personnel Management, Role of Personnel Manager.

**Unit 4** **(7 hrs)**

Recruiting Human resources: Nature, purpose and importance of recruitment, Factors governing recruitment, Recruitment process
Selecting Human Resources: Organisation for selection, selection process, barriers to effective selection, selection in India
Inducting and Placing: Evaluation of orientation program, Problems of orientation, typical orientation program.

**Unit 5** **(7 hrs)**

Training: Nature of training and development, Inputs in training and development, gaps in training, The training process in various construction companies.
Remuneration: Remuneration of personnel, Factors Influencing employees remuneration, various method of deciding the remuneration wage policy in India Job evaluation, Performance appraisal, Merit rating.

**Unit 6** **(7 hrs)**

Motivation Perspective: Motivation, importance of motivation, theories of motivation comparison of domestic HRM and IHRM, Managing international HR activities.
Labour laws, Labour legislation

**Text Books:**

- Aswathappa K, "Human Resource Management", Tata McGraw Hill, V Edition, 2008
- DeNisi A.S., Griffin R.W., "Human Resource Management", Biztantra Publishers, II Edition, 2009

***Reference Books:***

- Loosemore M., Dainty A., Lingard H., "Human Resource Management in Construction Projects", Spon Press, 2003
- Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi, 1997
- Rao T , "HRD in the New Economic Environment", Tata McGraw Hill
- William J Bruns Jr. "Performance Measurement, Evaluation and Incentives", Tata McGraw Hill.
- NICMAR Publication on - HRD in the Construction Industry - papers and proceedings of the 5th National HRD round table in the Construction Industry - Pune - March - 2000.

**Course Outcomes:**

A. Students will be able to determine the practical application of Human resource Management.

(Po- e,f, g,h,i, j)

B. Students will be able to determine requirement of human resource, training pattern for

employees.(PO- a, b,d)

C. Students will be able to understand different performance appraisals techniques and various acts used in India for Human welfare.(PO- b, c, e, f, h )

## DEC- Advanced Geotechnical Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Soil as Engineering Material**
Typical Indian soil deposits with their engineering characteristics, deciding suitability of soil as a construction material through evaluation of soil properties, Field identification and IS classification of soil, Significance of Consistency Limits and Indices, Clay Minerals – Structure, Clay Water Relationship, Clay Particle Interaction, Soil Structure and Fabric

**Unit 2** **(7 hrs)**

**Shear Strength**
Shear strength behavior of clayey and sandy soil under different drainage conditions, skempton's pore pressure parameters and their determination, stress path method, Stress-Strain behaviour of soil

**Unit 3** **(7 hrs)**

**Soil Retaining Structures**
Failure modes of gravity and flexible retaining walls, design of gravity and rigid cantilever retaining wall, Introduction to design of flexible retaining wall, Introduction to reinforced earth wall

**Unit 4** **(7 hrs)**

**Stability of Slopes**
Finite slopes, stability analysis – method of slices, Bishop's method, Taylor's Stability Number and stability curves

**Unit 5** **(7 hrs)**

**Introduction to Rock Mechanics**
Index properties of rock, RQD, Laboratory tests - unconfined compressive strength, point load test, tri-axial test, Insitu tests, Rock Mass Rating, Engineering Classification of rock, Modes of failure of rocks, Stress-Strain curves, Shear Strength, Mohrs Coulomb failure criteria

**Unit 6** **(7 hrs)**

**Introduction to Modeling in Geotechnical Engineering**
Analytical, Physical and Geotechnical Centrifuge Modelling

**Text Books**
- Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers
- Principles of geotechnical engineering by B. M. Das, Cengage Learning ( Thompson )
- Soil Mechanics and foundation Engineering, Dr.K.R.Arora, Standard Publishers Distributors.

**Reference Books**
- Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
- Foundation Analysis and Design, J.E.Bowles, McGraw Hill International
- Advanced Soil Mechanics, B.M.Das, Tata McGraw Hill

**Course outcome:**
A. Student will be able to identify the type of loading conditions, type of soil and accordingly choose and interpret the required laboratory and field soil tests. (PO-a, b, c, e, h, j)
B. Students will be able to carry out geotechnical design of the flexible as well as rigid retaining structures. (PO- a, b, c, e, j)
C. Students will have an idea of various modeling techniques and their suitability and various laboratories tests to be performed for the assessment of rock. (PO- a, b, d, e, i, l)

## DEC- Water Resources Planning and Management

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Introduction**
Introduction, National water policy, Development stages for conservation and flood protection purpose, reservoir yield and capacity, mass curve, sequent peak method,, reservoir sediment distribution by various methods, flood routing and various methods

**Unit 2** **(7 hrs)**

**Reservoir Planning (Irrigation)**
Planning for irrigation, evapotranspiration, methods of evapotranspiration, crop irrigation requirement, reservoir regulation, Reservoir operation- standard operating policy, Hedging rules

and rule curves,

**Unit 3** **(7 hrs)**

**Reservoir Planning (Hydropower)**
Planning for hydropower, flow duration curve and load duration curve, Planning for run-of-river plant, planning of storage plant, base load plant, peak load plant and its planning, reservoir regulation.

**Unit 4** **(7 hrs)**

**Systems Analysis in water resources planning**
Concepts, optimizing techniques, conventional and evolutionary, simulation, applications of soft computing techniques for water resources planning and management. Linear programming, Formulation of model, solution by Graphical method and software

**Unit 5** **(7 hrs)**

**Water resources economics**
Water resources economics- cash flow diagram, discounting Factors, discounting techniques- benefit- cost ratio, internal rate of return, Annual cost and Present worth method, Evaluation of discounting techniques

**Unit 6** **(7 hrs)**

**Basin Planning and management**
Water balance of a basin, integrated river basin development, River water disputes, Inter-basin river water transfers, Environmental considerations in water resources planning

**Reference Books:**


- Goodman, A.S., Principles of Water Resources Planning, Prentice Hall Inc., New Jercy, 1984.
- James, L.D. and Lee, R.R., Economics of Water Resources Planning, Mc Graw Hill, 1971.
- Warnic, C.C., Hydropower Engineering, Prentice Hall Inc., New Jercy, 1984.
- Vedula, S. and Majumdar, P. P., Water Resources Systems. Modeling Techniques and Analysis, TATA Mc Graw Hill, 2005
- Linsley, R.K. and Franzini, J.B., Water Resources Engineering, Third Edition, Mc Graw Hill,Inc.


**Course Outcome:**

A. Students will be able to analyze data like inflow, crop data, evaporation, sediments, etc. (PO-a, d)
B. Students will be able to plan and design reservoir for irrigation and hydropower. (PO-c)
**C.** Students will be able to evaluate the most economic project from the available options. (PO-b, c, e)
**D.** Students will be able to formulate a mathematical model for irrigation project and obtain optimal solution using graphical approach and software. (PO-a, b, e)

## DEC- Introduction to Finite Element Analysis

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Basic Concepts**
Introduction to finite element method. History, applications. Stress strain relationship, strain displacement relationship. Equilibrium equations (Minimum potential energy approach, virtual work approach), Basic bar element

**Unit 2** **(7 hrs)**

**One-dimensional Finite Elements**
Bar Element, Beam Element, Consistent nodal loads, Element displacement fields, Shape functions and interpolation polynomials

**Unit 3** **(7 hrs)**

**Two-dimensional Elements**
Equations from theory of Elasticity, Potential energy for the continuum, General finite-element formulation, Triangular elements, CST, LST elements, Rectangular elements, Numerical Integration: Gaussian Quadrature

**Unit 4** **(7 hrs)**

**Method of Weighted Residuals**
Method of Weighted Residuals, The Galerkin Finite Element, Element Formulation, Application of Galerkin's Method to Structural Elements, Bar Element, Beam Element

**Unit 5** **(7 hrs)**

**Three-dimensional Analysis**
Tetrahedral elements, Constant strain tetrahedron Triangular Elements, Rectangular hexahedral Elements, Axi-symmetric Elements, Iso-parametric Formulation

**Unit 6** **(7 hrs)**

**Applications in Civil Engineering**
Plane-stress, Plane-Strain Formulation, Iso-parametric formulation for Plane Quadrilateral Element, Axi-symmetric stress Analysis, Strain and Stress Computation, Applications for seepage flow

**Text Books**

- Matrix and Finite Element Displacement Analysis of Structures, D. J. Dawe, Oxford Uni Press, 1984
- Fundamentals of Finite Element Analysis, David Hutton,McGraw-Hill,2004

**Reference Books**

- Concepts and Applications of Finite Element Analysis, Cook R.D. John Wiley New York 1995
- Finite Element Methods in Engineering, Belegundu A.D. And Chandrupatla T.R. Prentice hall India 1991
- Finite Element Methods, Reddy J.N ,John Wiley and sons 1982
- Finite Element Analysis, Buchanan G.R., McGraw Hill Publications New York 1995

**Course Outcome:** This course will enable the students to

A. understand the basic concepts of finite element method. (PO-a)

B. develop basic computer programs for the solution of continuum problems. (PO-a,e)

C. apply finite element method for different problems in the field of Civil Engineering. (PO-b, c & e)

## DEC- Advanced Foundation Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(8 hrs)**

**Bearing Capacity of Foundation**
Bearing Capacity under vertical downward, inclined, eccentric and momentloading

**Unit 2** **(9 hrs)**

**Settlement of Foundation**
Estimation of settlement of shallow foundations consisting of elastic, primary and secondary consolidation settlement with settlement corrections, settlement in sand and clayey soils

**Unit 3** **(9 hrs)**

**Pile Foundation Design (PartI)**
Bearing capacity of piles and pile groups in C, Φ and C-Φ soils, estimation of settlement of pile group,

**Unit 4** **(8 hrs)**

**Pile Foundation Design (PartII)**
Horizontalg capacity of piles, Uplift capacity of pile, Negative drag on piles, pile groupsbehavior under these conditions

**Unit 5** **(8hrs)**

**Introduction to Ground Improvement Techniques**
Stabilization, Dynamic compaction, Grouting, Prefabricated Vertical Drains (PVD), Stone columns, Soil nailing, Geosynthetics, Case histories of Ground Improvement Techniques

**Text Books**
- Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers
- Principles of foundation engineering by B. M. Das, Cengage Learning ( Thompson )
- Soil Mechanics and foundation Engineering, Dr.K.R.Arora, Standard Publishers Distributors.

**Reference Books**
- Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
- Foundation Analysis and Design, J.E.Bowles, McGraw Hill International
- Foundation Engineering Hand Book, Winterkorn and Fang
- Design aids in soil mechanics and foundation engineering, Kaniraj S.R., Tata McGraw Hill Publishing Company Ltd.
- Foundation Design and Construction, M.J.Tomlinson, ELBS Publication

**Course outcome:**
A. Student will be able to design the foundations such as shallow foundations or pile foundations according to various types of loading conditions, such as vertical, horizontal and moment conditions. (PO- a, b, c, e, h, j)

B. Students will have an idea of design of anchored sheet pile walls, preliminary design of ground improvement techniques, and methodologies to be adopted for foundations on expansive soil conditions. (PO- a, b, c, e, j)

## DEC- Fiber Reinforced Cement Composites

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

Introduction, Historical Development, properties of constituent materials Cement, aggregates Admixtures.

**Unit 2** **(8 hrs)**

Interaction between fibers and matrix. Basic concepts and mechanical properties like tension, bending, mixing and casting procedures.

**Unit 3** **(7 hrs)**

Properties of freshly mixed FRC using various types of fibers,

**Unit 4** **(7 hrs)**

Properties of hardened FRC, Testing of FRC under Fatique and impact loading
Creep, Shrinkage and long term performance , Plastic and early drying shrinkage.

**Unit 5** **(6 hrs)**

Advances in Fiber Reinforced cement composites, like Fiber reinforced shotcrete, Glass Fiber Reinforced concrete, FRP, Thin sheet products, Slurry infiltrated fiber concrete

**Unit 6** **(7 hrs)**

Experimental Evaluation of conventional Fiber –cement composites .and High –volume Fraction Fiber Composites Study of various models for the prediction of Failure stress, Future challenges in Fiber reinforced Concrete Technology.

**Reference Books**


1) Concrete –P.K.Mehta and Paulo J.M.Monteiro
2) Neville and Books- Concrete technology.
3) P.N. Balaguru, S.P. Shah – Fiber reinforced cement Composites.


**Course Outcomes:**

This course will enable the students to
A) Identify and illustrate various factors those will affect quality of fresh as well as hardened FRCC. (PO-a, d)
B) Introduce various Fibers and their applications to use them as per the requirement. (PO-b, c, e)
C) Understand behavior of FRCC based on current research works. (PO-b, d, g)
D) Verify various properties of FRCC in Lab and will be able to apply it as per the requirement of the site. (Po-d, g)

## DEC- Advanced Analysis of Structures

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-

Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Basic Equations of Thin Plate Theory**
Assumptions, Slopes and Curvatures of a bent plate, Strain-Curvature relations, Moment Curvature relations. Governing differential equation for rectangular plate, Various boundary conditions.

**Unit 2** **(7 hrs)**

**Bending of Isotropic Rectangular Thin Plates**
Navier solution for all round simply-supported rectangular plate under sinusoidal load, uniformly distributed load, patch load and point load, Levy solution for rectangular plate with various boundary conditions under uniformly distributed load.

**Unit 3** **(7 hrs)**

**Approximate Method of Analysis for Rectangular Plates**
Principles of virtual work and minimum potential energy, Rayleigh – Ritz Approach for all round simply-supported and all round clamped rectangular plate under uniformly distributed load.

**Unit 4** **(7 hrs)**

**Numerical Method of Analysis for Rectangular Plates**
Difference equations, Finite Difference Approach for all round simply-supported and all round clamped rectangular plate under uniformly distributed load.

**Unit 5** **(7 hrs)**

**Response of SDOF System to General Dynamic Loading**
Duhamel's integral. Direct integration method. Fourier analysis for periodic loading.

**Unit 6** **(7 hrs)**

**Lumped Parameter MDOF System**
Orthogonality conditions, Natural frequencies by inverse iteration method, Dynamic response by mode superposition.

**Text Books:**


- S. Timoshenko and W. Krieger: Theory of plates and shells: Mc – Graw Hill.
- Ansel C. Ugural : Stresses in Plates and Shells : Mc Graw Hill.
- K. Chandrashekhara: Theory of plates: Universities press.
- A.K. Chopra: Structural Dynamics and introduction to earthquake engineering
- J. W. Smith: Vibration of structures. Application in civil engineering design: Chapman and Hall

**Course Outcomes:**

This course will enable the students to

A. Demonstrate a working knowledge of thin plate analysis. (PO- a)
B. Demonstrate a basic understanding of applying numerical procedure for thin plate bending. (PO- b)
C. Analyze thin rectangular plates. (PO- b, c)
D. Estimate the response of structure for dynamic loadings. (PO- c)
E. Carry out free-vibration analysis for structures. (PO- e)

## DEC- Matrix Analysis of Structures

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Introduction**
Matrix methods for skeletal structures, Finite-Element Method, Basic considerations of structural analysis, Boundary conditions, Reciprocal theorems, Displacement Method, Stiffness relationships

**Unit 2** **(7 hrs)**

**Matrix Displacement method**
Bar element with axial force, Bar structure stiffness matrix, Bar element subjected to torsion, Stiffness matrix of a beam element, Assembly of the structure stiffness matrix

**Unit 3** **(7 hrs)**

**Plane Frames**
Pin-jointed frames, Rigid jointed frames, Neglect of axial strain for rigid jointed frames, inclined supports, Bandwidth of stiffness matrix, Member Stiffness Relations in the Local Coordinate System, Coordinate Transformations, Stiffness in the Global Coordinate system

**Unit 4** **(7 hrs)**

**Other kinds of Loading**
Loading between joints, Effects of temperature change and lack of fit

**Unit 5** **(7 hrs)**

**Space Frames**
Grid structures, Ball-jointed space frames, Rigid-jointed space frames, Structure Stiffness Relations

**Unit 6** **(7 hrs)**

**Programming for Framed Structures**
Flow Charts, Continuous Beam Program, Plane Truss Program, Plane Frame Program, Space Truss Program

**Text Books**
- Matrix Analysis of Framed Structures, Weaver and Gere, CBS Publ.1986
- Matrix and Finite Element Displacement Analysis of Structures, D. J. Dawe, Oxford Uni Press, 1984

**Reference Books**
- Matrix Methods of Structural Analysis, M. B. Kanchi, Wiley Eastern Ltd. 1993
- Computer Methods in Structural Analysis, J. L. Meek, E and FN, Spon Publ.1995
- Matrix Analysis of Structures, Aslam Kassimali, Brooks/Cole Publishing Co. 1999

**Course Outcomes:** Students will be able to

A. analyze various skeletal structures using the computer oriented stiffness matrix method. (PO-a, b, e)

B. develop the computer programs based on the stiffness method for the analysis of skeletal structures. (PO- a, e)

## DEC- Advanced Engineering Geology and Rock Mechanics

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**Introduction**
Importance of geological studies in engineering investigations, Precautions necessary to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to R.Q.D. Dependence of design on geological features of project site. Case histories illustrating economics made possible by proper geological studies and wasteful expenditure or difficulties resulting from their neglect.
Engineering characteristics of rocks of major rock formations of India.

**Groundwater conditions in Maharashtra**
Ground water conditions in Maharashtra with reference to Deccan Trap area. Waterbearing characters of different type of basalts, volcanic breccias, tachylytic basalts, dykes, fractures, weathering products and older alluvium. Geological factors governing natural recharge. Geological aspects of multiaquifier system, deep drilled tube wells. Geological aspects of

conservation of water and artificial recharge,
Dependence of success of such schemes as percolation tanks and watershed development on Geological conditions and necessity of Geological studies for such schemes, Study of case histories

**Earthquakes**

Seismisity in Maharashtra, Earthquakes taken place in the areas of some dams and Geological conditions indicating lack of connection of these reservoirs

**Unit 2** **(7 hrs)**

**Engineering geology of the Deccan Trap Basalts**

Factors affecting strength and water tightness. Stability of cuts and ability to stand without support, signficance of commonly occurring features like gas cavities, jointing, weathering, hydrothermal alteration, volcanic breccias, tachylytes, dykes, fractures, faults and their civil engineering significance, Field structures of flows, stratigraphical sequence of flows etc. in various civil engineering projects.

**Urban Geology**

Influence of Geological factors upon Urban development and planning

**Construction Material**

Deccan Trap basalts as construction material, Use of compact basalts and amygdaloidal basalts as Rubble for masonry and metal for concrete and pavement quality concrete, Study of case histories

**Unit 3** **(7 hrs)**

**Geology of soil formation**

Residual and transported soils, Rock weathering conditions favorable for decomposition and Disintegration, Influence of climate on residual and transported soils in the Deccan Trap area, Nature of alluvium of Deccan Trap rivers and its engineering characters. Effect of deposition of Calcium Carbonate. Scaarcity of sand in the rivers in the deccan trap area

**Geophysical Investigations**

Seismic and electrical resistivity methods of exploration as applied to engineering investigations.

**Rock Mechanics**

General principles of rock mechanics, Dependence of physical properties of rocks of Geological Characters, Testing methods, Mechanical properties of Deccan Trap rocks, Calculation of R.Q.D,Joint frequency index, R.M.R., Q system, stand up time calculations. Bieniawski's Geomechanical Classification, etc.

**Unit 4** **(7 hrs)**

**Foundation treatment**

Foundation investigations during construction for determining the foundation treatment for adverse geological features. Determination of foundation levels / cut off levels for earth dams. Correction of adverse features by means of grouting, Groutability of rocks. Consolidation grouting for improving strength of weak and fragmented rocks, Curtain grouting for preventing leakage through foundation rocks, Determining depths and zones of consolidation and curtain grouting, Relation of zones of grouting with height of dams, Foundation treatment

for fractures having different manifestation, jointed rocks, tachylytes and dykes, Typical case histories

**Unit 5** **(7 hrs)**

**Erosion of tail channels**

Erosion of tail channel as a factor in selecting site for spillway, Causes of rapid erosion of tail channels of side spillways. Geological conditions leading to tail channel erosion, Case histories.

**Bridges**

Investigation for bridge foundations, difference in objectives of investigation of dam foundation and investigation of bridge foundation, Computing safe bearing capacity (S.B.C.) for bridge foundations based on nature and structures of rock, Foundation settlements, Case histories

**Dams**

Strength and water tightness of Deccan Trap rocks from foundation point of view. Physical properties such as compressive strength, water absorption etc. of basalts, Effect of weathering and hydrothermal alteration on the engineering properties of rocks, Deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks, Illustrative case histories.

**Unit 6** **(7 hrs)**

**Tunnelling**

Variation in methodology of investigation for different types of tunnels for different purposes; location, spacing, angles, and depths of drill holes suitable for different types of tunnels, Difference in behavior of basalts because of jointing as exemplified by compact basalts and amygdaloidal basalts, Difficulties involved by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts and unfavourable field characters. Computing structural discontinuities in rock masses, R.Q.D., joint frequency index, R.M.R. values, Q System, standup time. Limitations of these, dependence of protective measures such as guinitting, rock bolting, shortcreting, permanent steel supports, lagging, concreting and contact grouting above permanent steel supports on Geological conditions. Suitability of T.B.M. and road headers, Experience of some important tunnels in Deccan Trap rocks

**One field visit to study the above contents**.

**Reference Books**


- Gupte R.B.: A Text Book of Engineering Geology – P.V.G. Publications, Pune
- Gupte R.B. (1980) : P.W.D. Hand Book – Chapter 6, Part II, 'Engineering Geology' Government of Maharashtra
- Jaeger – Rock Mechanics in Engineering
- Goodmann – Principles of Rock Mechanics
- Bieniawski Z.T. – Engineering classification of jointed rock masses.


**Course Outcomes :**

Through theoretical tests and actual field problems, it is revealed that most of the students are able to do the following.

**A.** The students are able to apply their knowledge of Geology to Civil Engg Projects .

**B.** They are able to identify the rock type and then carry out the various test in the Lab like Crushing strength etc .

**C.** They can perform RQD , RMR AND RSR calculations involving various rock types(Igneous Sedimentary and Metamorphic). And they are in a position to understand basic calculations of Joints and Fractures in Beds of Rocks and further try to interpret the properties for suitable foundations etc

## DEC- Green Buildings

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(10 hrs)**

Sustainable site selection orientation, building envelop, building plan layout, design of doors and windows, natural ventilation, solar energy, use of solar energy for water heating, solar concentrators, solar photovoltaic panels, direct and indirect lighting, comparison of various lighting devices-electric tubes, incandescent lamps, CFL and LED lamps, indirect lighting devices-light tubes, fiber optic, Fresnel lens.

**Unit 2** **(5 hrs)**

Passive and active architecture, Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air-conditioning. Concept of Embodied energy of various common building materials. Energy and water audit of building.

**Unit 3** **(5 hrs)**

Various rating systems in Green building, LEED criteria, USGBC, IGBC Green rating, GRIHA criteria, Eco housing, Environmental clearance of buildings.

**Unit 4** **(6 hrs)**

Water efficiency, Water Efficient Landscaping- Rain water harvesting, potable water and bore well recharging, minimization of water use, dual flush, Waterless urinals, Smart controlled water tabs, Recycling of treated waste water for different non potable use, Domestic solid waste – segregation, green materials.

**Unit 5** **(7 hrs)**

Indoor environment Quality low-VOC emitting materials. Adhesive and sealants, Paints and coatings, carpet systems, Composite fibre agro fibre products as like jute, bamboo, coconut and their use as interiors.

**Unit 6** **(9 hrs)**

Recycling of building materials, Exting walls, roofs and floors, Interial non structural element, Construction waste management, Materials use, Recycled content, Use of fly ash, foundary sand and other inert solid wastes in building, life cycle analysis, Construction phase, Operation phase, demolition and land use.
Assignments:
1) Green and Energy audit of one building
2) Suggested modifications for improving green rating and and energy conservation in building studied.

**Reference Books:**


- By Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture" Springer Publication, ISBN 978-3-642-00634-0.
- Kibert, C. J. "Sustainable construction: Green building design and delivery", Wiley, Hoboken, NJ.
- LEED for homes green building rating system – U.S. green building council, <http://www.usgbc.org/leed/homes>
- IGBC green building rating system, <http://igbc.in/site/igbc/testigbc.jsp?desc=115708&event=115679>
- Green Rating for Integrated Habitat Assessment (GRIHA).〈http://www.grihaindia.org〉
- Building research establishment's environmental assessment method. Design and procurement pre-assessment estimator BREEAM
- Eco Housing green building rating system. <http://portal.mcgm.gov.in/irj/portalapps/com.mcgm.ecohousing/docs/Eco_housing_Construction.pdf>
- Comprehensive assessment system for building environmental efficiency. CASBEE for new construction: technical manual 2004 edition. <http://www.ibec.or.jp/CASBEE>
- ASHRAE Standard 62-1999 Ventilation for Acceptable Indoor Air Quality
- ASTM E1903-97
- ASHRAE IESNA Standard: 90.1
- National Building Code 2005.


**Course Outcome**

After completion of the course Student will able to:

A. Understand the economic benefits of a green building. (PO- f,g, l)
B. Classify the terms and the construction methodologies between "traditional building" and "green building". (PO- a, b, g, l)
C. Evaluate the status of building for various green building rating system. (PO- f, g, l)

## DEC- Plumbing Services

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-

Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(6 hrs)**

**Introduction to codes and standards**

Approvals, AHJ, alternative materials, minimum standards, sewers required, industrial wastes, workmanship, prohibited fittings and practices, water conservation, protection of pipes and structures, waterproofing, rat proofing, hangers and supports, trenching, types of joints.

**Architectural and Structural Coordination**

Local municipal laws relating to plumbing and basic information on fire static water requirements. Spaces required for various sanitary facilities, plumbing shafts, water tanks and pump rooms, centralized hot water systems, coordination with the architects. Structural parameters such as sunken toilets, location of columns and beams, post-tension slabs, importance of ledge walls.

**Unit 2** **(7 hrs)**

**Plumbing Terminology**

Definitions for most words can be found in a dictionary, but there are technical or trade terms which take on a special meaning when used in relation to plumbing.

**Plumbing Fixtures and Fixture Fittings**

Plumbing fixtures, water conserving fixtures, water closets, bidets, urinals, flushing devices, lavatories, bath/shower, kitchen sinks, water coolers, drinking fountain, clothes washer, mop sink, overflows, strainers, prohibited fixtures, installation standards, strainers, floor drains, floor slopes, location of valves, hot water temperature, and table of minimum plumbing facilities.

**Unit 3** **(8 hrs)**

**Traps and Interceptors**

Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps, clarifiers, grease interceptors, sizing, FOG disposal, oil and sand interceptors.

**Indirect Waste**

Air-gap, food establishments, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, chemical wastes, point of discharge, venting. Introduction to pipe sizing.

**Vents**

Vent requirement, trap seal protection, materials, vent connections, flood rim level, termination, vent stacks, water curtain and hydraulic jump, horizontal and vertical wet venting, combination waste and vent system, cleanouts, venting of interceptors. Introduction to vent sizing, sizing of combination vents etc.

**Unit 4** **(7 hrs)**

**Sanitary Drainage**

Preamble, pipe materials and jointing methods, special joints, fixture connections (drainage), hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, testing, sumps and pumps, public sewers, sewage disposal. Introduce DFU, sizing of horizontal and vertical pipes.

**Storm Drainage**

Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters/channels/scuppers, window areaway drains, roof drains, strainers, leaders, conductors and connections, siphonic drains, underground drains, materials, traps required, prohibited installations, testing. Introduction to sizing of channels, rainwater down takes, underground drains. Introduction to rain water harvesting.

**Unit 5** **(7 hrs)**

**Water Supply**

Preamble, sources of water, potable and non-potable water, reclaimed water, water storage, treatment, hot and cold water distribution system, backflow prevention, air gap, cross connection control, pipe materials and jointing methods, pressure controls, unions, thermal expansion, types of valves, installation and testing, disinfection, protection of underground pipes, color codes and arrow marking. Introduce WSFU, sizing calculations.

**Solar Hot Water**

Introduction to solar water systems. System components, panels, hot water tanks, electrical backup, safety measures, auto controls, hot water supply and return systems, various insulating materials, control valves, introduction to other methods of hot water generation.

**Gray-water Systems**

Definition of gray water, specifications and drawings, total gray water discharge, soil absorption, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water, pipe identification, installation, signs, valves, cross connection, inspection and testing, approved uses.

**Unit 6** **(7hrs)**

**Pumps and HPS**

Types of pumps for water supply, heat exchangers, wastewater dewatering and sewage. Pressure boosting and hydro-pneumatic systems shall be elaborated along with the accessories and controls.

**Construction Management**

Organization charts, inter-organization relations, coordination of other agencies, role of Engineer-in-charge, safety and security, working at heights and confined spaces, accidents reporting. Inventory, material ordering and stacking, testing, record keeping, measurements, and billing. Time and cost analysis, specifications writing, resources planning, takeoff quantities (BOQ), and cost estimates of few plumbing items. Break down activities, activity sequence and activity period for few selected cases.

**Reference Books**


- Uniform Plumbing Code- India (UPC-I), 2008
- Illustrated Training Manual (ITM), 2008.

**Course Outcomes:**

A. Students will gain understanding of the principles and code requirements of plumbing system designs and develop the ability to design and review code-based plumbing systems. (PO- a, c, e, k)

## OEC- Applied Numerical Methods with SCILAB

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(6 hrs)**

**Introduction**
SCILAB Environment, Mathematical operations, use of built-in function, Graphics, Arrays and Matrices

**Unit 2** **(6 hrs)**

**Programming with SCILAB**
Branching Statements and program design, loops, user defined functions, File I/O operations, Structured programming

**Unit 3** **(6hrs)**

**Roots**
Bracketing Methods and open methods

**Unit 4** **(6 hrs)**

**Linear Algebric Equations,**
**[06 hrs]**
Gauss elimination, Pivoting, Tridigonal system, Iiterative Methods

**Unit 5** **(6 hrs)**

**Interpolation**
Polynomial interpolation, Newton interpolation polynomial, Lagrange interpolation polynomial, Extrapolation

**Unit 6** **(6 hrs)**

**Numerical Integration and Differentiation**
Newton Cote's formula, Trapezoidal rule, Simpson's rule, Gauss quadrature, Numerical

differentation

**Text Books**

- SCILAB Litrature available online
- Applied Numerical Methods with MATLAB, Steven C Chapra, Tata McGraw Hill

**Course Outcomes:** Students will be able to

A. understand the basics of SCILAB programming (PO-a, e)
B. develop the computer programs in SCILAB (PO-a, e)
C. apply the numerical methods using SCILAB for solving engineering problems. (PO-a, b, e)

## OEC- Systems Approach in Engineering

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(7 hrs)**

**System Concepts, System Parameters, Objectives and Constraints**

System Classifications, system cycle, open and closed systems, Identification of Civil Engineering Systems and their methods of analysis, Mathematical representation of a system, Introduction to Single variable optimization, Multi variable optimization with no constraints, Multivariable optimization with equality constraints, Multivariable optimization with inequality constraints, concave and convex functions, regions and sets

**Unit 2** **(7 hrs)**

**Linear Programming**

Applications of Linear Programming, standard form of a Linear Programming Problem, Solution of a system of linear simultaneous equations, Pivotal reduction of a general system of equations, Simplex Method, Two Phase Method, Method of Big-M, Sensitivity or Post Optimality Analysis, Primal Dual Relations

**Unit 3** **(7 hrs)**

Allocation Problem, Transportation Problems, Assignment Problems, Queuing Theory, Simulation, Sequencing

**Unit 4** **(7 hrs)**

**Non-Linear Programming**

Unconstrained Programming, One Dimensional Search Techniques, Dichotomous, Fibonacci, Golden Section, Multivariable Problems, Gradient Techniques, Steepest Ascent/Descent Technique, Newton's Method.

**Unit 5** **(7 hrs)**

**Constrained Optimization and Dynamic Programming**
Lagrangian Multiplier Technique, Kuhn-Tuckers Conditions, Penalty Function Methods, Principle of Optimality, Recursive Equation

**Unit 6** **(7 hrs)**

Capitalization, Annuity, Benefit Cost Analysis, Games Theory and its Application to Construction Management.

**Text Books**

- Principles of Operations Research, Wagner
- Quantitative Techniques, L. C. Jhamb

**Reference Books**

- Numerical Optimization Techniques for Engineering Design with Applications, G. N. Vanderplatts, McGraw Hill
- Optimization Theory and Applications, S. S. Rao, Wiley Eastern, New Delhi
- Operations Research - An Introduction, Hamdy Taha, Pearson Education

**Course Outcomes:** Students will be able to

A. apply systems concept to solve actual problems in engineering field. (PO-b)
B. formulate the field problem and then select appropriate technique to optimize the same within the constraints. (PO-b, e)
C. familiar with optimizing the given engineering problem by adopting a suitable technique effectively. (PO-e, g))

## OEC Environmental Pollution

**Teaching Scheme**
Lectures : 3hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

**Unit 1** **(5 hrs)**

**Environment and its interaction with human activities** –
Environmental imbalances, attribute, impacts, Indicators and Measurements, Factors Contributing to Urban Air Pollution in India.
**Air pollution**- Definition, sources of air pollution, types and classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights,

**Unit 2** **(5 hrs)**

**A) Chemistry of air pollution**: Photochemistry of air pollution, Photochemical smog reactions involved in its formation, Factors influencing its reactions.
**B) Effects of Air Pollution:** Effects on man, animals, vegetation and property, Economics of loss due to pollution, Episodes, Global effects of air pollution
**C) Odors:** Sources, measurement and control

**Unit 3** **(7 hrs)**

**Meteorological Aspects:**
Parameters influencing air pollution, measurement of parameters plume behavior, transport, and diffusion. Formulae for stack heights, Gaussian diffusion models for finding ground level concentration. Design problems of height of chimney and ground level concentration

**Unit 4** **(7 hrs)**

**Control of Pollution:** By process modification, Change of raw materials, Fuels, process equipment and process operation by use of air pollution control equipments, For particulate pollutants, Air Pollution control by using Equipments, Design of control equipments as ESP, Scrubber, Bag filter, Cyclones etc Control of gaseous pollutants Absorption devices, Adsorption Devices, Combustion devices, Condensation devices **Land use planning:** As a method of air pollution control

**Unit 5** **(7 hrs)**

**A) Noise Pollution** Sources, Noise characteristics, measurement of noise, Effects of noise, Control of noise.
**B) Environmental Impact Assessment:**

Definition, Broad Goals, Objectives, Phases in EIA, Contents of Application form, Advantages & Disadvantages of EIA, Environmental management plan, Environmental Impact of Industries, Urbanization and Agricultural activities. Case studies

**Unit 6** **(9 hrs)**

**Water and Wastewater treatment**
Sources of water, Physical, Chemical and biological quality of water, Standards for drinking water, flow diagram of water treatment process,
Sources of wastewater, Physical, Chemical and Biological characteristics Waste water sampling and analysis, interpretation and practical Significance of test results. Important microorganisms in wastewater and their importance in wastewater treatment system. Sources of sewage, Variations in sewage flow, storm-water runoff, ground water infiltration.
River pollution, Self-purification of natural streams, effluents Standards, Oxygen Sag Curve.
Classification of wastewater treatment, Aerobic and anaerobic treatment, Biological and chemical treatment, flow diagram of wastewater treatment process, industrial effluent and treatment Centralized sewage treatment systems, Consequences of centralized wastewater treatment, Objectives of small and decentralized wastewater treatment systems Advantages of

Decentralized Wastewater Treatment, Applications of decentralized wastewater management

**Reference books**


- Air Pollution By M.N. Rao Tata Macgrahill 1989 edition
- Air Pollution By Perkins McGraw-Hill Edition 2000
- Air Pollution By KVSG Muralikrishnan Kaushal & Company Kakinada A.P.
- Environment Impact Assessment - Canter (Mc Graw Hill)
- Environment Impact Assessment - Analysis Handbook - G. J. Gau, C. D. Wooten
- (McGraw Hill)
- Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97 ...Ministry of Urban development
- Metcalf and Eddy, Wastewater Engineering, Tata McGraw Hill, 1996


**Course Outcomes:**

A. Students will be able to know various processes which generate air pollution. They will be able to identify local and global effects of pollution and suggest control measures.

B. Students will be able to identify atmospheric stability conditions and relate them to transport of air pollutants

C. Students will be able to design stack under given conditions.

D. Students will be able prepare brief Environmental Impact Assessment report

E. Students will be able to determine the flow diagram of water and waste water treatment process and decide domestic wastewater treatment processes.

F. Students will be able to suggest suitable type of industrial waste water treatment process

## Annexure I

### List of Liberal Learning courses offered at Institute Level

- **Agricultural** – Animal Science, Forestry, Horticulture, Floriculture, Sustainable Agriculture, Veterinary
- **Arts** – Graphic Design, Interior Design, Fashion Design
- **Basic Sciences** – Astronomy, Astro- Physics, Biology, Genetics, Kinesiology, Microbiology, Neuro Sciences.
- **Business** – Administration, Communication, Entrepreneurial studies, Hostel Management, Marketing.
- **Defense Studies** - Military Studies, Naval Studies, Air Force Studies, War strategies.

- **Education** - Education policies, Engineering Education, Teacher Training.
- **Environmental Sciences** – Ecology, Meteorology
- **Linguistics** – Word Language
- **Medicine** – Health Studies Nutrition and dietetics
- **Performing Arts**- Music, Dance Theatre, Cinema
- **Philosophy**- Religious Studies
- **Sports and Athletics**