



**Important Academic Rules  
M.Tech. Degree Programme  
in  
Civil Engineering**

**GENERAL**

- The Regulations may evolve and get revised/refined or updated or amended or modified or changed through approvals from the Academic Council from time to time, and shall be binding on all parties concerned, including the Students, Faculty, Staff, Departments, University Authorities and officers. Further, any legal disputes shall be limited to the legal jurisdiction determined by the location of the University and not that of any other parties.
- If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation etc., the matter will be reported to the AC, recommending revoking the admission of the candidate.
- The LU reserves the right to cancel the admission of any student at any stage of his study programme in the University on the grounds of unsatisfactory academic performance or indiscipline or any misconduct.
- Medium of Instruction shall be English.

**PROGRAMME**

- For full-time students, the duration of study shall be a minimum of Six Terms and a maximum of FOUR years. For part-time students, the duration will be a minimum of Nine Terms and a maximum of FIVE years.
- There are three types of student status in the M.Tech. Degree Programme:
  - (a) Full-time student of GATE-Scholarship (FTG)
  - (b) Full-time/Part-time sponsored student from Industry or other Organizations including Educational Institutions (FTS/PTS)
  - (c) Full-time/Part time non-sponsored non-scholarship student (FTN/PTN)
- The course content for an M.Tech. Degree Programme will typically consist of the following components.

- (a) Two-Letter Grade Courses
  - (i) Compulsory Courses
  - (ii) Programme Core Courses
  - (iii) Elective Courses\*
  - (iv) Dissertation
- (b) Non-Two-Letter Grade Courses
  - (i) Seminar
  - (ii) Teaching Practice

\* Some electives may be pre-requisite for another elective course.

- The exact credits offered for the programme for the above components, the term-wise distribution among them, as well as the syllabi of all postgraduate courses offered by the department are given in the 'Scheme of Studies and Syllabus'.
- The minimum credit requirement for the M.Tech. Degree is 90.

**DISSERTATION**

- The Dissertation carries 11 credits and spreads over THREE Terms, (normally during 4<sup>th</sup> to 6<sup>th</sup> Terms for full time and 7<sup>th</sup> to 9<sup>th</sup> Terms for part time students or as recommended by BOS). The progress of the Dissertation shall be monitored by the guide.
- Under special circumstances a student can be allowed to undertake dissertation work in industry/research laboratory/other University. The place of work has to be approved by AC.
- A candidate shall submit 5 copies of the Dissertation duly recommended by the guide after assessment by the committee to the Chairman, DEC, on or before the specified date. The Report shall be in the format prescribed by the University.
- The earliest date for the submission of dissertation shall be three weeks before the closure of the trimester in which the dissertation work credits have been registered for, and is expected to be completed, or as announced by the DAA.
- Extension of time beyond the announced last date for submission of the Dissertation may be granted by the DAA on recommendation from the HOD.
- The final evaluation is done by a Dissertation Evaluation Committee (DEC) constituted by the pertinent BOS. There shall be an open seminar followed by a viva-voice examination as part of the final evaluation. After the final evaluation, appropriate double-letter grade is recommended to DAA, for necessary action.
- If in the opinion of DEC, the Dissertation needs some minor modifications DEC will report to DAA along with recommended grade. The DAA shall instruct the candidate suitably to incorporate the necessary modifications and to resubmit it to the Chairman, DEC. After such resubmission, the chairman, DEC will certify that the necessary modifications have been incorporated and recommend to DAA for the acceptance and award of the grade as recommended by DEC.

- The title of the Dissertation shall be indicated in the Transcript.
- The dissertation grades will be considered for TGPA and CGPA calculation.

### **NON TWO-LETTER GRADE COURSES**

- These are courses that must be completed by the student at appropriate time as suggested by the Faculty Advisor. The 'S' grade is awarded for satisfactory completion of the course and 'N' grade is awarded for non-completion of the course. In case 'N' grade is awarded, the student has to re-register for the same course wherein he has no alternative options. However, he can opt for other courses if he has been provided with multiple options. The 'S' and 'N' grades do not carry grade-points and hence not included in the TGPA, CGPA computations.

### **ASSOCIATION**

- Every Post Graduate student of the University shall be associated with the Parent Department, throughout his study period.
- The schedule of academic activities for a term, including the dates of registration, mid-term examinations, end-term examination, inter-term vacation, etc. shall be referred to as the Academic Calendar of the term, and announced at least two weeks before the closing date of the previous term.

### **PRE-REGISTRATION**

- In order to facilitate proper planning of the academic activities of a term, it is essential for the students to declare their intent to register for a course well in advance, before the actual start of the academic session, through the process of Pre-Registration, which is mandatory for all those students of second or subsequent term who propose to deviate from recommended scheme of studies.
- Pre-registration is an expression of intention of a student to pursue particular course(s) in the next term. It is an information for planning for next term. Every effort will be made to arrange for a course opted by the student. However, it is not obligatory on the part of the university to offer the course(s) and no course may be offered if the number of students opting for the course is less than 15 or 25 percent of the admission strength whichever is less.
- If a student fails to pre-register it will be presumed that he will follow suggested normal scheme of studies provided that he is progressing at a normal pace. For remaining students the HOD of the parent department will plan for courses as per the convenience of the department.

### **REGISTRATION TO COURSES**

- Every Student after consulting his Faculty-Advisor is required to register for the approved courses with the HOD of parent

- department at the commencement of each term on the days fixed for such registration as notified in the academic calendar.
- A student shall register for courses from amongst the courses being offered in the term keeping in mind the minimum and maximum credits allowed for a degree and other requirements i.e. pre-requisite, if any, TGPA & CGPA after consulting the Faculty Advisor. No registration will be valid without the consent of HOD of the parent department.
  - A student will be permitted to register in the next term as per the suggested normal scheme only if he fulfills the following Conditions:
    - (a) Satisfied all the Academic Requirements to continue with the programme of studies without termination.
    - (b) Cleared all university, library and hostel dues and fines (if any) of the previous term.
    - (c) Paid all required advance payments of the university and hostel for the current term.
    - (d) Not been debarred from registering on any specific ground by the university.
  - The students will be permitted to register for course(s) being offered in a term other than his normal suggested scheme provided that the time table permits.
  - The registration in the critical cases will be done as per the priority given below:
    - (a) Fulfillment of minimum credit requirement for continuation,
    - (b) The completion of programme in minimum period needed for degree, (Those who need to improve TGPA/CGPA)
    - (c) The fulfillment of pre-requisite requirement of courses.
  - Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.
  - REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the DAA after the recommendation of HOD through the guardian of the student.
  - Credits will be awarded in registered courses only.

### **TEACHING PRACTICE**

- A Student is required to do two courses (one one-credit course and the other a two-credit course) for Teaching Practice under the guidance of HOD. Here the student is required to be engaged in teaching of two UG courses of his choice each for two hours per week in any of the two terms during the programme.

### **REGISTRATION- REVISION**

- A student has the option to ADD courses for registration till the date specified for late registration in the Academic Calendar.
- On recommendation of the Teaching Department as well as the Parent Department, a student has the option to DROP courses

from registration until two weeks after the commencement of the classes in the term, as indicated in the Academic Calendar.

- A student can register for auditing a course, or a course can be converted from credit to audit or from audit to credit, with the consent of the Faculty Advisor and Course Instructor within two weeks after the commencement of the classes in the term as indicated in the Academic Calendar. However, CORE Courses shall not be available for audit.

### ATTENDANCE REQUIREMENTS

- LU academic programmes are based primarily on the formal teaching-learning process. Attendance in classes, participating in classroom discussions and participating in the continuous evaluation process are the most essential requirements of any academic programme.
- Attendance will be counted for each course scheduled teaching days as per the academic calendar.
- The attendance requirement for appearing in end term examination shall be a minimum of 75% of the classes scheduled in each course.

### LEAVE OF ABSENCE

- The leave of absence must be authorized as per regulations.
- A student short of attendance in a course (less than needed after leave of absence and condonation by VC) will be awarded 'FF' grade in the course.
- All students must attend all lecture, tutorial and practical classes in a course. The attendance will be counted course wise.
- To account for approved leave of absence e.g. representing the University in sports, games or athletics; professional society activities, placement activities, NCC/NSS activities, etc. and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes scheduled in each course to appear in the examination.
- A student with less attendance in a course during a trimester, in lectures, tutorials and practicals taken together as applicable, shall be awarded 'FF' grade in that course, irrespective of his academic performance, and irrespective of the nature of absence.
- If the period of leave is more than three days and less than two weeks, prior application for leave shall have to be submitted to the HOD concerned, with the recommendation of the Faculty-Advisor, stating fully the reasons for the leave requested, along with supporting documents.
- If the period of leave is two weeks or more, prior application for leave shall have to be made to the DAA with the recommendations of the Faculty-Advisor, HOD concerned stating fully the reasons for the leave requested, along with the supporting documents. The DAA may, on receipt of such

application, grant leave or decide whether the student be asked to withdraw from the course for that particular term because of long absence.

- If a student fails to apply and get sanction for absence as in (a) and (b) above, his parent/guardian may apply to the VC with reasons duly recommended by the faculty advisor, HOD and DAA and explain in person to the VC the reasons for not applying in time. The VC will consider on merit and decide to grant the leave or withdrawal from the course for that particular term subject to any condition that he may like to impose. The decision of the VC shall be final and binding.

### ABSENCE DURING EXAMINATIONS

- A student who has been absent during Mid-term Examination due to illness and/or any exigencies may give a request for make-up examination within one week after the Mid-term Examination to the HOD with necessary supporting documents in person. The HOD may consider such requests depending on the merits of the case, and after consultation with the course instructor, may permit the Make-up examination for the Student concerned. However, no makeup examination will be permitted if the attendance in the course is less than 60% till the date of examination.
- In case of absence from End-term Examination of a course(s) on Medical ground and/or other special circumstances, the student can apply for award of 'I' grade in the course(s) with necessary supporting documents and certifications by an authorized person to the HOD within one week after the End-term Examination. The HOD may consider the request, depending on the merit of the case, and after consultation with the Course(s) Instructor(s)/ faculty advisor permit the MET Examination for the student concerned. The student may subsequently complete all course requirements within the date stipulated by BOS (which may possibly be extended till first week of trimester under special circumstances) and 'I' grade will then be converted to an appropriate Double-letter grade, as per Clause No: G5.9. All the details of such a decision with date of finalizing the grade shall be communicated to DAA. If such an application for the 'I' grade is not made by the student then a double-letter grade will be awarded based on his term performance.

### COURSE CREDIT ASSIGNMENT

- Every Course comprises of specific Lecture-Tutorial-Practical (L-T-P) Schedule. The credits for various courses are shown in the Schemes of Studies & syllabus.
- The Academic Performance Evaluation of a Student shall be according to a Letter Grading System, based on the Class Performance Distribution.
- The double-letter grade (AA, AB, BB, BC, CC, CD, DD, FF)

indicates the level of academic achievement, assessed on a decimal (0-10) scale.

#### Letter-Grades and Grade-Points:

LETTER-GRADE	GRADE-POINTS	REMARKS
AA	10	
AB	9	
BB	8	
BC	7	
CC	6	
CD	5	
DD	4	
FF	0	Fail
I	-	Incomplete
U	-	Audited
W	-	Withdrawal
S	-	Satisfactory
N	-	Unsatisfactory

#### DESCRIPTION OF GRADES

- An 'AA' grade stands for outstanding performance, relative to the class which may include performance with previous batches. The Course Instructor is supposed to take utmost care in awarding of this highest double-letter grade.
- The 'DD' grade stands for marginal performance and is the minimum passing double-letter grade.
- The 'FF' grade denotes very poor performance, i.e. failure in a course, and the Course Instructor is supposed to take utmost care while awarding this lowest double-letter grade.
- A student, who obtains 'FF' grade in a core course, has to repeat (re-register) that core course, in subsequent trimesters/sessions whenever the course is offered, until a passing grade is obtained. However, for an elective course in which 'FF' grade has been obtained, the student may either repeat the same course, or register for any other elective course.
- An 'I' grade denotes incomplete performance in any course due to absence at the end term examination (see also Clause No: G7.4). When the 'I' grade is converted to a regular double letter grade, a penalty of ONE Grade-Point is imposed, by awarding the double-letter grade that is immediately below the one that the student would have otherwise received except when the student has 95% attendance record in the subject concerned. For example, if on the basis of the performance including MET Examination, a student gets AB grade, he will be awarded BB grade if not under exception rule.
- 'U' grade is awarded in a course that the student opts to register for audit. It is not mandatory for the student to go through the entire regular process of evaluation in an audit course. However, the student has to go through some process of minimal level of

evaluation and also the minimum attendance requirement, as stipulated by the Course Instructor and approved by the corresponding BOS, for getting the 'U' grade awarded in a course, failing which that course will not be listed in the Grade Card.

- A 'W' grade is awarded when the student withdraws from the course. Withdrawal from a course is permitted only under extremely exceptional circumstances (like medical emergencies, family tragedies and/or other unavoidable contingencies) and has to be recommended by the HOD and approved by the DAA. However, no withdrawal is permitted after the finalization of the grades in the term.
- 'S'/'N' These grades are awarded for the Mandatory Learning Courses. The 'S' grade denotes satisfactory performance and completion of a course. The 'N' grade is awarded for non-completion of course requirements and the student will have to register for the course until he obtains the 'S' grade.

#### FEEDBACK TO STUDENTS

- A student requires feedback on the progress of his learning. For this purpose, the Instructor will conduct at least two quizzes for a theory course in a term-one before Mid-term Examination and the other there after. The quizzes will form a component of class work, the other components being tutorials, home assignments or any other mode.
- For a laboratory course, the continuous assessment's feedback will be given through the laboratory records which are required to be submitted after performing the experiment in the next laboratory class.

#### EVALUATION

- The double-letter grade awarded to a student in a course other than a practical course i.e. 0-0-P course for which he has registered, shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to one mid-term examination and end-term examination. The weightage of these components of continuous evaluation may be as follows:

End-term Examination	:	50%
Mid-term Examinations	:	30%
Quizzes, Tutorials, Assignments, etc.	:	20%
(Several over the term)		
Total	:	100%
- The double letter grade awarded to the student in a practical course i.e. 0-0-P course will be based on his performance in regular conduct of experiments, viva voce, laboratory report, quizzes etc., in addition, to term practical examination. The weightage of the components of continuous evaluation may be as follows:

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Conduct of Experiments (as per syllabus)	:	40%
Lab Record	:	10%
Quizzes/Viva Voice	:	20%
End-term Examination	:	30%
Total	:	100%

- The University shall conduct the End-term examination for all theory courses being taught in the term.
- The answer books of all Mid-term Examination and End-term Examination will be shown to the students within three days of the last paper. It is the responsibility of the student to check this evaluation and affix his signature in confirmation.
- If the student finds some discrepancy, he should bring it to the notice of the Course Coordinator. The Course Coordinator will look into the complaint and remove the doubts of the student and proceed with the work of grading.
- If a student is not satisfied with the award of the grade after the announcement of the grades, he may appeal on a Grievance Form duly filled in along with the fee receipt for this purpose to the HOD of the parent department within one week of the following term. The HOD will forward the form along with his recommendation based on the records of the case to DAAB within the date specified in the Academic Calendar.

### SCHEME OF EXAMINATION

- The duration of examinations for a theory course will be 3 hours for end-term examination 1½ hours for mid-term examination.
- The pattern of question paper/examination will be as under:
- **Theory Courses:**  
The University shall conduct the End-term examination for all theory courses being taught in the term.
  - (a) There will be eight questions in all distributed over all the units in a course syllabus. The question paper will be in three parts with weightage 20 percent, 40 percent and 40 percent respectively.
  - (b) Part-A will be short answer type with multiple parts covering all the units in the syllabus, which will be compulsory.
  - (c) Part-B will have three questions from any three units, which will have long answers of derivation/descriptive type. Two questions are to be answered from this part.
  - (d) Part-C will consist of four questions from the remaining four units and they will be of problem solving type in order to measure ability on comprehension /analysis /synthesis / application. The relevant data will be made available. The student is required to solve two questions. However, for Part-C, the external examiner may select the questions from the question bank supplied by LU.
- Students are allowed in the examination the use of single memory, non-programmable calculator. However, sharing of calculator is not permitted.

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- **Laboratory Courses:**
  - (a) The End-term Examination in laboratory course will be conducted jointly by an external examiner (other than the instructor) and an internal examiner (the coordinator / instructor) jointly.
  - (b) The student will be given randomly an experiment to perform from within the list of experiments in the course.
  - (c) No change in the experiment will be permitted after the draw, if the student had performed the same in the class.
- **Mid-Term Examination:**  
Question 1 is compulsory covering all topics taught till then. Question 2 and 3 will be essay type, out of which student will answer any one. Question 4 and 5 will be to measure to ability of analysis / comprehension / synthesis / application. The student will answer any one.

### TRANSPARENCY

- The answer books of all Mid-term Examination and End-term Examination will be shown to the students within three days of the last paper. It is the responsibility of the student to check this evaluation and affix his signature in confirmation.
- If the student finds some discrepancy, he should bring it to the notice of the Course Coordinator. The Course Coordinator will look into the complaint and remove the doubts of the student and proceed with the work of grading.
- The entire process of evaluation shall be transparent, and the course instructor shall explain to a student the marks he is awarded in various components of evaluation.

### RESULT

- The final marks shall be displayed on the notice board for ONE day, (the date of which will be indicated in the academic calendar). A student can approach the concerned course instructor(s) for any clarification within Two days of display. The process of evaluation shall be transparent and the students shall be made aware of all the factors included in the evaluation. In case of any correction, the course instructor shall have to incorporate the same before finalization of the grades.
- The Student's Grade Card shall contain the Letter-Grade for each registered course; along with the TGPA at the end of the term, and the CGPA at the completion of the programme.

### APPEAL FOR REVIEW OF GRADE

- The entire process of evaluation shall be transparent, and the course instructor shall explain to a student the marks he is awarded in various components of evaluation.
- In case of any grievance about the grades, the student may appeal for review of grades to the Departmental Academic Appeals Board (DAAB) before the date specified in Academic Calendar.

- The fee for such an appeal will be decided from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student without interest.
- VC shall have power to quash the result of a candidate after it has been declared, if
  - he is disqualified for using malpractice in the examination;
  - a mistake is found in his result;
  - he is found ineligible to appear in the examination

### AWARD OF DIVISIONS

- The overall performance of a student will be indicated by two indices:
  - TGPA** which is the Term Grade Point Average
  - CGPA** which is the Cumulative Grade Point Average

**TGPA for a Term is computed as follows:**

$$TGPA = \frac{\sum C_i G_i}{\sum C_i}$$

Where,

$C_i$  denotes credits assigned to  $i^{th}$  course with double-letter grade, and  $G_i$  denotes the grade point equivalent to the letter grade obtained by the student in  $i^{th}$  course with double-letter grade, including all 'FF' grades in that term.

**CGPA is computed as follows:**

$$CGPA = \frac{\sum C_i G_i}{\sum C_i}$$

Where,

$C_i$  denotes credits assigned to  $i^{th}$  course with double-letter grade, and  $G_i$  denotes the grade point equivalent to the letter grade obtained by the student in  $i^{th}$  course for all courses with double-letter grades, including all 'FF' grades in all terms at the end of the programme.

For CGPA calculation, the following grades are to be counted:

- Grades in all core courses,
  - The best grades in the remaining eligible courses to fulfill the minimum credits requirement for a programme.
- The degree will be awarded only upon compliance of all the laid down requirements for programme as under:
    - There shall be University requirement of earning a minimum credits for a degree, satisfactory completion of mandatory learning courses and other activities as per the course structure.
    - There shall be a minimum earned credit requirement on all Departmental core courses, Elective course and Major Project as specified by BOS.
    - There shall be a maximum duration for complying to the degree requirement.
    - The candidate will be placed in First Division with Honours / First Division with Distinction/First Division/Second Division which will be mentioned on the degree certificate as under:

DIVISION	CONDITIONS TO BE FULFILLED
First Division with Honours	CGPA $\geq$ 8.5 No 'FF', N or W grade in any course during the programme
First Division with Distinction	CGPA $\geq$ 8.5
First Division	CGPA $\geq$ 6.75
Second Division	CGPA $\geq$ 5.0 but $<$ 6.75

**Note:** Although, there is no direct conversion from grades to marks, however, for comparison purposes percentage of marks may be assumed to be CGPA multiplied by nine.

### M. TECH. DEGREE REQUIREMENTS

- The requirements for the M.Tech. degree programme are as follows:
  - University Requirements:**
    - Minimum Earned Credit Requirement for Degree which is 90.
    - Securing a CGPA of at least 5.5.
    - Satisfactory completion of Seminars & Teaching Practice
  - Programme Requirements:**  
Minimum Earned Credit Requirements on all compulsory courses, Core Courses, Elective Courses and dissertation as specified by the BOS and conforming to Course Structure given above.
  - The Maximum duration for a student for complying to the degree requirement from the date of registration for his first Term, is FOUR years for full-time registration and FIVE years for part-time registration.

### GRADE IMPROVEMENT

- A student may be allowed to improve CGPA in an appropriate term if his CGPA falls below 5.5.

### TERMINATION FROM THE PROGRAMME

- A student shall be required to leave the University without the award of the Degree, under the following circumstances:
  - If a student fails to earn the minimum credits specified below:

#### (i) Full-time student

Check Point	Credit Threshold *
End of FIRST year	20

#### (ii) Part-time student

Check Point	Credit Threshold *
End of FIRST year	15
End of SECOND year	30

\* If at any stage, a student fails to cross the threshold with a minimum CGPA of 5.5, he will be treated as a critical case and will be advised to improve the grades.

**Note:** The period of temporary withdrawal is not to be counted for the above Credit Threshold.

- (b) If a student is absent for more than 4 (Four) weeks in a Term without sanctioned leave.
- (c) Based on disciplinary action to that effect approved by the AC, on the recommendation of the appropriate committee.
- Under any circumstances of termination, the conditions specified in Permanent Withdrawal shall also apply.

## WITHDRAWAL FROM PROGRAMME

### **Temporarily:**

- A student who has been admitted to a degree programme of the University may be permitted to withdraw temporarily, for a period of one term or more, on the grounds of prolonged illness or grave calamity in the family, etc., provided:
  - (i) He applies to the LU stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent / guardian
  - (ii) There are no outstanding dues or demands, from the Departments / LU / Hostels / Library and any other centers;
  - (iii) Scholarship holders are bound by the appropriate Rules applicable to them.
  - (iv) The decision of the VC of the LU regarding withdrawal of a student is final and binding.
- Normally, a student will be permitted only one such temporary withdrawal during his tenure as a student and this withdrawal will not be counted for computing the duration of study.

### **Permanently:**

- Any student who withdraws permanently admission before the closing date of admission for the Academic Session is eligible for the refund of fee as per the University rules. Once the admission for the year is closed, the following conditions govern withdrawal of admission:
- A student who wants to leave the LU for good, will be permitted to do so (and take Transfer Certificate from the LU, if needed), only after clearing all the dues for the remaining duration of the course.
- A student who has received any scholarship, stipend or other form of assistance from the LU shall repay all such amounts, in addition, to those mentioned in clause No. G8.2 (a) above.
- The decision of the VC regarding all aspects of withdrawal of a student shall be final and binding.

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**Scheme of Studies  
and  
Syllabus**

**M. Tech.  
Civil Engineering  
(Full Time/Part Time)**

**M. Tech.  
Civil Engineering**

**OBJECTIVES**

The student is provided with an opportunity to acquire deeper knowledge of and proficiency in:

1. **Analytical and Application oriented courses:** numerical methods, computer method in engineering, finite element methods.
2. **Geotechnical cum Environmental Engineering:** Site exploration for inherent properties of soil, design of foundations, sewerage system and water quality control system.
3. **Structural Engineering:** Design of buildings, I Highways, Tunneling, Power Houses, Dam, Elevated and underground water tanks etc., and construction management: planning scheduling, controlling and execution.
4. **Irrigation and Water Resources:** Water Storage capacity, design of different type Design of Hydraulic Structure; Dams, aqueduct, siphon aqueduct, cross drainage, canal, etc.

**Scheme of Studies  
M.Tech. (Civil Engineering)  
(Full Time)**

<b>1<sup>st</sup> Year</b>				
<b>TERM – I</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	MA-501	Numerical Techniques	5-1*-0	4
2	CE-501	Construction Contract and Contracting	5-1*-0	4
3	CE-502	Advanced Water & Waste Water	5-1*-0	4
4	CE-553	Simulation Lab	0-0-4	2
5	CE-554	Water & Waste Water Lab	0-0-4	2
<b>15-3-8 (26)</b>				<b>16</b>

<b>TERM – II</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-505	Water Shed Management and Planning	5-1*-0	4
2	CE-506	Disaster and Management System	5-1*-0	4
3	CE-507	Construction Safety and Quality Management	5-1*-0	4
4		Elective - I	5-0-0	3
5	CE-558	Transportation Lab	0-0-4	2
<b>20-3-4 (27)</b>				<b>17</b>

<b>TERM – III</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-509	Advanced Highway Engineering	5-1*-0	4
2	CE-510	Design of Water and Waste water System	5-1*-0	4
3		Elective – II	5-0-0	3
4	CE-561	Highway Lab	0-0-4	2
5	CE-562	Seminar-I	0-0-2	1
<b>15-2-6 (23)</b>				<b>14</b>

**Scheme of Studies  
M.Tech. (Civil Engineering)  
(Full Time)**

<b>2<sup>nd</sup> Year</b>				
<b>TERM – IV</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-601	Advance Geotechnology	5-1*-0	4
2	CE-602	Design of Bridge and Tunnels	5-1*-0	4
3	CE-651	Advance Geotechnology Lab	0-0-4	2
4	CE-653	Dissertation Preliminary**	0-0-10	(5)
5	CE-654	Seminar-II	0-0-4	2
<b>10-2-18 (30)</b>				<b>12</b>

<b>TERM – V</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-605	Analysis & Design of Pre-stress Concrete Structures	5-1*-0	4
2	CE-656	Dissertation Phase-I **	0-0-12	(6)
3	CE-657	Seminar – III	0-0-4	2
4	CE-658	Minor Project	0-0-6	3
<b>5-1-22 (28)</b>				<b>9</b>

<b>TERM – VI</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-659	Dissertation Phase-II	0-0-24	12+5+6
2	CE-660	Teaching Practice-I***		(2)
3	CE-661	Teaching Practice-II		2+2
<b>0-0-24 (24)</b>				<b>27</b>

**Scheme of Studies  
M.Tech. Civil Engineering  
(Full Time)**

<b>LIST OF ELECTIVES</b>					
S.N.	Elective	Course No.	Course Name	L-T-P	Cr
<b>Structural Engineering</b>					
1	Elective – I	CE-521	Advanced Design of Reinforced Concrete Structures	5-0-0	3
2	Elective – II	CE-531	Structural Dynamics	5-0-0	3
<b>Water Resources Engineering</b>					
1	Elective – I	CE-522	Water Resources and Modeling	5-0-0	3
2	Elective – II	CE-532	Under Ground Seepage Modeling and Hydraulics	5-0-0	3
<b>Transportation Engineering</b>					
1	Elective – I	CE-523	Design and Planning of Railway Engineering	5-0-0	3
2	Elective – II	CE-533	Airport, Docks and Harbor Structures	5-0-0	3
<b>Construction Management</b>					
1	Elective – I	CE-524	Construction Operation and management	5-0-0	3
2	Elective – II	CE-534	Construction Planning and Equipment Management	5-0-0	3
<b>Environment Engineering</b>					
1	Elective – I	CE-525	Environment Impact and Risk Assessment	5-0-0	3
2	Elective – II	CE-535	Environmental Management and Sustainable Development	5-0-0	3

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits

**FINAL EVALUATION IN GRADES**

- \* Period will be used for self study resulting in submission of Term Paper.
- \*\* Credits earned (5/6) through evaluation will be added in Term-VI under the course CE-659 Dissertation Phase-II.
- \*\*\* Credits earned (2) through evaluation will be added under course CE-661 Teaching Practice-II. It is a mandatory learning course.

**Scheme of Studies  
M.Tech. Civil Engineering  
(Part Time)**

<b>1<sup>st</sup> Year</b>
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<b>TERM – I</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	MA-501	Numerical Techniques	5-1*-0	4
2	CE-501	Construction Contract and Contracting	5-1*-0	4
3	CE-553	Simulation Lab	0-0-4	2
<b>10-2-4 (16)</b>				<b>10</b>

<b>TERM – II</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-502	Advanced Water & Waste Water	5-1*-0	4
2	CE-505	Water Shed Management and Planning	5-1*-0	4
3	CE-554	Water & Waste Water Lab	0-0-4	2
<b>10-2-4 (16)</b>				<b>10</b>

<b>TERM – III</b>				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-506	Disaster and Management System	5-1*-0	4
2	CE-507	Construction Safety and Quality Management	5-1*-0	4
3	CE-558	Transportation Lab	0-0-4	2
<b>10-2-4 (16)</b>				<b>10</b>

**Scheme of Studies  
M.Tech. (Civil Engineering)  
(Part Time)**

**2<sup>nd</sup> Year**

TERM – IV				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-509	Advanced Highway Engineering	5-1*-0	4
2		Elective - I	5-0-0	3
3	CE-561	Highway Lab	0-0-4	2
<b>10-1-4 (15)</b>				<b>9</b>

TERM – V				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-601	Advance Geotechnology	5-1*-0	4
2		Elective–II	5-0-0	3
5	CE-651	Advance Geotechnology Lab	0-0-4	2
<b>10-1-4 (15)</b>				<b>9</b>

TERM – VI				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-510	Design of Water and Waste Water System	5-1*-0	4
2	CE-658	Minor Project	0-0-6	3
3	CE-562	Seminar-I	0-0-2	1
<b>5-1-8 (14)</b>				<b>8</b>

**Scheme of Studies  
M.Tech. (Civil Engineering)  
(Part Time)**

**3<sup>rd</sup> Year**

TERM – VII				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-602	Design of Bridge and Tunnels	5-1*-0	4
2	CE-653	Dissertation Preliminary**	0-0-10	(5)
3	CE-654	Seminar-II	0-0-4	2
<b>5-1-14 (20)</b>				<b>6</b>

TERM – VIII				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-605	Analysis & Design of Pre-stress Concrete Structures	5-1*-0	4
2	CE-656	Dissertation Phase-I **	0-0-12	(6)
3	CE-657	Seminar – III	0-0-4	2
<b>5-1-16 (22)</b>				<b>6</b>

TERM – IX				
S.N.	Course No.	Course Name	L-T-P	Cr.
1	CE-659	Dissertation Phase – II	0-0-24	12+5+6
2	CE-660	Teaching Practice-I***		(2)
3	CE-661	Teaching Practice-II		2+2
<b>0-0-24 (24)</b>				<b>27</b>

**Scheme of Studies**  
**M.Tech. Civil Engineering**  
**(Part Time)**

<b>LIST OF ELECTIVES</b>					
S.N.	Elective	Course No.	Course Name	L-T-P	Cr
<b>Structural Engineering</b>					
1	Elective – I	CE-521	Advanced Design of Reinforced Concrete Structures	5-0-0	3
2	Elective – II	CE-531	Structural Dynamics	5-0-0	3
<b>Water Resources Engineering</b>					
1	Elective – I	CE-522	Water Resources and Modeling	5-0-0	3
2	Elective – II	CE-532	Under Ground Seepage Modeling and Hydraulics	5-0-0	3
<b>Transportation Engineering</b>					
1	Elective – I	CE-523	Design and Planning of Railway Engineering	5-0-0	3
2	Elective – II	CE-533	Airport, Docks and Harbor Structures	5-0-0	3
<b>Construction Management</b>					
1	Elective – I	CE-524	Construction Operation and management	5-0-0	3
2	Elective – II	CE-534	Construction Planning and Equipment Management	5-0-0	3
<b>Environment Engineering</b>					
1	Elective – I	CE-525	Environment Impact and Risk Assessment	5-0-0	3
2	Elective – II	CE-535	Environmental Management and Sustainable Development	5-0-0	3

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits

**FINAL EVALUATION IN GRADES**

- \* Period will be used for self study resulting in submission of Term Paper.
- \*\* Credits earned (5/6) through evaluation will be added in Term-VI under the course CE-659 Dissertation Phase-II.
- \*\*\* Credits earned (2) through evaluation will be added under course CE-661 Teaching Practice-II. It is a mandatory learning course.

## DETAILED SYLLABUS

<b>CE-501</b>	<b>CONSTRUCTION CONTRACT AND CONTRACTING</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **CONSTRUCTION SPECIFICATIONS:** Standard specifications; development interpretation.
2. **CONTRACTS AND:** Engineering contracts and its formulation; definition and essentials of a contract; types of contracts and clauses for contracts.
3. **MANAGEMENT OF CONTRACTS:** Preparation of tender documents Issues related to tendering process; awarding contract.
4. **PERFORMANCE OF CONTRACTS:** Discharge of a contract classification of contracts Indian Contract Act 1872 extracts and variations in engineering contracts
5. **PERFORMANCE PROVISION OF CONTRACT:** Time of performance provisions of contract law breach of contract; contracts for projects under international AID.
6. **LAWS RELATED TO CONSTRUCTION INDUSTRY:** Labour and industrial laws payment of wages act; contract labor workmen's compensation act insurance; industrial dispute act.
7. **ARBITRATION OF ENGINEERING CONTRACTS:** Indian Arbitration Act 1940 issues in arbitration process institutional arbitration alternate dispute resolution; the arbitration and reconciliation ordinance 1996 Law on contracts 1994.

### REFERENCE BOOKS

1. "Codes of Practice and Standard Specifications" of AP PWD, CPWD, MES, etc.
2. Vasavada, B. J., "Engineering Contracts and Arbitration", March 1996
3. Gajaria, G. T., "Laws Relating to Building and Engineer's Contracts", M.M. Tripathi Pvt. Ltd., Mumbai, 1985.
4. Namavat, Roshan, "Professional Practice", Anupbhai Publications
5. Horgon, M. O'c and Roulstion, F. R., "Project Control of Engineering Contracts", E and FN, SPON, Ny, 1988.
6. Collex, K., "Managing Construction Contracts", Reston Publishing Company, Virginia, 1982.
7. Park, W.B., "Construction Bidding for Projects", John Wiley, 1978.

<b>CE-502</b>	<b>ADVANCE WATER AND WASTE WATER</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **WATER QUALITY:** Quality specifications and requirements.
2. **PURIFICATION:** Principle of sedimentation, coagulation, filtration and disinfection
3. **DEMINERALIZATION:** Iron, manganese, fluorides; removal of total solids.
4. **TREATMENT OF WATER:** Design and operational details of units employed for water treatment; typical sketches, plan and sections of important units.
5. **SEWAGE TREATMENT:** Objectives of sewage treatment; unit operation.
6. **ADVANCED WATER TREATMENT METHODS:** Principle of physical and biological methods of sewage treatment and management of sludge.
7. **WATER TREATMENT PLANT:** Study of water treatment plant; relevant layout; line diagram, etc.

### REFERENCE BOOKS

1. Fair G. M., Geyer J. C. and Okun D. A., "Water and Waste Water Engineering", Abe Books, 1968
2. "Water Quality and Treatment", 5th Edition, American Water Works Association, 1999
3. "Water Treatment Manual", CPHEEB
4. Ernest W. Steel, "Water Supply and Sewerage", 4th Edition, McGraw Hill, 1991

<b>CE-505</b>	<b>WATER SHED MANAGEMENT AND PLANNING</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **WATER RESOURCES PLANNING:** Objectives, Economic benefit, cost objectives long run; short run benefit; and cost functions; theory of consumer behaviour theory of the firm; production function; demand, supply and market equilibrium.
2. **IDENTIFICATION AND EVALUATION:** Water management plans; plan formulation; planning models; selection procedures; objective functions; constraint equations; linear programming ;
3. **DYNAMIC PROGRAMMING:** Application to allocation problem water supply capacity expansion; reservoir operation-simulation; search methods; water distribution systems; network simulation optimization models for design of branched and looped systems.
4. **DETERMINISTIC RIVER BASIN MODELING:** Stream flow estimation-storage firm yield analysis for water supply; hydro electric power production; storage firm energy analysis; flood

control alternatives-reservoir storage for flood control; withdrawals; diversions of water model synthesis.

5. **PLANNING AND EXPANSION:** Water resources systems linear programming and dynamic programming models; multi objective models; plan formulation and selection.
6. **GROUND WATER SYSTEMS:** Types of ground water management models; simulation of ground water systems; hydraulic management models; embedding approach (basic concepts only).
7. **SURFACE WATER QUALITY PREDICTION AND SIMULATION:** Types of models; development criteria; steady state models of river and estuarine systems; multi reach models; non-point source pollution models; urban runoff models.

**REFERENCE BOOKS**

1. Loucks, D. P., Stedinger J. R. and Haith, D. A., "Water Resources Systems Planning and Analysis", Prentice Hall, 1981
2. Goodman, A. A., "Principles of Water Resources Planning", Prentice Hall, 1984
3. Wills, Robert and Yeh, W. W. G, "Ground Water Planning and Management", Prentice Hall, 1987

<b>CE-506</b>	<b>DISASTER REDUCTION AND MANAGEMENT</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **NATURAL DISASTERS:** Natural disasters earthquake, floods; drought; coastal hazards; landslides; rockslides and forest fires.
2. **ELEMENTS OF ENGINEERING SEISMOLOGY:** Elements of engineering seismology earthquake phenomenon; earthquake recording instruments.
3. **INTRODUCTION TO THEORY OF VIBRATIONS:** Introduction to theory of vibrations single degree un-damped and damped systems; elastic response to simple load functions and earthquake response spectra's.
4. **PERFORMANCE OF BUILDINGS AND STRUCTURES:** Performance of buildings and structures main causes of damage: intensity of earthquake forces; lack of strength and integrity in buildings; quasi- resonance; lack of ductility;
5. **LACK OF DETAILING. EARTHQUAKE EFFECTS:** Lack of detailing. earthquake effects on ground and soil liquefaction; buildings; structures; power plants; switch yards; equipments and other lifeline structures; release of poisonous gases and radiation.
6. **LESSONS LEARNT FROM THE PAST EARTHQUAKES:** Lessons learnt from the past earthquakes case studies of important Indian earthquakes and major world earthquakes.

7. **DISASTER MANAGEMENT:** Disaster management salient features of disaster rescue; risk management and casualty management

**REFERENCE BOOKS**

1. Prakash, Indu, "Disaster Management" Rashtra Prahari Prakashan, Sahibabad, 1994
2. Jai Krishna, Chandrasekharan A. R. and Chandra, Brijesh, "Elements of Earthquake Engg", 2nd Edition, South Asian Publishers, New Delhi, 1994
3. Stratta, James L., "Manual of Seismic Design", Pearson Education, 2004
4. Manickaselvam, V.K., "Introduction to Earthquake Analysis and Design", Dhanpat Rai Publications.

<b>CE-507</b>	<b>CONSTRUCTION SAFETY AND QUALITY MANGEMENT</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **INTRODUCTION:** HSE (safety, health and environment); list of laws and regulation relative to HSE; statutory permission / approval on HSE.
2. **COSTAL MANAGEMENT SYSTEM:** Impetus for draft notification; categorization of costal zones; implication time frame; list of ecological sensitization area; ESA.
3. **INDUSTRIAL SAFETY HEALTH:** World congress in safety; declaration exaction on OSH 2005-2008; Europeans commission studies.
4. **SAFETY MANAGEMENT:** prosiest; comical lab.; power head; desisted head; global stimulus; Sutras on redaction and emergency preparedness; action plan ; list of ISO 14000 family and environmental; structure building; mental health and cyclonical introduction; principle; action of minimum; response; life style. Santa able development; body mass indexed; emission standard of commons in instigators.
5. **QUALITY STANDARDS IN CONSTRUCTION:** Standards for various building materials and other inputs for construction processes; methods and techniques for construction outputs; products and Services; Indian standards; British, American, German and Japanese standards; study, comparisons and equivalence.
6. **MANAGING QUALITY IN CONSTRUCTION:** Building quality into designs of structures; inspection of incoming materials and machinery; in-process quality inspections and tests. designing of quality manuals; checklists and inspection reports; installing the quality assurance system; monitoring and control; quality assurance department and quality control responsibilities of the

line organization; quality in foundations and pilling work; structural work; concreting; electrical system; buildings facilities; waste recycling and maintenance.

- 7. DEVELOPING QUALITY CULTURE IN THE ORGANIZATION:** Training of people; mineralization of operations; benchmarking quality; synergy; quality circles. ISO 9000; ISO 14000 & QS 9000 standards and certification procedures.

**REFERENCE BOOKS**

- Farrilaro, Josy J., "Handbook of Human Resources Administration", International Edition, McGraw-Hill, 1987
- Dwivedi, R. S., "Human Relations and Organizational Behavior", Macmillan, 1995
- Manoria, C. B., "Personnel Management", Himalaya Publishing House, 1992.
- Coulter, Corlecton and Coulter, Jill, "The Complete Standard Hank Book of Construction Management", Prentice Hall, 1989.
- Juran, Frank J. M. and Gryna F. M., "Quality Planning and Analysis", Tata McGraw Hill, 1982.
- Grant, E.L. and Leavensworth, "Satisfical Quality Control", McGraw Hill, 1984.

<b>CE-509</b>	<b>ADVANCED HIGHWAY ENGINEERING</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

- 1. HIGHWAY DEVELOPMENT AND PLANNING:** Highway development in India; necessity for highway planning; different road development plans; classification of roads; road network patterns; highway alignment; factors affecting alignment; engineering surveys; drawings and reports.
- 2. HIGHWAY GEOMETRIC DESIGN:** Importance of geometric design; design controls and criteria; highway cross section elements; sight distance elements; stopping sight distance; overtaking sight distance and intermediate sight distance; design of horizontal alignment; design of super elevation and extra widening; design of transition curves; design of vertical alignment; gradients; vertical curves.
- 3. TRAFFIC ENGINEERING:** Basic parameters of traffic-volume; speed and density; traffic volume studies; data collection and presentation; speed studies; data collection and presentation; parking studies and parking characteristics; road accidents; causes and preventive measures; accident data recording; condition diagram and collision diagrams.
- 4. TRAFFIC REGULATION AND MANAGEMENT:** Road traffic signs; types and specifications; road markings; need for road markings; types of road markings; design of traffic signals; Webster method; and IRC method.

- 5. INTERSECTION DESIGN:** Types of intersections; conflicts at intersections; types of at-grade intersections; canalization objectives; traffic islands and design criteria; types of grade separated intersections; rotary intersection; concept of rotary and design criteria; advantages and disadvantages of rotary intersection.
- 6. ANALYSIS OF PAVEMENTS:** Pavement types; design factors; equivalent single wheel and axle loads; stresses in flexible and rigid pavements.
- 7. DESIGN OF PAVEMENTS:** Design of flexible pavements group index method; CBR method; California resistance value method; tri-axial method; bur misters method; McLeod's method; IRC method; analytical methods; design of rigid pavements PCA method; IRC methods; design of dowel and tie bars; overlay design: structural and functional distress in pavements; flexible and rigid pavement overlay design; IRC; TRRL; Asphatt Institute method and analytical methods.

**REFERENCE BOOKS**

- Khanna, S. K. and Justo C. E. G., "Highway Engineering", Nemchand and Bros., 7th Edition, 2000.
- Kadiyali, L. R. and Lal, "Highway Engineering Design", Khanna Publications
- Bindra, S. P., "Highway Engineering", 4th Edition, Dhanpat Rai & Sons, 1981
- Yoder E. J. and Witczak, M. W., "Principles of Pavement Design", John Wiley & Sons.
- Yang, H. Huang, "Pavement Analysis and Design", 2nd Edition, Prentice Hall, 2003
- Teng W. C., "Functional Designing of Pavements", McGraw Hill, 1980
- Chakraborty Partha and Das Animesh, "Principles of Highway Engineering", 3rd Edition, Prentice Hall of India

<b>CE-510</b>	<b>DESIGN OF WATER AND WASTE WATER SYSTEM</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

- 1. QUALITY PARAMETER:** Quality parameters of natural water bodies like lake; estuary; and river eutrophication.
- 2. POLLUTION:** Characteristics of point and non-point sources of pollution.
- 3. GROUND WATER:** Solution of diffusion and dispersion problems. ground water quality
- 4. PREVENTIVE MEASURES:** Sources of pollution; remedial and preventive measures.
- 5. DESIGN OF WATER QUALITY MODELS:** Design of water quality models; different component of plant design etc. analysis

study of quality water supply analysis study of water treatment plant

- MONITORING SYSTEMS:** Physical; chemical and bio monitoring of water; analytical study in demineralization or removal of total solids; analysis of hexavalent chromium and dissolve asphalt of water quality; analysis of radio active materials and vanadium; nitrogen.
- MONITORING STATION:** Guidelines for sample size and location of monitoring stations.

**REFERENCE BOOKS**

- Fair G. M., Geyer J. C. and Okun D. A., "Water and Waste Water Engineering", Abe Books, 1968
- "Water Quality and Treatment", 5th Edition, American Water Works Association, 1999
- "Water Treatment Manual", CPHEEB
- Ernest W. Steel, "Water Supply and Sewerage", 4th Edition, McGraw Hill, 1991

CE-521	ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES	L T P	Cr
		5 0 0	3

- BASIC DESIGN PHILOSOPHIES:** Limit state method comparison with working stress and ultimate load methods; comparison of different code regulations.
- BEHAVIOUR AND DESIGN OF REINFORCED CONCRETE:** Skeletal members considering flexure; shear torsion; combined with flexure and shear; space truss analogy; code regulations;
- DESIGN OF COMPRESSION MEMBER:** Analysis and design of axial compression members combined with flexure behaviour of short and slender column axial load with uni-axial bending construction and uses of interaction diagrams.
- SERVICEABILITY LIMITS STATES:** Estimation of deflection and crack widths in RC members; analysis and design of cracked sections.
- DESIGN OF SPECIAL RC STRUCTURE:** Analysis and design of special RC structures-deep beams; ribbed slabs corbels; bunkers and silos.
- YIELD LINE ANALYSIS:** Yield line analysis of slabs; yield line mechanisms; equilibrium and virtual work methods; circular slabs; non-rectangular slabs; Hiller Borg's strip method.
- FAILURE CRITERIA:** Structural failures; case history

**REFERENCE BOOKS**

- Hong, F. K. and Evans, R. H., "Reinforced and Pre-stressed Concrete", 3rd Edition, Van Nostrand Reinhold, 1987

- Client, W. F. "Plasticity on Reinforced Concrete", McGraw Hill, 1982
- Park, R. and Paulay, T., "Reinforced Concrete Structures", Wiley and Sons, 1975
- Fintel, Mark, "Handbook of Concrete Engineering", Springer, 1985
- Ramakrishna A. and Arthur P. D., "Ultimate Strength Design of Structural Concrete", A.H. Wheeler Publishing Company, 1977
- Purushothaman, P., "Reinforced Concrete Structural Elementary", Tata McGraw Hill
- "IS Codes- IS 456:2000, SP-16 Design Aids", Bureau of Indian Standards, New Delhi.
- Varghese, P. C., "Advanced Design of Reinforced Concrete", Prentice Hall of India, 1977
- MacGregor, J. C., "Reinforced Concrete Design", Prentice Hall, 1996

CE-522	WATER RESOURCES AND MODELING	L T P	Cr
		5 0 0	3

- SOIL CONSERVATION:** Land Use capability; soil erosion and hazard assessment; soil water conservation practices; water harvesting; agro; forestry and soil conservation.
- ESTABLISHMENT:** Characterization of watershed; establishment of watershed research station
- EVALUATION:** Watershed resources evaluation; slope protection and water conservation
- HUMAN IMPACT:** Managing human impacts on watersheds and water resources and understanding the interrelationships among land-use; soil; water.
- YIELD CRITERIA:** The course will focus on controlling the amount and timing of water yield; storm flow; and water quality.
- SOCIO-ECONOMIC:** sedimentation with socio-economic and policy considerations.
- RESOURCES AND PLANNING:** Human uses of and impacts on water; principles of water resource and watershed planning

**REFERENCE BOOKS**

- Ven Te Chow, "Handbook of Applied Hydrology", McGraw Hill, 1964
- Raghunath, H. M., "Groundwater", Wiley, 1990
- Linsely, R. K., Franzini, J. B., Freyberg, D. L. and Tchobanoglous, G., "Water Resources Engineering", McGraw Hill, 1992
- Dzurik, A.A., "Water Resources Planning", Rowman & Littlefield Publishers, Inc., 2002

CE-523	DESIGN AND PLANNING OF RAILWAY ENGINEERING	L T P	Cr
		5 0 0	3

- INTRODUCTION:** Introduction to railways engineering; permanent way components; cross section of permanent way.
- COMPONENT:** Functions of various components like rails; sleepers and ballast; rail fastenings.
- CREEP OF RAILS:** Creep of rails; theories related to creep adzing of sleepers; sleeper density.
- GEOMETRIC DESIGN:** Geometric design of rail track gradients; grade compensation.
- SUPER ELEVATION:** Cant and negative super elevation; cant deficiency.
- DESIGN OF CURVE:** Design of different type of curve; degree of curve; crossings and turn outs.
- PLANNING:** Planning of different type of rail track; scheduling and controlling by CPM.

#### REFERENCE BOOKS

- Chadula, S. P., "Railway Engineering: A Text Book of Transportation Engineering", S. Chand & Co., 2001
- August, "Railway Engineering", 15th Edition, Prabha and Co., 1994

CE-524	CONSTRUCTION OPERATION AND MANAGEMENT	L T P	Cr
		5 0 0	3

- INTRODUCTION:** Operations management; nature, scope, importance and functions; evolution from manufacturing to operations management; evolution of the factory system; manufacturing systems–quality–mass customization; contribution of Henry Ford, Deming, Crosby, Taguchi.
- TYPES OF INDUSTRIES:** Variety of business; integration of manufacturing and services; scale of operations; methods of manufacturing; project / jobbing, batch production, flow / continuous production, process production; characteristics of each method.
- FACILITIES LOCATION & LAYOUT:** Strategic importance; factors affecting location and layout; installation of facilities; single location; multi-location decisions; principles and types of facilities layout.
- IMPORTANCE AND FUNCTIONS OF PRODUCTION PLANNING & CONTROL:** Introduction to PERT/CPM; network crashing; numerical for PERT/CPM

- MAINTENANCE MANAGEMENT:** Importance and types of maintenance; maintenance planning; spare parts management; concept of TPM.
- INSPECTION:** Cent percent inspection; sample inspection; operation characteristics curves; statistical quality control; construction and interpretation of control charts – (X-R, n, p, c, np) introduction to six sigma, (numerical expected for control charts).
- PRODUCTIVITY - WORK STUDY:** Objectives; scope and uses; methods study; flow process chart; flow diagram and process mapping; work measurement; elements; performance rating; allowances; standard time - synthetic time standards; work sampling (Numerical expected for standard time); **Lean Production Systems:** TOYOTA system – JIT - KANBAN - theory of constraints.

#### REFERENCE BOOKS

- Krajewski Lee J., Ritzman Larry P. and Malhotra Manoj K., "Operations Management", 9th Edition, Pearson Education, 2010
- Mahadevan B., "Operations Management: Theory & Practice", 2nd Edition, Pearson Education, 2003
- Chary S. N., "Production & Operations Management", 3rd Edition, Tata McGraw Hill, 2004
- Chase R. B. and Aquilano L. J., "Production & Operations Management: Manufacturing and Services", Irwin Professional Publishing, 1994
- Adam E. E. & Ebert R. J., "Production & Operations Management", Prentice Hall, 1989
- Jhamb, L. C., "Manufacturing & Operations Management", Everest Publishing House, 2003
- Womack James P., Jones Daniel T., Roos Daniel, "The Machine that Changed the World", Harper Collins, 1991

CE-525	ENVIRONMENTAL IMPACT AND RISK ASSESSMENT	L T P	Cr
		5 0 0	3

- PLANNING:** Planning and management of environmental impact studies.
- METHODOLOGIES:** Impact indentation methodologies base line studies; screening; scooping; checklist; networks; overlays.
- SOCIO-ECONOMIC:** Prediction and assessment of impacts on the socio-economic environment.
- EVALUATION:** Environmental costs benefit analysis; decision methods for evaluation of alternatives.
- ASSESSMENT:** Case studies environmental impact assessment at project level; regional level; sectoral level; and policy level.

6. **SUSTAINABLE DEVELOPMENT:** Sustainable development; environmental policy in planned; mixed and market economies; global environmentalism.
7. **ENVIRONMENTAL MANAGEMENT:** Preventive environmentalism; Preventive environmental management.

### REFERENCE BOOKS

1. Anjaneyulu, Y., "Environmental Impact Assessment Methodologies", B. S. Publication, Hyderabad.
2. Glynn, J. and Gary, W. Hein, Ke, "Environmental Science and Engineering", Prentice Hall.
3. Dhaneja, Suresh K, "Environmental Science and Engineering", S. K. Kataria & Sons Publications,
4. Bhatia, H.S., "Environmental Pollution and Control", Galgotia Publication,

CE-531	STRUCTURAL DYNAMICS	L T P	Cr
		5 0 0	3

1. **INTRODUCTION:** Introduction; systems with single degree of freedom (SDOF)
2. **DYNAMIC LOAD ANALYSIS:** Equation of motion; analysis of free vibration-response to harmonic; impulsive; periodic and general dynamic loadings.
3. **DAMPED AND UNDAMPED VIBRATION:** Forced and free vibration response of MDOF damped and undamped discrete.
4. **EQUATION OF MOTION :**Systems; equation of motion; evaluation of natural frequencies and modes; approximate methods; overview of dynamics of continuous elastic systems; flexural beams; hear beams-columns; base excited system-formulation of equations for SDOF and MDOF
5. **SPECTRAL ANALYSIS:** Systems-concepts of spectral quantities and response spectrum-fundamental of earthquake engineering.
6. **EIGEN VALUE PROBLEMS:** Computational and numerical methods-solution of Eigen value problems.
7. **SUPERPOSITION METHOD:** mode superposition method and modal truncation errors-modal acceleration method; direct integration method- explicit and implicit methods.

### REFERENCES BOOKS

1. Clough R. W. and Penzien J. "Dynamics of Structures", 3rd Edition, McGraw Hill, 1993
2. Grover, G. K., "Mechanical Vibrations", Nem Chad and Bros., 1996
3. Walter, Hurty C. and Rubinstein Moshe F., "Dynamics of Structures", Prentice Hall, 1964

CE-532	UNDER GROUND SEEPAGE MODELING AND HYDRAULICS	L T P	Cr
		5 0 0	3

1. **FLOW OF WATER THROUGH POROUS MEDIUM:** Darcy's Law and its limitations. Reynolds's number.
2. **HYDRODYNAMIC EQUATIONS:** General hydrodynamic equations for two dimensional flows; stream function; stream lines and Equip potential lines; anisotropy; seepage force and critical gradient.
3. **FLOW INTO WELLS AND GALLERIES:** Confined and unconfined aquifers; partially penetrating wells; interference of wells; artificial recharge of a well; test pumping analysis; methods of solving the basic equations; exact solutions; conformal methods and method of images.
4. **APPROXIMATE SOLUTIONS:** Approximate solutions finite differences and graphical methods.
5. **EXPERIMENTAL AND SEMI THEORETICAL METHODS:** Zhukov sky functions; Schwatz-Christoffel transformation; seepage from canals; experimental and semi theoretical methods.
6. **GROUND WATER ANALYSIS:** Ground water prospecting; construction and design of wells; well casing; well screens; gravel packs; dug; bored; driven; jetted and drilled wells; radical collector wells.
7. **CONFINED FLOW AND KHOSLA SOLUTION:** Confined flow weir on a base of infinite depth; Khosla solution; depressed weirs on permeable bases with sheet piles; approximate solutions.

### REFERENCE BOOKS

5. Ven Te Chow, "Handbook of Applied Hydrology", McGraw Hill, 1964
6. Raghunath, H. M., "Groundwater", Wiley, 1990
7. Linsely, R. K., Franzini, J. B., Freyberg, D. L. and Tchobanoglous, G., "Water Resources Engineering", McGraw Hill, 1992
8. Dzurik, A.A., "Water Resources Planning", Rowman & Littlefield Publishers, Inc., 2002

CE-533	AIRPORT, DOCKS AND HARBOR STRUCTURES	L T P	Cr
		5 0 0	3

1. **AIRPORT TERMINAL DESIGN :** Airport terminal design of passenger terminal; cargo building; baggage processing; space requirements; parking;
2. **SEA ROUTE AROUND INDIA:** Study of major and minor ports in India: nature and volume of traffic; detailed study of a major port; major port; Cochin port.

3. **HARBOR PLANNING AND CONSTRUCTION:** Ship characteristics as they relate to port planning harbor and channel lines; planning port-site investigation-breakwaters; design harbor and channel lines-planning a port- site investigation; breakwaters; design consideration and construction- docks-dock fenders-dolphins; moles; trestles and catwalk off-shore moorings.
4. **CHARACTERISTICS OF PORT AND HARBOR:** Engineering characteristics of port and harbor-port buildings; trans sheds and warehouses; port administration buildings.
5. **SHIPPING TERMINALS AND CARGO HANDLING EQUIPMENT:** Shipping terminals and cargo handling equipment loading and unloading the ship; handling on land-handling in the hold; pallets; containers; roll-on and roll-off service; bulk cargo shipping terminals; storage facilities; material handling equipment-self unloading ship-oil terminals; modern bulk cargo terminals
6. **INLAND WATERWAYS:** Requirements of navigable waterways; methods of achieving navigability; open channel methods; construction methods; bank stabilization; straightening; integration of harbor with rail and road transport; feeder and coastal transportation; waterway improvement alternatives
7. **MAINTENANCE AND SAFETY:** Maintenance of ports; harbor and vehicles- customs regulation; safety and insurance of cargo.

**REFERENCE BOOKS**

1. Quinn. A., "Design and Construction of Ports and Marine", 2nd Edition, McGraw Hill, 1971
2. Linsley Ray K., Joseph B., Freyberg David L., Tchobanoglou George, "Water Resources Engineering Side Security", 4th Edition, McGraw Hill, 1992
3. Horonjeff R. and McKelvey F. X., "Planning and Design of Airports", 6th Edition, Tata McGraw Hill, 1994
4. Babkov, V. F., "Highway Engineering", Mir Publications, 1975

CE-534	CONSTRUCTION PLANNING AND EQUIPMENT MANAGEMENT	L T P	Cr
		5 0 0	3

1. **CONSTRUCTION EQUIPMENT:** identification, planning, equipment management in project maintenance management; replacement; safety management
2. **EQUIPMENT OF EARTH WORK:** fundamentals of earth operation; types of earthwork equipment: tractors, motors graders, scrapers, front and wadres, earth movers
3. **OTHERS CONSTRUCTIONS EQUIPMENT:** equipment for dredging trenching, tunneling ,drilling, blasing; equipment for compaction –Erections equipment -type of pumps used in

- constructions –equipment for dewatering and grouting – foundations and piles driving equipment
4. **MATERIALS HANDLINGS EQUIPMENT:** frocklifts and related equipment – portable materials Bins –conveyors-hauling equipments
  5. **EQUIPMENT FOR PRODUCTION OF AGGREGATES AND CONCRETING:** crushers; feeders screenings equipments; handlings equipments; Batching and mixing equipment; Hauling, pouring and pumping equipment; transporters
  6. **SPECIAL EQUIPMENT:** crawlers and wheel tractors their functions, types and specifications, gradability; bulls dozers and their uses, tractors pulled scrapers ,power shovels dimensions and clearances; output ; draglines, functions, types, sizes and output.
  7. **CONSTRUCTION ECONOMY:** Factors affecting the selections of construction equipment rolling,resistances .effect of grade on required tractive efforts ,effect of altitude and temperature on the performances of internal combustion engines, drawblers pull, rimpull and accelerations

**REFERENCE BOOKS**

1. Peurifoy, R. L. Ledbetter, W. B. and Schexnayder, C. "Construction Planning Equipment and Methods", McGraw Hill, Singapore
2. Sharma S .C., "Construction Equipment and Management", Khanna Publishers
3. Deodhar S. V., "Construction Equipment and Job Planning", Khanna Publishers
4. Varma Mahesh, "Construction Equipment and its Planning and Application of Equipment", Metropolitan Book Company, New Delhi, 1983
5. Gahlot P. S., and Dhir B. M., "Construction Planning and Management", Wiley Eastern

CE-535	ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT	L T P	Cr
		5 0 0	3

1. **EVOLUTION OF EIA:** Evolution of EIA concepts of EIA; EIA methodologies; screening and scoping; rapid EIA and comprehensive EIA general framework for environmental impact assessment
2. **ASSESSMENT OF ENVIRONMENT:** Characterization and site assessment; environmental risk; analysis; definition of risk; matrix method; checklist method; fault free analysis; consequence analysis

3. **SOCIOECONOMIC ASPECTS** : Socioeconomic aspects; measure of effectiveness of pollution control activities; environmental legislation;
4. **ENVIRONMENTAL MANAGEMENT** : Introduction to environmental management systems; environmental statement-procedures; environmental audit: cost benefit analysis life cycle assessment
5. **RESOURCE AND OPERATIONAL CONTROL**: Resource balance; energy balance and management review; operational control; case studies on EIA.
6. **EMERGING TECHNOLOGICAL**: Identification and evaluation of current and emerging technological issues that impact environmental decision-making; linkages between technologies; environmental quality; economic gain; and societal goals.
7. **CONTEMPORARY ISSUES**: Contemporary issues environmentally sound technology transfer; emission trading; international resources sharing issues; climate change; international environmental treaties and protocols.

#### REFERENCE BOOKS

1. Anjaneyulu, Y., "Environmental Impact Assessment Methodologies", B.S. Publication, Hyderabad.
2. Glynn, J. and Gary, W. Hein Ke, "Environmental Science and Engineering", Prentice Hall
3. Dhaneja, Suresh K, "Environmental Science and Engineering", S.K. Kataria & Sons Publications
4. Bhatia, H. S., "Environmental Pollution and Control", Galgotia Publications

<b>CE-553</b>	<b>SIMULATION LAB</b>	<b>L T P</b>	<b>Cr</b>
		<b>0 0 4</b>	<b>2</b>

1. Simulation of a beam Vibrating in two modes of Vibrations
2. Simulation of single link pendulum considering the flexibility characteristics and Structural dynamics of the link materials
3. Simulation of vibration in a cable hoist
4. Programming management problems such as price forecasting
5. Regression analysis
6. Inventory
7. Project management problems

Note: At least 10 experiments are to be performed. Three more experiments may be developed

<b>CE-554</b>	<b>WATER AND WASTE WATER TREATMENT LAB</b>	<b>L T P</b>	<b>Cr</b>
		<b>0 0 4</b>	<b>2</b>

1. Experiment on color, taste and odor control.
2. Analytical study of quality water supply
3. Experiment on disk intendance and fluoridation test.
4. Analytical study of water treatment plant
5. Analytical study of epidemics and comical building
6. Stability control of water quality, "Demonstration"
7. Experiment and analytical study in demineralization or removal of total solids
8. To study the analysis of hexavalent premium and dissolve asphalt of water quality.
9. To study the analysis of radio active materials and vanadium test
10. Experiment of nitrogen test.

Note: At least 10 experiments are to be performed. Three more experiments may be developed.

<b>CE-558</b>	<b>TRANSPORTATION LAB</b>	<b>L T P</b>	<b>Cr</b>
		<b>0-0-4</b>	<b>2</b>

#### Highway Materials Testing:

1. Tests on Bitumen
2. Tests on Emulsion

#### Design of Asphalt Concrete Mixes:

3. Marshall Stability Test

#### Pavement Evaluation Tests:

4. Benkelman Beam test
5. Roughness Test
6. Abrasions and Index Test
7. Ductility Test

Note : Atleast 10 experiments are to be performed. Three more experiments may be developed.

<b>CE-561</b>	<b>HIGHWAY LAB</b>	<b>L T P</b>	<b>Cr</b>
		<b>0 0 4</b>	<b>2</b>

#### A. Highway Materials

1. Tests on Bituminous
2. Test on Emulsion

**B. Design of Asphalt Concrete Mixes**

3. Materials Stability Test

**C. Pavement Evaluation Tests**

4. Benkelman Beam Test
5. Rough Test
6. Abrasion and Index Test
7. Ductility Test

**REFERENCE BOOKS**

1. Khanna, S. K. and Justo C. E. G., "Highway Engineering", Nemchand and Bros., 7th Edition, 2000.
2. Kadiyali, L. R. and Lal, "Highway Engineering Design", Khanna Publications
3. Bindra, S. P., "Highway Engineering", 4th Edition, Dhanpat Rai & Sons, 1981
4. Yoder E. J. and Witczak, M. W., "Principles of Pavement Design", John Wiley & Sons.
5. Yang, H. Huang, "Pavement Analysis and Design", 2nd Edition, Prentice Hall, 2003
6. Teng W. C., "Functional Designing of Pavements", McGraw Hill, 1980
7. Chakraborty Partha and Das Animesh, "Principles of Highway Engineering", 3rd Edition, Prentice Hall of India

CE-562	SEMINAR –I	L T P	Cr
		0 0 4	2

The student has to undertake extensive literature survey on a topic with the approval of the course coordinator. The course coordinator shall not be below the rank of Assistant Professor. The work may involve extensive search of print, audio-video materials, internet surfing etc.

The work of monitoring will be done by the course coordinator and evaluation by the course coordinator and the HOD or his nominee.

CE-601	ADVANCED GEOTECHNOLOGY	L T P	Cr
		5 1 0	4

1. **SOIL EXPLORATION:** Planning, direct, semi direct and methods, sampling, testing, soil profiles
2. **FOUNDATION EXCAVATION:** stability of open and braced cuts concept of arching phenomenon, analysis of sheet piles walls and anchored bulk heads, heaving of bottom of excavation

3. **BEARING CAPACITY:** Terzagh's theory of bearing capacity, field tests, considering of settlement s, proportioning of footings foe equal settlements, improving bearing capacity, design for raft foundation
4. **DEEP FOUNDATIONS:** Types of piles, methods of estimating pile capacity, cyclic piles test, group action, negatives skin frictions; cassions, method of construction, design consideration, drilled caissons
5. **EMBANKMENT DAMS:** Different types and criteria for their safe design, stability analysis for different conditions, seepage control
6. **ROCK MECHANICS:** classifications of rocks – physical properties, laboratory and in situ test for measuring stress – strain characteristics and rock stresses ,percolation and uplift pressures, stability of cuts and slopes
7. **TECHNIQUES OF IMPROVING GROUND:** stabilization, different methods and principles, Vibrofloatations and methods of sandwicks

**REFERENCE BOOKS**

1. Prakash Shamsher, Gopal Ranjan and Swami Saran, "Analysis and Design of Foundation and Retaining Structure", Satya Prakashan, 1979
2. Saran Swami, "Analysis and Design of Substructure" IBM Oxford
3. Gopal Ranjan "Basics and Applied Soil Mechanics", New Age Publications
4. Prakash Shamsher, "Soil Dynamics", McGraw Hill
5. Teng W. C., "Foundation Design", Prentice Hall, 1962
6. Singh Bharat and Prakash Shamsher, "Soil Mechanics and Foundation Engineering", 6th Edition, Nem Chand & Bros., Roorkee, 1990

CE-602	DESIGN OF BRIDGE AND TUNNELS	L T P	Cr
		5 1 0	4

1. **INTRODUCTION:** Introduction-definition and components of bridges.
2. **LAYOUT AND PLANNING:** Layout and planning of bridges classification; investigations for bridges; preliminary data collection; choice of type of the bridges; hydraulic design of bridges; traffic design of bridges.
3. **SUPER STRUCTURE DESIGN:** Analysis and design of superstructure of straight and curved bridge decks-loadings details; specification-reinforced concrete and steel decks; decks of various types like slab; hollow and voided slab; beam and slam; box girder etc.
4. **PIERS AND ABUTMENTS:** Design of substructure-piers and abutments of different types. Analysis and design of foundations-

shallow foundations (open Foundations); deep foundations- well foundations and caisson.

5. **MODERN METHODS OF DESIGN:** Design and constructional aspects of foundations; modern methods of construction of concrete and steel bridges; their impact on the analysis and the design.
6. **CONSTRUCTION METHODOLOGY:** Introduction to analysis and design of long span bridges like suspension and cable stayed bridges; special aspects in analysis and design; based on construction methodology; inspection and maintenance and rehabilitation of bridges.
7. **TUNNELS:** Purposes of tunneling; effects of tunneling on the ground role of geological considerations (i.e. tithological; structural and ground water) in tunneling over break and lining in tunnels.

**REFERENCE BOOKS**

1. Pama R. P. and Cusens A. R., "Bridge Deck Analysis", 1975
2. Hambly, Edward C., "Bridge Deck Behavior", E & FN Spon, London, 1991
3. Victor, D. Johnson, "Essentials of Bridge Engineering", Oxford and IBH Publishing, 2001
4. Gokhale, K. V. G. K., "Principles of Engineering Geology", B. S. Publications, 2005
5. Chennkesavulu, N., "Engineering Geology", Macmillan, India Ltd. 2005

<b>CE-605</b>	<b>ANALYSIS &amp; DESIGN OF PRESTRESS CONCRETE STRUCTURES</b>	<b>L T P</b>	<b>Cr</b>
		<b>5 1 0</b>	<b>4</b>

1. **LIMIT STATE DESIGN:** Limit state design of statically determinate pre-stressed beams- limit state of collapse by flexure; shear; and torsion limit state of serviceability.
2. **DESIGN OF POST TENSIONED MEMBER:** Anchorage zone stresses for post tensioned members. Statically indeterminate structures.
3. **ANALYSIS AND DESIGN:** Analysis and design- continuous beams and frames. Choice of profile; linear transformation; concordances; comically viable profile.
4. **COMPOSITE SECTION:** Composite beam with precast pre-stressed beams and cast in situ RC slab analysis and design.
5. **CREEP AND SHRINKAGE ANALYSIS:** Time dependant affects such as creep; shrinkage etc. on composite construction inclusive of creep relaxation.
6. **PRINCIPLE OF PRE-STRESSING:** Relaxation creep partial pre-stressing principles; analysis and design of simple beams; crack and crack width calculations.

7. **DESIGN OF PRE-STRESSED:** Analysis and design of pre-stressed pipes; tanks and spatial structures slabs; grids; folded plates and shells.

**REFERENCES BOOKS**

1. Lundy, "Pre-stressed concrete structures",
2. Lin, T. Y., "Pre-stressed Concrete"
3. Raju, N. Krishna, "Pre-stressed Concrete"

<b>CE-651</b>	<b>ADVANCED GEOTECHNICAL LAB</b>	<b>L T P</b>	<b>Cr</b>
		<b>0-0-4</b>	<b>2</b>

1. Find out percentage silt and clay for given sample of soil (wet analysis of soils)
2. Find shear strength of soil by triaxial cell testing sample 35mm and 50 mm dia
3. Consideration test (odometer)
4. Vane shear test
5. Marshal stability test
6. Find in situ measurement of soil load /deformation parameters (deformations modulus)
7. Plate bearing test

<b>CE-653</b>	<b>DISSERTATION PRELIMINARY</b>	<b>L T P</b>	<b>Cr</b>
		<b>0-0-10</b>	<b>5</b>

See note as given under course CE-659.

<b>CE-654</b>	<b>SEMINAR-II</b>	<b>L T P</b>	<b>Cr</b>
		<b>0-0-4</b>	<b>2</b>

The work of Dissertation Preliminary is to be presented by the student in the form of Seminar II.

The work of monitoring will be done by the guide and evaluation by the committee consisting of guide, course coordinator and the HOD or his nominee.

<b>CE-656</b>	<b>DISSERTATION PHASE -I</b>	<b>L T P</b>	<b>Cr</b>
		<b>0-0-12</b>	<b>6</b>

See note as given under course CE-659.

CE-657	SEMINAR-III	L T P	Cr
		0-0-4	2

The work of Dissertation Phase-I is to be presented by the student in the form of Seminar III.

The work of monitoring will be done by the guide and evaluation by the committee consisting of guide, course coordinator and the HOD or his nominee.

CE-658	MINOR PROJECT	L T P	Cr
		0-0-6	3

The student is required to do the design/fabrication/coding/simulation of equipment/process/system of his/her choice and to be approved by the course coordinator.

The course coordinator will evolve the evaluation procedure under the guidance of HOD.

CE-659	DISSERTATION PHASE-II	L T P	Cr
		0-0-24	12

Every student will carry out dissertation under the supervision of a guide. The topic of dissertation shall be approved by a committee constituted by the HOD. The method of evaluation including intermediate assessment shall be as evaluated by the pertinent BOS.

Dissertation work is spread over three terms and coded as CE-653, CE-656 and CE-659. The distribution of amount of work in these three terms is equivalent to 5, 6 and 12 credits respectively. The evaluation of work is continuous but award of grade is for 23 credits in the last term on the basis of total work.

CE-660	TEACHING PRACTICES-I	L T P	Cr
			2

See note as given under course CE-661

CE-661	TEACHING PRACTICES-II	L T P	Cr
		---	2

Teaching practice comprises of two non-two letter mandatory courses to be done under the guidance of HOD. Here, the student is required to be engaged in teaching of two UG courses (I and II) of his/her choice during the period between IVth to IXth Terms of the M.Tech. Degree Programme. The student shall register for Teaching Practice only at the time he plans to take up teaching of UG course, but the credits earned will be counted in Term-VI for Full Time students and Term-IX for Part Time students.

MA-501	NUMERICAL TECHNIQUES	L T P	Cr
		5 1* 0	4

#### OBJECTIVE

To develop expertise on mathematical numerical tools to get analytic solutions for complex engineering problems.

- LINEAR EQUATIONS:** Matrix theory; solution of general linear system of equations, existence & uniqueness of solution, Echelon form of matrix; I, II conditioned matrices Eigen value & Eigen vectors; Unitary, Hermitian & normal matrices; Gauss-elimination method and Gauss-Jordan methods for homogeneous and non-homogeneous systems of linear equations; round off errors
- NON-LINEAR EQUATIONS:** Bisection method; linear interpolation methods; Newton's method; Muller's method; Bairstow's methods for the quadratic factors; other methods for the solution of polynomials.
- INTERPOLATION PROBLEMS:** Lagrangian polynomial; divided differences; interpolating with cubic spline; Bexier curves and B-spline curves; polynomial approximation of the surfaces; least square method.
- DIFFERENTIATION & INTEGRATION:** Derivatives from difference table; higher order derivatives; extrapolation techniques; integration formulas- Simpson's rule, trapezoidal rule, Gaussian quadrature; adaptive integration, multiple integrals.
- SOLUTION OF ORDINARY DIFFERENTIAL EQUATION:** Modifier Euler methods; Milne's methods Adam's Moulton method; convergence criteria, Errors and error propagation, comparison of different methods.
- BOUNDARY VALUE PROBLEMS:** Shooting method; Rayleigh-Ritz method; Collocation and Galerkin method; characteristic

