ACADEMIC REGULATIONS, COURSE STRUCTURE

AND DETAILED SYLLABUS
UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2015-16

M. Tech. Two Year Degree Course

(MR-15 Regulations)

in

GEO TECHNICAL ENGINEERING (GTE)
Department of Civil Engineering

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

(An Autonomous Institution approved by UGC and affiliated to JNTUH, Approved by AICTE & Accredited by NAAC with 'A' Grade and NBA & Recipient of World Bank Assistance under TEQIP Phase – II, S.C 1.1)

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR 15– ACADEMIC REGULATIONS (CBCS) FOR M. Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of M. Tech. (Regular) programme from the Academic Year ***2015-16*** and onwards

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

INSTITUTION VISION

A Culture of excellence , the hallmark of MREC as world class education center to impart Technical Knowledge in an ambience of humanity, wisdom, intellect, creativity with ground breaking discovery, in order to nurture the students to become Globally competent committed professionals with high discipline, compassion and ethical values.

INSTITUTION MISSION

Commitment to progress in mining new knowledge by adopting cutting edge technology to promote academic growth by offering state of art Under graduate and Post graduate programmes based on well-versed perceptions of Global areas of specialization to serve the Nation with Advanced Technical knowledge.

DEPARTMENT VISION

Striving to be the centre of excellence in civil engineering education. To provide students the latest learning techniques and complete knowledgebase for sustainable development of society.

DEPARTMENT MISSION

Provide value based technical education and empower the students to become competent professionals.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide students with a solid foundation in Mathematical, Scientific, software skills and Engineering fundamentals required to solve engineering problems and also to pursue higher studies.

PEO2: To train students with good scientific and engineering breadth so as to comprehend, analyze, design and create novel products and solutions for the real life problems.

PEO3: To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and ability to relate engineering issues to broader social context.

PROGRAMME OUTCOMES (POs)

a	an ability to apply knowledge of mathematics, science, and engineering,
b	an ability to design and conduct experiments, as well as to analyze and interpret data,
c	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
d	an ability to function on multidisciplinary teams,
e	an ability to identify, formulate, and solve engineering problems,
f	an understanding of professional and ethical responsibility,
g	an ability to communicate effectively,
h	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
i	a recognition of the need for, and an ability to engage in life-long learning,
j	a knowledge of contemporary issues,
k	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

1.0 ELIGIBILITY FOR ADMISSIONS :

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.
Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Government of Telangana or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M.Tech. DEGREE :

2.1 A student shall be declared eligible for the award of the M.Tech. Degree, if the student pursues a course of study in not less than two and not more than four academic years. However, the student is permitted to write the examinations for two more years after four academic years of course work, failing which the student shall forfeit the seat in M. Tech. programme.

2.2 The student shall register for all 88 credits and secure all the 88 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 COURSES OF STUDY :

The following specializations are offered at present for the M. Tech. programme of study.

1. Computer Science and Engineering
2. Digital Systems and Computer Electronics
3. Electrical Power Systems
4. Embedded Systems
5. Geotechnical Engineering
6. Machine Design
7. Structural Engineering
8. Thermal Engineering
9. VLSI System Design

and any other programme as approved by the University from time to time.

3.1 Departments offering M. Tech. Programmes with specializations are noted below:

CE	GTE	Geo Technical Engineering
	SE	Structural Engineering
EEE	EPS	Electrical Power Systems
ME	MD	Machine Design
	TE	Thermal Engineering
ECE	DSCE	Digital Systems and Computer Electronics
	ES	Embedded Systems
	VLSI SD	VLSI System Design
CSE	CSE	Computer Science and Engineering

4 COURSE REGISTRATION :

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5 ATTENDANCE :

The programmes are offered on a unit basis with each subject/course being considered as a unit.

5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the Semester End examination (SEE). A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee (CAC).

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end Semester End Examination of that subject and their registration shall stand cancelled.

5.5 A fee prescribed by the CAC, shall be payable towards Condonation of shortage of attendance.

5.6 A Candidate shall put in a minimum required attendance in atleast three (3) theory subjects in I semester for promoting to II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

5.7 A student shall not be promoted to the next semester unless the student satisfies the attendance requirement of the present Semester, as applicable. The student may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, the student shall not be eligible for readmission into the same class.

6 EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS: :

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Continuous Internal Evaluation and Semester End Examinations. For all Subjects/ Courses, the distribution shall be 40 marks for CIE, and 60 marks for the SEE

6.1 Theory Courses :

6.1.1 Continuous Internal Evaluation (CIE):

The CIE consists of two Assignments each of 05 marks and two mid-term examinations each of 35 marks. The CIE shall be finalized based on the 70% of the best performed and 30% of the other performance.The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The Assignments shall be as specified by the concerned subject teacher.. Each mid-term examination shall be conducted for a total duration of 120 minutes, for 35 marks.

The division of marks for CIE is as given below:

Mid – Term Examination				
Part	**Type of Questions**	**No. of questions**	**Marks per question**	**Total**
Part A	Multiple-choice questions	10	0.5	05
	Fill-in the blanks	10	0.5	05
	Sub-Total			10
Part B	Compulsory questions	5	2	10
Part C	Choice questions (3 out of 5)	3	5	15
			Mid-Term Exam Total	35
			Assignment	05
			Grand Total	40

6.1.2 Semester End Examination (SEE):

The division of marks for SEE is as given below:

Semester End Examination				
Part	**Type of Questions**	**No. of questions to be answered**	**Marks per question**	**Total**
Part A	Compulsory Questions (One from each module)	5	4	20
Part B	Choice Questions (5 out of 8) (Minimum one from each module)	5	8	40
			Grand Total	60

6.2 Practical Courses:

6.2.1 Continuous Internal Evaluation (CIE):

There will be CIE for 40 marks, shall be awarded with a distribution of 20 marks for day-to-day performance and timely submission of lab records, 5 marks for viva-voce, 15 marks for internal lab exam (best out of two exams).

6.2.2 Semester End Examination (SEE):

There will be SEE for 60 marks, shall be awarded with a distribution of 20 marks for write-up on the given experiment, 20 marks for proficiency in the exam, 10 marks for results and 10 marks for viva-voce. For conducting SEE, one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations of the College. The external examiner should be selected from outside the College among the autonomous/reputed institutions, from a panel of three examiners submitted by the concerned Head of the Department.

6.3 Seminar:

There shall be two seminar presentations during I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks with a distribution of 30 marks for the report, 50 marks for presentation and 20 marks for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.4 Comprehensive Viva-Voce:

There shall be a Comprehensive Viva-Voce in III Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects studied during the M. Tech. course of study. The Head of

the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consists of the Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Chief Controller of Examinations from a panel of three examiners submitted by the concerned Head of the Department. There are no internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.5. **General:** A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject he has to reappear for the Semester End Examination in that subject. A candidate shall be given one chance to re-register for the subject if the internal marks secured by the candidate are less than 50% and failed in that subject. This is allowed for a maximum of three subjects and should register within two weeks of commencement of that semester class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, the student's Continuous Internal Evaluation (CIE) marks and Semester End Examination (SEE) marks obtained in the previous attempt stands cancelled.

7 EXAMINATIONS AND ASSESSMENT - THE GRADING SYSTEM :

7.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab / Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

7.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	Grade Points	Letter Grade (UGC Guidelines)
≥ 80%	10	O (Outstanding)
≥ 70% to < 80%	9	A+ (Excellent)
≥ 60% to < 70%	8	A (Very Good)
≥ 55% to < 60%	7	B+ (Good)
≥ 50% to < 55%	6	B (Above Average)
< 50%	0	F (Fail)
Absent	Ab	Ab

7.3 A student obtaining F Grade in any Subject shall be considered 'failed' and is be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

7.4 A student not appeared for examination then 'Ab' Grade will be allocated in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

7.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.

7.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that particular Subject/ Course.
Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

7.8 The Student passes the Subject/ Course only when he gets GP ≥ 6(B Grade or above).

7.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:

$$\text{SGPA} = \left\{\sum_{i=1}^{N} C_i G_i\right\} / \left\{\sum_{i=1}^{N} C_i\right\} \ldots \text{For each Semester}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N'is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the i^{th} Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i^{th} Subject.

7.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the II Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \left\{\sum_{j=1}^{M} C_j G_j\right\} / \left\{\sum_{j=1}^{M} C_j\right\} \ldots \text{for all S semesters registered}$$
(i.e., upto and inclusive of S semesters, S ≥ 2)

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1stSemester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into

account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the j^{th} Subject, and G_j represents the Grade Points (GP)corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11 For Calculations listed in Item 7.6 – 7.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations.

8. EVALUATION OF PROJECT/DISSERTATION WORK :

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the III Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.
Note: *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper related to the thesis in a National/International Conference/Journal.*

8.7 For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor, HOD and Principal shall be submitted to the Chief Controller of Examinations for project evaluation (viva voce).

8.9 For Project work part-I in III Semester there is an internal marks of 50, the evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-I. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.10 For Project work part-II in IV Semester there is an internal marks of 50, the evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-II. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.11 For Project Evaluation (Viva Voce) in IV Semester there is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.12 If the student fails to fulfill as specified in 8.11, based the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.

8.13 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva-Voce examination.

9. AWARD OF DEGREE AND CLASS :

9.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **88** Credits (with CGPA $\geq$ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	≥ 6.75 and < 7.75
Second Class	≥ 6.00 and < 6.75

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10. WITHHOLDING OF RESULTS :

If the student has not paid the dues, if any, to the University or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

11. TRANSITORY REGULATIONS :

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of three earlier or equivalent subjects at a time as and when offered.

11.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per MR15 Academic Regulations.

12. GENERAL :

12.1 **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

12.2 **Credit Point:** It is the product of grade point and number of credits for a course.

12.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”.

12.4 The academic regulation should be read as a whole for the purpose of any interpretation.

12.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the CAC is final.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the SEE)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to that course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate shall be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled

		in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE) / Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and

	the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	shall not be permitted to appear for the remaining examinations of the courses of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is

		also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note: ***The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.***

MALLA REDDY ENGINEERING COLLEGE

(Autonomous)

M.Tech Geo Technical Engineering

COURSE STRUCTURE

I SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC-I	51301	Advanced Soil Mechanics	4	-	-	4	40	60	100
2	CC-II	51108	Advanced Foundation Engineering	4	-	-	4	40	60	100
3	CC-III	51105	Ground Improvement Techniques	4	-	-	4	40	60	100
4	PE-I	50B14	Computer Oriented Numerical Methods	4	- - -	- - -	4	40	60	100
		51302	Environment and Ecology							
		51303	Remote Sensing & Geographical Information Systems							
5	PE-II	51304	Earth & Rock Fill Dams	4	- - -	- - -	4	40	60	100
		50B15	Optimization Techniques							
		51305	Geotechnical Earthquake Engineering							
6	PE-III	51306	Geo-Environmental Engineering	4	-	-	4	40	60	100
		50B12	Applied Statistics							
		51307	Physical Modeling in Geotechnical Engineering							
7	Laboratory-I	51308	Advanced Geotechnical Engg. Lab-I	-	-	4	2	40	60	100
8	Seminar-I	51309	Seminar-I	-	-	4	2	100	--	100
			Total	24	-	8	**28**	**Contact Periods -32**		

II SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC-IV	51310	Retaining Structures	4	-	-	4	40	60	100
2	CC-V	51311	Rock Mechanics and Engineering	4	-	-	4	40	60	100
3	CC-VI	51312	Soil - Structure Interaction	4	-	-	4	40	60	100
4	PE-IV	51313	Finite Element Methods for Geotechnical Engineers	4	- - -	- - -	4	40	60	100
		51314	Disaster Management							
		51315	Environmental Impact Assessment and Management							
5	PE-V	51316	Groundwater Contamination and Remediation	4	- - -	- - -	4	40	60	100
		51317	Soil Dynamics and Machine Foundations							
		51120	Design of Sub Structures							
6	PE-VI	51318	Geosynthetics & Soil Reinforcement	4	-	-	4	40	60	100
		51319	Material Characterizatio n and Pavement Engineering							
		51320	Offshore Geotechnical Engineering							
7	Laboratory – II	51321	Advanced Geotechnical Engg Lab- II	-	-	4	2	40	60	100
8	Seminar-II	51322	Seminar-II	-	-	4	2	100	--	100
	Total			24	-	8	**28**	**Contact Periods -32**		

III-SEMESTER

S. No	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CV	51323	Comprehensive Viva Voce	-	-	-	4	-	100	100
2	PR -I	51324	Project work Part-I	-	-	16	8	50	-	50
			Total	-	-	16	**12**	**Contact Periods -16**		

IV-SEMESTER

S. No	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PR -II	51325	Project work Part-II	-	-	16	8	50	-	50
2	PR -III	51326	Project Viva-Voce	-	-	-	12	-	150	150
			Total	-	-	16	**20**	**Contact Periods -16**		

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51301 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

ADVANCED SOIL MECHANICS

OBJECTIVE: To understand the physical and mechanical properties of soil and its behavior under external loads.

MODULE-I **[12 Periods]**

Introduction & Geostatic Stresses: Classification of Soils, Consistency Limits, Stresses within a soil mass, Effective Stress principle, Geostatic stresses.

MODULE-II **[12 Periods]**

Flow through Soils: Permeability, seepage – Finite difference formulae for steady state and transient flows – flow nets – computation of seepage – uplift pressure, and critical hydraulic gradient.

MODULE-III **[12 Periods]**

Compaction and Consolidation: Compaction Curve, Compaction Control, Oedometer test, Over consolidation ratio, Primary and secondary consolidation settlement, One, two and three dimensional Consolidation, Consolidation of partially saturated soils.

MODULE-IV **[12 Periods]**

Stress-Strain-Strength Behaviour of Soils: Principle Stresses, Mohr Circle, Shear strength of soils; Failure criteria, drained and undrained shear strength of soils. Significance of pore pressure parameters; Determination of shear strength; Drained, Consolidated Undrained and Undrained tests; Interpretation of triaxial test results. Behaviour of sands; Critical void ratio; dilation in soils, Stress paths.

MODULE-V **[12 Periods]**

Critical State Soil Mechanics: Critical state parameters; Critical state for normally consolidated and overconsolidated soil; Significance of Roscoe and Hvorslev state boundary surfaces; Yielding, Bounding Surfaces.

TEXT BOOKS

1. Das, B. M. & Sobhan K, .- Principles of Geotechnical Engineering, Cengage Learning, Edition (2015)
2. Mitchell J.K. - Fundamentals of soil behaviour - John Wiley and Sons, Inc., New York. (Third edition) 2005

REFERENCES:

1. Atkinson J. H. - An Introduction to the Mechanics of Soils and Foundation - through critical state soil mechanics, McGraw- Hill Co. (1993)
2. J A Knappett and R F Craig – Craig's Soil Mechanics, Eighth Edition, Spon Press Taylor & Francis (2012)
3. Lambe, T. W. and Whitman, R. V.- Soil Mechanics SI version , John Wiley & Sons.(2011)

OUTCOME: Students should be able to understand the soil behaviour under external loads, and procedures to measure relevant soil parameters.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51108 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester
ADVANCED FOUNDATION ENGINEERING

OBJECTIVE: To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

MODULE-I **[12 Periods]**

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

MODULE-II **[12 Periods]**

Shallow Foundations: **Bearing Capacity:-** Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

MODULE-III **[12 Periods]**

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands-Schmertmann and Burland & Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, Codal Provisions.

MODULE-IV **[12 Periods]**

Deep Foundations: **Single Pile:** Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions.

MODULE-V **[12 Periods]**

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

Introduction to Reliability-Based Design: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008)

REFERENCE BOOKS

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john wiley & sons inc (1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering, Wiley Publications (2003)

Outcome: Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

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Course Code: 51105 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

GROUND IMPROVEMENT TECHNIQUES

Objective: To understand the importance of ground improvement and know various ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.

MODULE-I **[12 Periods]**

Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In-situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications.

MODULE-II **[12 Periods]**

Mechanical Modification – Principles Compaction control of soil densification – Properties of Compacted soil tests, Specification Dynamic compaction requirements, Blasting, Tamping and Compaction piles of Vibro compaction.

MODULE-III **[12 Periods]**

Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geosynthetics, sand drains, Preloading and vertical drains, Electro-kinetic dewatering.

MODULE-IV **[12 Periods]**

Physical and Chemical Modification – Modification by admixtures, Shotcreting and GMODULEing Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

MODULE-V **[12 Periods]**

Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, bar, mesh, sheet and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing, case studies.

TEXT BOOKS

1. Hausmann, M. R. (1990) –Engineering Principles of Ground Modification, McGraw Hill publications, New York.
2. P.Purushothama Raj (1995) - Ground Improvement Techniques, Laxmi Publications, India.

REFERENCES:

1. M.P.Moseley and K. Krisch (2006) – Ground Improvement, II edition, Taylor and Francis.
2. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
3. K. Krisch & F.Krisch (2010) –Ground Control and Improvement, John Wiley & Sons, 1994.
4. Peter G. Nicholson (2015): Soil Improvement and Ground Modification Methods, Elsevier Publishers

Outcome: Depending on the site conditions, students will be able to identify suitable ground improvement technique for specific project and its implications.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 50B14 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

COMPUTER ORIENTED NUMERICAL METHODS

(Professional Elective-I)

Objectives: To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

Objectives: To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

MODULE- I: **[12 Periods]**

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

MODULE- II: **[12 Periods]**

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

MODULE- III **[12 Periods]**

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulae using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation-Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

MODULE- IV. **[12 Periods]**

Numerical Differentiation: Difference methods based on undetermined coefficients-optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method

MODULE- V **[12 Periods]**

Ordinary Differential Equation: Euler's method – Backward Euler method – Mid point method – single step method, Taylor's series method- Boundary value problems.

REFERENCES:

1. Numerical methods for scientific and engineering computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited.
2. Numerical methods by S.S.Shastry.
3. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley – published campus.
4. Numerical methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill book company.
5. C Language and Numerical methods by C.Xavier – New age international publisher.
6. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi.

Outcomes : The learner will be able to apply various mathematical techniques to Structural engineering problems.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51302 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

ENVIRONMENT AND ECOLOGY

(Professional Elective-I)

Objective: To develop a conceptual outlook on various ecological facets of environment.

MODULE I **[12 Periods]**

Environment, Ecology and Sustaining the Earth; Nature and Humans: Earth, population, environment.

MODULE II **[12 Periods]**

Ecosystems; Ecosystems, ecology of populations, human population dynamics – growth and urbanization; environmental economics and politics.

MODULE III **[12 Periods]**

Ecological Balances – Material cycles in ecosphere, Matter and Energy Resources; Energy flow in ecosystems; bio-geochemical systems.

MODULE IV **[12 Periods]**

Air, Water and Soil Resources**:** Air Resources, pollution, global warning, ozone depletion; water resources – surface and groundwater, sources of pollution; soil resources – conservation, contamination, salt water intrusion, hazardous wastes.

MODULE V **[12 Periods]**

Living Resources Food resources, pesticides, pest control: land resources – forests, wetlands, wilderness, national parks; wild plants and animal resources, Energy and Mineral Exploitation: perpetual and renewable energy; non-renewable energy; non-renewable mineral resources, solid and hazardous wastes.

TEXT BOOKS:

1. Environmental Science by Tyley Miller- Brooks Cole(2012)
2. Concepts Of Ecology by Edward J Kormondy - Phi Learning(2009)

Outcome: Knowledge on Ecosystems and Ecological Balances, An outlook on living and non-living resources as well as energy resources of environment.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51303 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS
(Professional Elective-I)

Objective: To impart knowledge on basic concepts of Remote Sensing and GIS and its application on various aspects of water environment.

MODULE-I **[12 Periods]**

Introduction: Electromagnetic spectrum, energy sources and Radiation principle, Energy interactions in the atmosphere, energy interactions with earth surface features – Vegetation, Soil and water.

MODULE-II **[12 Periods]**

Data Acquisition: Platforms – sensors used for the remote sensing data acquisition. Data processing – Radiometric, Geometric corrections.

MODULE-III **[12 Periods]**

Digital Image Processing: Image enhancement – linear, non-linear spatial filtering; edge enhancement. Classification – supervised, unsupervised classification.

MODULE-IV **[12 Periods]**

Geographical Information System (GIS): Definition data input and output; Topology, Digital elevation data; Data management – relational data model. Spatial data models – Raster and Vector data Models. GIS analysis – Classification, overlay operation.

MODULE-V **[12 Periods]**

Land use/Land cover Analysis: Classification principles and systems; Applications of soil, water resources, environmental, earthquakes, landslides. Software scenario – watershed modelling, watershed management, environmental modelling.

TEXT BOOKS:

1. Lilles and Kiefer – Remote Sensing Principles and Interpretation – John Willey and Sons. America, 2000.
2. Anji Reddy, M. – Remote Sensing and GIS – BS Publications, 2004

REFERENCES:

1. F.F. Sabins Jr., - Remote Sensing Principles and Interpretations – W.H. Freeman & Co., 1987
2. Paul J. Gibson & Clare H. Power – Introductory Remote Sensing – British Library, London. 1st Published, 2000.
3. Stan Arnoff – Geographic Information Systems – A management perspective, Canada, 1995.

Outcome:

Development of multilevel conceptual outlook on Remote Sensing and GIS, development of skill based knowledge with reference to image processing, digital elevation models etc. and Specific knowledge related to application of Remote Sensing & GIS concepts for the development of water resources management.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51304 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

EARTH & ROCKFILL DAMS
(Professional Elective-II)

Objective: Suitability of materials for earth and rockfill dams, causes of failures and to determine slope stability.

MODULE-I **[12 Periods]**

Earth and Rockfill Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction and requirements, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

MODULE-II **[12 Periods]**

Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design.

MODULE-III **[12 Periods]**

Slope Stability Analysis: Types of Failure: Failure surfaces - Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes.

MODULE-IV **[12 Periods]**

Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/shotcrete).

MODULE-V **[12 Periods]**

Rockfill Dams: Requirements of compacted rockfill, Shear strength of rockfill, Rockfill mixtures, Rockfill embankments, Earth-core Rockfill dams, Stability, Upstream & Downstream slopes.

TEXT BOOKS:

1. Christian, K. Earth & Rockfill Dams – Principles of Design and Construction, CRC Press, 1997.
2. Sowers, G.F. – Earth and Rockfill Dam Engineering, Asia Publishing House, 1962.

REFERENCES:

1. Bharat Singh and Sharma, H. D. – Earth and Rockfill Dams, 1999
2. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilisation methods – John Wiley & sons. (2002)
3. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.
4. US Army Corp of Engineers, Earth and Rock-fill Dams, General Design and construction Considerations, University Press of the Pacific (2004).

Outcome: Able to design earth and rockfill dams, get familiarity with slope stability calculations, and prevention techniques for slope failures.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 50B15 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

OPTIMIZATION TECHNIQUES
(Professional Elective-II)

Course Objectives:
Student will be able to

1. Define statement of optimization problem
2. Solve optimization problems using linear programming
3. Solve optimization problems using Dynamic programming

MODULE-I: **[12 Periods]**
LINEAR PROGRAMMING

Introduction and formulation of models; convexsity; graphical &simplex method; two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, Big-M Method sensitivity analysis; Revised simplex method; Transportation and Assignment problems.

MODULE- II: **[12 Periods]**
NON-LINEAR PROGRAMMING:

Classical optimization methods; equality and inequality constraints; Lagrange multipliers; &Kuhn-tucker conditions; quadratic forms; quadratic programming and Beal's methods.

MODULE- III: **[12 Periods]**
SEARCH METHODS:

One dimensional optimization; Fibonacci search; multi-dimensional search methods; univariate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

MODULE-IV: **[12 Periods]**
DYNAMIC PROGRAMMING:

Belman's Principle of optimality; recursive relations; solution of L.P. Problem; simple examples.

MODULE-V: **[12 Periods]**
INTEGER LINEAR PROGRAMMING:

Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

REFERENCES

1. Introduction to optimization-J.C.Paint; Jain brothers; New Delhi.
2. Optimisation theory and applications-S.S.Rao; Wiley Eastern Ltd., New Delhi.
3. Optimization method-K.V.Mital; Wiley Eastern Ltd... New Delhi.
4. Introduction to OR J.K. SHARMA Introduction to OR S.D .SHARMA.

Course Outcomes

On successful completion of this course, it is expected that students should be able to

1. Understand Engineering optimization.
2. Classify the optimization problems.
3. Understand various methods of linear programming & Dynamic programming

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51305 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

GEOTECHNICAL EARTHQUAKE ENGINEERING
(Professional Elective-II)

OBJECTIVE: To understand the effect of earthquake on soil structures and to design earthquake resistant geotechnical structures.

MODULE-I **[12 Periods]**

Earthquake Seismology – Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.

MODULE –II **[12 Periods]**

Earthquake Ground Motion – Seismograph, Characteristics of ground motion, Effect of local site conditions on ground motions, Design earthquake, Design spectra, Development of site specification and code-based design.

MODULE –III **[12 Periods]**

Ground Response Analysis – One-dimensional ground response analysis: Linear approach, Nonlinear approach, Comparison of one dimensional ground response analyses. Two-dimensional ground response analysis: Dynamic finite element analysis, Equivalent linear approach, Nonlinear approach, Comparison of two dimensional ground response analyses.

MODULE –IV **[12 Periods]**

Liquefaction and Lateral Spreading - Liquefaction related phenomena, Liquefaction susceptibility: Historical, Geological, Compositional and State criteria. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Criteria for mapping liquefaction hazard zones. Soil improvement for remediation of seismic hazards.

MODULE –V **[12 Periods]**

Seismic Design of Foundations, Retaining Walls & Slopes - Seismic design requirements for foundation, Seismic bearing capacity, Seismic settlement, Design loads. Seismic slope stability analysis - Internal stability and weakening instability, Seismic design of retaining walls: Dynamic response of retaining walls, Seismic displacement of retaining walls, Seismic design consideration.

Text Books:

1. Kramer S. L - Geotechnical Earthquake Engineering, Prentice Hall, 1996.
2. Bharat Bushan Prasad- Advanced Soil Dynamics and Earthquake Engineering, PHI Learning Pvt. Ltd., New Delhi, 2011.

References:

1. R. W. Day - Geotechnical Earthquake Engineering Handbook, McGraw-Hill, 2002.
2. Naeim, F. - The Seismic Design Handbook, Kluwer Academic Publication, 2nd Edition, 2001.
3. Bolt, B. A. - Earthquakes, W. H. Freeman and Company, 4th Edition, 1999.
4. Lourie, W. - Fundamentals of Geophysics, Cambridge University press, 1997.
5. Kamalesh Kumar - Basic Geotechnical Earthquake Engineering – New Age International Publishers, 1st Edition, 2008.
6. Dowrick - Earthquake Resistant Design, John Wiley & Sons.(2009)

Outcome: Able to understand the behavior of ground during the earthquakes, so that geotechnical structures can be designed to resist/ sustain the earthquake loading.

2015 – 16

Malla Reddy Engineering College (Autonomous)

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Course Code: 51306 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

GEOENVIRONMENTAL ENGINEERING
(Professional Elective-III)

Objective: To understand various sources of contamination of ground and to characterize contaminated ground and to find extent of contamination and to get familiarize with various remediation methods.

MODULE-I **[12 Periods]**

Sources and Site Characterization: Scope of Geoenvironmental Engineering, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.

MODULE-II **[12 Periods]**

Solid and Hazardous Waste Management: Classification of waste, Characterization of solid wastes, and Environmental Concerns with waste, waste management strategies.

MODULE-III **[12 Periods]**

Contaminant Transport: Transport process, Mass-transfer process, Modeling, Bioremediation, and Phytoremediation.

MODULE-IV **[12 Periods]**

Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation of NAPL sites, Emerging Remediation Technologies.

MODULE-V **[12 Periods]**

Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.

TEXT BOOKS:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)

REFERENCES:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001
2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001

Outcome: Able to characterize the contaminated ground and identify most appropriate method of remediation.

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Course Code: 50B12 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

APPLIED STATISTICS
(Professional Elective-III)

Objective: The course Statistics for Engineers is introduced to understand the central tendency of a given data. The objective of this course is to provide foundations on design of experiments and statistical analysis of experimental data obtained from laboratory and/or industrial processes. It is preferred that at the end of the course, the student will be equipped with the basic knowledge and art of statistical data analysis combined with systematic approaches to experimental design. While the lectures will cover the theory, the assignments will give an opportunity to implement and learn the practical aspects of the subject.

MODULE-I: **[12 Periods]**

Descriptive measures: Measures of central tendency: Arithmetic mean – median – mode – geometric mean – harmonic mean.
Measures of dispersion: Range – Quartile deviation – mean deviation – standard deviation, Measures of sleekness, Measures of kurtosis

MODULE-II: **[12 Periods]**

Analysis of Variance (ANOVA): one-way & two-wav ANOVA and multiple comparisons. Introduction to Factorial design-2^2 and 2^n. Factorial design, Analysis of Co-variance (ANCOVA), Conducting ANCOVA.

MODULE-III: **[12 Periods]**

Design of Experiments: Importance and applications of design of experiments. Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

MODULE-IV: **[12 Periods]**

Importance of SQC in industry. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np, c&d charts with fixed and varying sample sizes). Interpretation of control charts. Natural tolerance limits and specification limits, process capability index. Concept of Six sigma and its importance, Single and double sampling plans.

MODULE-V: **[12 Periods]**

Time Series and Data Analysis: Fitting a trend line to a time series, Method of least Squares and Method of Moving Averages, Measure of Seasonal Variation.
Index Numbers: Laspeyre's, Paasche's and Fisher's Ideal index, FRT, TRT, Circular Test.

TEXT BOOKS:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Applied Statistics, Sultan Chand&Sons, New Delhi
2. Willam Feller: Introduction to Probability theory and its applications. Volume – I, Wiley 2.
3. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand&Sons, New Delhi
4. GoonAM, Gupta MK, Das Gupta B : Fundamentals of Statistics, Vol-I, the World Press Pvt.Ltd., Kolakota.
5. Applied statistics and probability for engineers, Montgomery.

Course Outcomes:

1. The students will understand central tendency and variability for the given data.
2. The students will be able to perform hypothesis testing.
3. The students will be able to carry out error analysis.
4. The student can able to design an experiment with his statistical technique.
5. The students will learn the concept of Six Sigma and its importance to real life problems.

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Course Code: 51307 **Credits: 4**

M.Tech (Geo-Technical Engineering) – I Semester

PHYSICAL MODELLING IN GEOTECHNICAL ENGINEERING
(Professional Elective-III)

Objective: To learn fundamental knowledge and techniques related to physical modeling in geotechnical boundary value problems, including similitude, principles of measurement and test program

MODULE-I **[12 Periods]**

Similitude and Modeling Principles: Importance of physical Modeling, scaling laws, small-scale model studies in 1-g and N-g, historical Perspectives.

MODULE-II **[12 Periods]**

Design of physical model and model ground preparation: scale effects, flexible and rigid boundary conditions, preparation of sand/clay bed preparation, wet pluviation, dry pluviation, tamping techniques, slurry consolidation, uniformity of sand/clay beds.

MODULE-III **[12 Periods]**

Model planning and measurement strategy: Selection of Model dimension, model containers, preparation of models to test shallow and deep foundations, pull-out behavior, retaining walls, shaking table studies, vertical and inclined loading system, Perspex walls, markers, digital analysis.

MODULE-IV **[12 Periods]**

Sensors and Data Acquisition: Strain gauges, Load cells, Earth Pressure Transducers, LVDTs, Linear Potentiometers, pore pressure transudes, accelerometers, Hydraulic jack, calibration methods, dead weight calibration, pneumatic calibration, frequency of calibration, calibration charts, calibration factor, In-soil & fluid calibration, data acquisition system.

MODULE-V **[12 Periods]**

Recent Developments in Physical Modelling: Static behaviour of shallow and deep foundations, Piles subjected to lateral loading, behaviour of foundation subjected to earthquake loading, foundations subjected to cyclic loading, use of shaking table, behaviour of foundations on expansive soils.

Text Books

1. David muir wood, Geotechnical Modelling, Spon Press, Taylor & Francis, 2004.
2. Madabhushi, G. - Centrifuge Modeling for Civil Engineers, CRC Press, Taylor and Francis Group, 2015.

Reference Books

3. Taylor, R.N. Geotechnical Centrifuge Technology, Taylor and Francis Publication, 1995.
4. Charles Ng, Zhang,L.M., and Wang, Y.H. (2006) : Proceedings of 6th International Conference on Physical Modeling in Geotechnics, Hong Kong.
5. S. Springman, J. Laue & L. Seward, Proceedings of the 7th International

Conference on Physical Modelling in Geotechnics, Zurich, Switzerland, 2010.
6. Gaudin, C. & White, D. The Proceedings of the 8th international conference on Physical modeling in Geotechnics, Perth, Australia, 2014.

Outcome: Student will be able to understand scaling laws and modeling considerations for physical modeling in geotechnical problems both for static and dynamic conditions.

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Course Code: 51308 **Credits: 2**

M.Tech (Geo-Technical Engineering) – I Semester

ADVANCED GEOTECHNICAL ENGINEERING LABORATORY – I

1. Grain size analysis –Wet Sieve Analysis
2. Grain size analysis – Hydrometer Analysis
3. In-situ MODULE Weight (core Cutter & Sand Replacement)
4. Liquid Limit, Plastic Limit and Shrinkage Limit
5. Proctor I.S. Compaction Test
6. Permeability of Clay Soils.
7. Free Swell, Swell Potential, Swell Pressure Test
8. Oedometer Test (for determination of c_c & c_v)
9. Direct Shear Test
10. Triaxial Tests- UU
11. Triaxial Tests- CU
12. Standard Penetration Test

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Course Code: 51309 **Credits: 2**

M.Tech (Geo-Technical Engineering) – I Semester

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Course Code: 51310 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

RETAINING STRUCTURES

OBJECTIVE: To design the earth retaining structures used in construction of road/railways/pipe lines/open excavations.

MODULE-I **[12 Periods]**

Earth Pressure Theories: Rankine's and Coulomb's Earth pressure theories for cohesive and cohesionless soils, stresses due to compaction and surcharge loads.

MODULE-II **[12 Periods]**

Conventional Retaining Wall: Types of retaining walls, Stability (sliding, overturning, bearing capacity & overall) of gravity and cantilever walls, Proportioning of retaining walls, Backfill material and drainage.

MODULE-III **[12 Periods]**

Flexible Walls: Sheet pile walls, Construction methods- Cantilever and Anchored sheet pile wall.

MODULE-IV **[12 Periods]**

Reinforced Soil Walls/Mechanically Stabilised Earth: - Failure mechanisms-bond and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static and seismic analyses.

MODULE-V **[12 Periods]**

Braced Cuts: Lateral earth pressure in braced cuts, Design of various components, Stability of braced cuts, base heave and stability, yielding and settlement of ground surrounding excavation.

Text Books:

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)

Reference:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book - Springer (2001)
2. Hans Friedrich Winterkorn, Hsai-Yang Fang - Foundation Engineering Handbook, Van Nostrand Reinhold, 1975
3. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

OUTCOME: Able to design conventional/Reinforced earth retaining walls, sheet pile walls, bracing system for open excavations.

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Course Code: 51311 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

ROCK MECHANICS AND ENGINEERING

Objective: To determine properties and behavior of various types of rock under different loading conditions for underground and open excavations.

MODULE-I **[12 Periods]**

Engineering Classification of Rocks: Classification of intact rocks, Rock mass classifications, Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR), Norwegian Geotechnical Classification (Q-system), Strength and modulus from classifications, Classification based on strength & modulus and strength and fracture strain, Geoengineering classification.

MODULE-II **[12 Periods]**

Laboratory and In-Situ Testing of Rocks: Physical properties, Compressive strength, Tensile strength, Direct shear test, Triaxial shear test, Slake durability test, Schmidt rebound hardness test, Sound velocity test, In-Situ Tests: Seismic methods, Electrical resistivity method, In situ stresses, Plate loading test, Goodman jack test, Plate jacking test, In-situ shear test, Field permeability test.

MODULE-III **[12 Periods]**

Strength, Modulus and Stresses-Strain Responses of Rocks: Factors influencing rock response, Strength criteria for isotropic intact rocks, Modulus of intact rocks, effect of confining pressure, Uniaxial Compressive strength, Strength criteria for intact rocks, Strength due to induced anisotropy in rocks,. Stress Strain Models: Constitutive relationships, Elastic, Elasto-plastic, Visco-elastic, Elasto-viscoplastic stress-strain models.

MODULE-IV **[12 Periods]**

Stability of Rock Slopes and Foundations on Rocks: Rock slopes, Modes of failure, Rotational failure, Plane failure, Design charts, Wedge method of analysis, Buckling failure, Toppling failure, Improvement of slope stability and protection. Foundations on Rock: Introduction, Estimation of bearing capacity, Stress distribution, Sliding stability of dam foundations, strengthening measures, Settlements in rocks, Bearing capacity of pile/pier in rock, Remedial measures, Foundations located on edge of jointed slope.

MODULE-V **[12 Periods]**

Underground and Open Excavations: Blasting operational planning, Explosive products, Blast Design, Underground blast design, Controlled blasting techniques, blasting damage and control, Safe practice with explosives and shots.

TEXT BOOKS:

1. Goodman – Introduction to Rock mechanics, Willey International (1980).
2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall India (2007).

REFERENCES:

1. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London.(1979)

2. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982.
3. Brady, B. H. G. and Brown, E. T. - Rock Mechanics for Underground Mining, Chapman & Hall, 1993.

Outcome: Able to determine the required rock properties, determination of bearing capacity of rocks, checking the stability of slopes, and design underground and open excavation.

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Course Code: 51312 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

SOIL - STRUCTURE INTERACTION

OBJECTIVE: To understand the behavior of soil and its interaction analysis with the structure.

MODULE-I **[12 Periods]**

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

MODULE –II **[12 Periods]**

Beam on Elastic Foundation- Soil Models: Infinite beam, Two-parameters models, Isotropic elastic halfspace model, Analysis of beams of finite length, combined footings.

MODULE –III **[12 Periods]**

Plates on Elastic Continuum: Thin and thick rafts, Analysis of finite plates, Numerical analysis of finite plates.

MODULE –IV **[12 Periods]**

Analysis of Axially and Laterally Loaded Piles and Pile Groups: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap, Load deflection prediction for laterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile-raft system,

MODULE –V **[12 Periods]**

Ground-Foundation-Structure Interaction: Effect of structure on ground-foundation interaction, Static and dynamic loads.

Text Books:

1. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction, 1979
2. Rolando P. Orense, Nawawi Chouw & Michael J. Pender - Soil-Foundation-Structure Interaction, CRC Press, 2010 Taylor & Francis Group, London, UK.

References:

1. Soil Structure Interaction – The real behaviour of structures, the institution of structural engineers, London, March 1989.
2. Poulos, H. G., and Davis, E. H. - Pile Foundation Analysis and Design, 1980
3. Scott, R. F. - Foundation Analysis, Prentice Hall, Englewood Cliffs, 1981
4. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
5. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)

OUTCOME: Can analyze soil-structure interaction considering different models for various soil conditions and for different structures

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Course Code: 51313 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

FINITE ELEMENT METHODS FOR GEOTECHNICAL ENGINEERS
(Professional Elective – IV)

OBJECTIVE: To provide the fundamental concepts of the theory of the finite element method, and apply them to numerically model behaviour of soils subjected varieties of loading systems.

MODULE-I **[12 Periods]**

Introduction: Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

MODULE –II **[12 Periods]**

Element Properties: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.

MODULE –III **[12 Periods]**

Generation of Element Stiffness and Nodal Load Matrices, Isoparametric Formulation: Concept, Different isoparametric elements for 2D analysis, formulation of 4-noded and 8-noded isoparametric quadrilateral elements, Lagrangian elements, Serendipity elements.

MODULE –IV **[12 Periods]**

Assemblage of Elements: Discretization of a structure, numbering systems, Aspect ratio its effects, Assemblage, Direct Stiffness method.

MODULE –V **[12 Periods]**

Geotechnical Applications Sequential construction, Excavations and embankments, Bearing capacity and Settlement analysis.

Text Books:

1. Desai, C. S. and J.F. , Abel, Introduction to the Finite. Element MethodVan Nostrand Reinhold Company (1972)

References:

1. J. N. Reddy - Introduction to the Finite Element Method - McGraw-Hill Publishers, 1993
2. Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw-Hill,1994
3. Zienkiewicz, O. C. - Finite element Methods, McGraw-Hill Publishers, 1971

OUTCOME: To obtain an understanding of the fundamental theory of the Finite Element Method, and apply the theory to solve soil behaviour under external loads.

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Course Code: 51314 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

DISASTER MANAGEMENT
(Professional Elective – IV)

Objectives

This course provides the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences along with International Strategy for Disaster Reduction. It also has the potential to make the student design and implement disaster mitigation measures.

Module I: Concept of hazards and Disasters

A: Environmental Hazards & Disasters: [5 Periods]

Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology – Landscape, Ecosystem and Perception approach - Human ecology & its application in geographical researches.

B: Types of Environmental Hazards & Disasters: [5 Periods]

Natural hazards and Disasters – Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Module II: Classification of hazards

A: Endogenous Hazards [5 Periods]

Volcanoes- Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions – Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India - Human adjustment, perception & mitigation of earthquake, Landslides- causes and impacts, Avalanches - causes and impacts.

B: Exogenous hazards [5Periods]

Infrequent events: Cyclones – Lightning – Hailstorms, Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation), Cumulative atmospheric hazards/ disasters : Floods- Droughts- Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation), Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures, Extra Planetary Hazards/ Disasters-Man induced Hazards /Disasters- Physical hazards/

Disasters-Soil Erosion Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion, Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes, Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation, Biological hazards/ disasters:- Population Explosion.

Module III: Approaches and Measures in Disaster Management

A: Emerging approaches (4 periods)

Three Stages: 1. Pre- disaster stage (preparedness) 2. Emergency Stage 3. Post Disaster stage-Rehabilitation

B: Natural Disaster Reduction & Management (4 periods)

1) Provision of Immediate relief measures to disaster affected people 2) Prediction of Hazards & Disasters 3) Measures of adjustment to natural hazards

Module IV: Disaster Management (12 periods)

An integrated approach for disaster preparedness, mitigation & awareness.

Mitigation- Institutions- discuss the work of following Institution.

a. Meteorological observatory

b. Seismological observatory

c. Volcanological institution

d. Hydrology Laboratory

e. Industrial Safety inspectorate

f. Institution of urban & regional planners

g. Chambers of Architects

h. Engineering Council

i. National Standards Committee

Integrated Planning- Contingency management Preparedness –

a) Education on disasters

b) Community involvement

c) The adjustment of Human Population to Natural hazards & disasters Role of Media Monitoring Management- Discuss the programme of disaster research & mitigation of disaster of following organizations.

a) International Council for Scientific Unions (ICSU)- Scientific committee on problems of the Environment (SCOPE), International Geosphere- Biosphere programme (IGBP)

b) World federation of Engineering Organizations (WFED)

c) National Academy of Sciences

d) World Meteorological organizations (WMO)

e) Geographical Information System (GIS)

f) International Association of Seismology & Physics of Earth's Interior (IASPEI)

g) Various U.N agencies like UNCRD, IDNDR, WHO, UNESCO, UNICEF, UNEP.

Module V: Disaster Management in India (10 periods)

a. A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India

b. Ecological planning for sustainability & sustainable development in India- Sustainable rural development: A Remedy to Disasters -Role of Panchayats in Disaster mitigations

c. Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

Text Books:

1. Jagbir singh, **"Disaster management–Future challenges and opportunities"**, I.K. International publishing house, 1st edition, 2005.

2. Coppala P Damon, **"Introduction to International Disaster management",** ABD publishers**,** 2007**.**

References:

1. R.B.Singh (Ed), **"Environmental Geography"**, Heritage Publishers, New Delhi, 1st edition, 1990.

2. Kates,B.I & White. G.F, **"The Environment as Hazards"**, oxford publishers, 5th edition, New York, 1978.

3. R.B. Singh (Ed), **"Disaster Management"**, Rawat Publication, New Delhi, 1st edition, 2000.

Course Outcomes:

The student will acquire the knowledge

- To analyze, evaluate and manage the environmental, social, cultural, economical, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
- To assess the different public health aspects at local and global levels as a result of disaster, and can well plan to mitigate them.

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Course Code: 51315 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT
(Professional Elective – IV)

OBJECTIVE: To develop a methodical approach on assessment of environmental impacts due to developmental activities and a conceptual outlook on sustainable development.

MODULE-I **[12 Periods]**

Basic concept of EIA: Initial environmental Examination, Elements of EIA,- factors affecting EIA IMPACT evaluation and analysis, preparation of Environmental Base maps, Classification of environmental parameters.

MODULE –II **[12 Periods]**

E I A Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, Benefit Analysis.

MODULE –III **[12 Periods]**

Impact of Development Activities and Land use: Introduction, Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities, Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measure.

MODULE –IV **[12 Periods]**

E I A an surfaced water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact, Assessment of Impact on development Activities of Vegetation and wildlife, environmental Impact of Deforestation –Courses and effects of deforestation.

MODULE –V **[12 Periods]**

Environmental Audit & Environmental legislation: Objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report, Post Audit activities, The Environmental pollution Act, The water Act, The Air (Prevention & Control of pollution Act.). EIA Report preparation and Case studies

Text Books:

1. Anjaneyulu, Y. - Environmental Impact Assessment Methodologies, B. S. Publication, Sultan Bazar, Hyderabad

References:

1. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers, 1999
2. Suresh K. Dhaneja - Environmental Science and Engineering, S.K.,Katania & Sons Publication., New Delhi.

3. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication(P) Ltd, Delhi, 2003

OUTCOME: Knowledge on prediction and assessment of environmental impacts due to developmental activities, Concepts on various environmental impact assessment methodologies and an outlook on legislations to safeguard environment.

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Course Code: 51316 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

GROUNDWATER CONTAMINATION AND REMEDIATION
(Professional Elective – V)

OBJECTIVE: To estimate the movement of contamination in the ground and to know the various remediation methods.

MODULE-I **[12 Periods]**

Introduction: Sources and types of groundwater contamination, Characterisation of contaminated site, Contaminant transport mechanisms.

MODULE –II **[12 Periods]**

Sorption and Other Chemical Reactions: Introduction, concept of sorption, factors influencing sorption, sorption isotherms, hydrophobic theory for organic contaminants, sorption effects on fate and transport of pollutants, Estimation of sorption.

MODULE –III **[12 Periods]**

Flow and Transport in the Unsaturated Zone: Capillarity, soil-water characteristics curves, unsaturated hydraulic conductivity, governing equation for unsaturated flow, measurement of soil properties.

MODULE –IV **[12 Periods]**

Non-Aqueous Phase Liquids: Introduction, Types of NAPLs, NAPL transport- General processes, NAPL transport- computational methods- Fate of NAPLs in the subsurface, characterizing NAPLs at remediation sites.

MODULE –V **[12 Periods]**

Groundwater Remediation Technologies – Methods of remediation of contaminated ground - pump and treat, in-situ flushing, permeable reactive treatment walls, air sparging, soil vapour extraction, natural attenuation, bioremediation and phytoremediation.

Text Books:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008

References:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book -Springer (2001)
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)
3. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
4. Daniel, D. E. - Geotechnical Practice for Waste Disposal

OUTCOME: Modelling the contaminant transport in the ground and able to identify most appropriate remediation technique for various types of contaminants and ground conditions.

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Course Code: 51317 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

SOIL DYNAMICS AND MACHINE FOUNDATIONS
(Professional Elective – V)

Objective: To understand the wave propagation in soils, determine dynamic properties of soil for analyzing and designing foundations subjected to vibratory loading.

MODULE-I **[12 Periods]**

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

MODULE-II **[12 Periods]**

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.

MODULE-III **[12 Periods]**

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

MODULE-IV **[12 Periods]**

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

MODULE-V **[12 Periods]**

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

TEXT BOOKS:

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt.Ltd. (2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)

REFERENCES:

1. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
2. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler

Publication Ltd., 1998.
3. Das, B. M. & Ramana, G.V. - Principles of Soil Dynamics, 2nd Edition, CL Engineering Publishers, 2010.

Outcome: Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines.

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Course Code: 51120 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

DESIGN OF SUB STRUCTURES
(Professional Elective – V)

Objectives:

1. To impart knowledge on the types and purposes of different foundation systems and structures
2. To gain familiarity with different types of foundation
3. To explore the students to the design of shallow foundations and deep foundations
4. To understand the concept of retaining walls and machine foundations

MODULE I **[12 Periods]**

SHALLOW FOUNDATIONS

Soil investigation – Basic requirements of foundation –Types and selection of foundations. Design of reinforced concrete isolated, combined, eccentric, strip, and strap footings.

MODULE II **[12 Periods]**

RAFT FUODATIONS

Design of raft foundation. Types of rafts, Design of slab raft foundation and Design of beam and slab raft foundation.

MODULE III **[12 Periods]**

PILE FOUNDATIONS

Introduction – Types of pile foundations – load carrying capacity - structural design of straight piles – Structural design of pile-Reinforcement details of pile and pile caps different shapes of piles cap – structural design of pile cap.

MODULE IV **[12 Periods]**

DESIGN OF RETAINING WALLS

Stability Analysis and design of gravity, Cantilever, counter fort and basement retaining walls.

MODULE V **[12 Periods]**

MACHINE FOUNDATIONS

Introduction – Types of machine foundations – General criteria for design of machine foundation - Vibration analysis of machine foundation - Design of foundation for Reciprocating machines and Impact machines - as per l.S. Codes. Vibration isolation - types and methods of isolation - isolating materials and their properties.

Outcomes:

- The students will be able to understand necessary theoretical background for design of foundation systems

TEXT BOOKS

1. Sawmi Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.1998
2. P. C. Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Pvt. Ltd., New Delhi, 2009
3. Kurain N. P, "Design of foundation systems-Principles and Practice", Narosa Publishing house, New Delhi, 2005.
4. "Handbook of Machine Foundations" Srinivasulu, P. And Vaidyanathan, C. V., Tata McGraw
5. -Hill, New Delhi, 2001

REFERENCES:

1. Bowles .J.E., "Foundation Analysis and Design", McGraw Hill Publishing co., New York, 1986.
2. Tomlinson.M.J, "Foundation Design and Construction", Longman, Sixth Edition, New Delhi, 1995.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak Foundation design manual,Dhanpat Rai & Sons, 2006
5. "Foundations for Machines, Analysis and Design" Prakash Shamsher and Puri Vijay K, John Wiley and Sons, USA, 1988
6. IS 2911 : Part 1 : Sec 1 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concrete piles

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Course Code: 51318 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

GEOSYNTHETICS & SOIL REINFORCEMENT
(Professional Elective – VI)

OBJECTIVE: To determine the properties, functions and applications of various geosynthetic materials and to design reinforced soil structures.

MODULE-I **[12 Periods]**

An Overview of Geosynthetics: Classification of Geosynthetics, Functions and applications, Properties of geotextiles, Geogrids and Geomembranes.

MODULE –II **[12 Periods]**

Soil Reinforcement: Mechanism, improvement of Bearing capacity, Embankments on soft ground, Soil Nailing.

MODULE –III **[12 Periods]**

Reinforced Embankments and Reinforced soil walls –Internal and External Stability

MODULE –IV **[12 Periods]**

Geosynthetics for Highways: Roadway Reinforcement, applications for Separation, Filtration, Drainage, Reinforcement, Moisture Barrier, Membrane encapsulation.
Landfills: Geosynthetic applications for land fill liners, covers and other components

MODULE –V **[12 Periods]**

Dewatering Systems: Sand drains, Prefabricated Vertical drains (PVD), French Drains.

Text Books:

1. Koerner, R. M. - Designing with Geosynthetics, Prentice Hall; 2nd edition, (1991)
2. Rao, G. V. & Raju G. V. S. S. - Engineering with Geosynthetics, Tata-McGraw Hill. Publication, New Delhi. (2004.)

References:

1. Hausmann, M. R. - Engineering Principles of Ground Modifications, McGraw Hill Pub Co, 1989
2. Xianthakos, Abreimson and Bruce - Ground Control and Improvement, John Wiley & Sons, 1994.
3. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis
4. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
5. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

OUTCOME: Able to apply the appropriate geosynthetic material for improving ground for various Civil Engineering projects, and design of various reinforced soil structures.

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Course Code: 51319 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

MATERIAL CHARACTERIZATION AND PAVEMENT ENGINEERING
(Professional Elective – VI)

Objectives

The main objective of this course is to provide students with a thorough understanding of the important factors in pavement design and analysis. The focus will be on practices of pavement design and maintenance used by highway agencies.

MODULE I: **[12 Periods]**

Subgrade Soil Characterization: Properties of subgrade layers; different types of soils, Mechanical response of soil; Soil Classification; Index and other basic properties of soil; A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. SPT, DCPT, CPT, CBR, Plate Load test & resilient modulus; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Dynamic properties of soil: FWD test.

MODULE II: **[12 Periods]**

Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control. Introduction to Ground improvement techniques; Introduction to Geo textiles and synthetics applications.

MODULE III: **[12 Periods]**

Aggregate Characterization: Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation, Fuller and Thompson's Equation, 0.45 power maximum density graph; Use of locally available materials in lieu of aggregates.

MODULE IV: **[12 Periods]**

Bitumen and Bituminous Concrete Mix Characterization: Bitumen sources and manufacturing, Chemistry of bitumen, bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test, stiffness modulus of bitumen mixes using shell nomographs; Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties.Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Introduction to emulsified bitumen and its characterization; Long term and short term ageing and its effect on bitumen performance, Tests to simulate ageing of bitumen viz. RTFOT and PAV.

Desirable properties of bituminous mixes, Design of bituminous mixes: Modified Marshall's specifications, Hubbard Field method of mix design, Hveem's method of mix design; Introduction to super pave mix design procedure

MODULE V: **[12 Periods]**

Cement and Cement Concrete Mix Characterization:

Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties; Introduction to advanced concretes like self compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; IS method of cement concrete mix design with case studies; Role of different admixtures in

cement concrete performance; Joint fillers for Jointed Plain Cement Concrete Pavements and their characterization; Nano technology applications in cement concrete.

REFERENCE BOOKS:

1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall. 2: Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971.
2. Relevant IRC and IS Codes of Practices (Separate List will be given).
3. Read, J. And Whiteoak, D., "The Shell Bitumen Handbook", Fifth edition, Shell Bitumen, Thomas Telford Publishing, London 2003
4. Relevant IRC and IS codes

Outcomes:

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

- Determine the proportions of ingredients required for the mix design of both asphalt mixtures and cement concrete.
- Characterize the pavement materials including soil, aggregate, asphalt, cement, asphalt mixtures, cement concrete.
- Select appropriate asphalt binder for construction of a flexible pavement depending upon the traffic and climatic conditions.
- Choose appropriate stabilization technique for pavement

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Course Code: 51320 **Credits: 4**

M.Tech (Geo-Technical Engineering) – II Semester

OFFSHORE GEOTECHNICAL ENGINEERING
(Professional Elective – VI)

OBJECTIVE: To understand differences between the soil and loading conditions of on-shore and offshore structures, various types of offshore foundation systems, and to evaluate the performance of offshore structures.

MODULE I **[12 Periods]**

The nature of Submarine Soils: origin, classification and distribution of marine sediments; insitu stress state in submarine deposits; inorganic clay deposits; calcareous sediments; siliceous sediments. Offshore Geotechnical Investigations: phases of the investigation, geophysical survey, drilling and sampling procedures, in-situ testing techniques, laboratory testing.

MODULE II **[12 Periods]**

Foundations for Offshore Gravity Structures: construction, installation, instrumentation of gravity platforms, stability analysis, deformation analysis based on elastic theory, piping and erosion.

MODULE III **[12 Periods]**

Foundations for Jack-up Rigs: foundations types and design loads, Prediction of individual footing performance, prediction of mat footing performance, seabed anchors, load capacity of anchors, breakout forces, anchor systems for floating structures.

MODULE IV **[12 Periods]**

Offshore Pile Foundations: types of offshore piles, temporary support of piled structures, dynamic analysis of pile driving, axial load capacity, axial deformation analysis, Lateral loading, and dynamic response.

MODULE V **[12 Periods]**

Seafloor Stability: causes of seafloor instability, geological features of submarine slides, mechanisms of instability, slope stability under gravity forces and wave forces, Effects of soil instability on piles, installation and stability of submarine pipelines.

Text Books:

1. Marine Geotechnics – H.G. Poulos (1988), Prentice Hall Inc.
2. Construction of marine and offshore structures – Ben C Gerwick, jr., CRC Press, Taylor and Francis Group.(2012)

References:

1. Seabed Reconnaissance and Offshore Soil Mechanics (for the installation of petroleum structures) – Pierre LE Tirant (1979), Gulf Publishing Company, Houston, Texas.
2. API (2000) – Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – API, RP2A.
3. Pile design and construction practice – M J Tomlinson, View point Publications, Palladian Publications Limited.(1987)
4. Port Engineering planning, construction, maintenance and security – George P Tsinker, John Wiley & Sons, Inc. (2004)

OUTCOME: Students should be able to design and evaluate the performance of offshore foundations.

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Course Code: 51321 **Credits: 2**

M.Tech (Geo-Technical Engineering) – II Semester

ADVANCED GEOTECHNICAL ENGG LAB- II

List of Experiments

1. Slake Durability Test
2. Brazilian Test
3. Point Load Test
4. Unconfined Compression Test
5. Geo studio's software for slope stability analysis
6. Slides software slope stability analysis
7. Pile pro for pile foundation analysis
8. Finite element analysis using plaxis software

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Course Code: 51322 **Credits: 2**

M.Tech (Geo-Technical Engineering) – II Semester

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Course Code: 51323 **Credits: 4**

M.Tech (Geo-Technical Engineering) – III Semester

COMPREHENSIVE VIVA VOCE

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Course Code: 51324 **Credits: 8**

M.Tech (Geo-Technical Engineering) – III Semester

PROJECT WORK PART-I

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Course Code: 51325 **Credits: 8**

M.Tech (Geo-Technical Engineering) – IV Semester

PROJECT WORK PART-II

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Course Code: 51326 **Credits: 12**

M.Tech (Geo-Technical Engineering) – IV Semester

PROJECT VIVA- VOICE