K.S.R.M.
COLLEGE OF ENGINEERING

(UGC - Autonomous)
Accredited by NAAC with A+ Grade & B.Tech. (EEE, ECE, CSE, CE and ME) Programs by NBA
An ISO 9001:2015, 14001: 2015 & 50001: 2018 Certified Institution

ACADEMIC REGULATIONS (R25PG)
COURSE STRUCTURE AND SYLLABI

(Effective for the students admitted into I year
from the academic year 2025 -2026 onwards)

MASTER OF TECHNOLOGY (M.Tech.)
GEOTECHNICAL ENGINEERING
(Regular, Full-time)

VISION AND MISSION
OF
K.S.R.M. COLLEGE OF ENGINEERING

VISION:

To evolve as a centre of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

MISSION:

M1. Provide high quality education with enriched curriculum blended with impactful Teaching-Learning practices.

M2. Promote Research, Entrepreneurship and Innovation through industry collaborations.

M3. Produce highly competent professional leaders for contributing to socio-economic development of the region and the nation.

VISION AND MISSION
OF
DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a leading center for Civil Engineering education and research focusing on producing Industry-ready, skilled and ethical professionals with leadership qualities embedded with human values to serve society and the nation.

MISSION

M1. Providing quality Civil Engineering education with a modern, outcome based curriculum and effective teaching-learning methods following Professional Ethics.

M2. Using modern tools and techniques to do research, consultancy and upskilling through collaboration with industries thereby providing sustainable engineering solutions for society and the country.

M3. Developing leadership qualities, entrepreneurship, and moral values in students for the development of nation.

M.Tech. GEOTECHNICAL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To promote highly skilled geotechnical engineers who excel in designing and executing innovative projects within advanced geotechnical engineering and infrastructure domains.

PEO2. To foster passionate researchers and lifelong learners, equipped for dynamic professional advancement and cutting-edge exploration in geotechnical engineering.

PEO3. To nurture visionary leaders and responsible innovators, committed to sustainable construction and pioneering ground improvement solutions that address global challenges with integrity.

PEO4. To empower graduates to communicate effectively, demonstrate exemplary leadership, and uphold ethical standards while responding to complex societal and environmental challenges in geotechnical engineering practice.

PROGRAM OUTCOMES (POs)

After successful completion of the program, graduates will be able to

PO1. Apply advanced principles of soil mechanics, rock mechanics, and geotechnical analysis to evaluate and solve complex soil related engineering problems.

PO2. Plan and execute geotechnical investigations, interpret field and laboratory data accurately and conduct research to address challenges in soil behaviour, foundation performance and ground stability.

PO3. Design sustainable geotechnical systems including foundations, retaining structures, slopes, embankments and ground improvement solutions in line with Professional standards.

PO4. Use advanced geotechnical software, numerical modelling tools, and project management practices to analyze, design, and implement geotechnical engineering projects effectively.

PO5. Communicate technical information effectively and uphold ethical standards in professional practice and decision-making.

PO6. Pursue lifelong learning and understand the social, environmental and global impact of geotechnical engineering solutions.

K.S.R.M. COLLEGE OF ENGINEERING

(AUTONOMOUS)

Academic Regulations of M.Tech. (Full Time/Regular) Programme

(Effective for the students admitted into I year from the Academic Year 2025-26 and onwards)

K.S.R.M. College of Engineering (KSRMCE) offers **Two** Years (**Four** Semesters) full-time Master of Technology (M.Tech.) Degree programme, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

The affiliating university Jawaharlal Nehru Technological University Anantapur shall confer M.Tech. degree on candidates who are admitted to the programme and fulfill all the requirements for the award of the degree.

1. Award of the M.Tech. Degree

A student will be declared eligible for the award of the M.Tech. degree if he/she fulfils the following:

1.1 Pursues a course of study for not less than two academic years and not more than four academic years.

1.2 Registers for 75 credits and secures all 75 credits.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in M.Tech. course and their admission stands cancelled.

3. Programme of Study:

The following M.Tech. Specializations are offered at present in different branches of Engineering and Technology and are as follows:

Discipline	**Name of the Specialization**	**Code**
Civil Engineering	Geo Technical Engineering	12
Electrical and Electronics Engineering	Power Systems	52
Mechanical Engineering	Renewable Energy	99
Computer Science and Engineering	Artificial Intelligence and Data Science	98
Electronics & Communication Engineering	Embedded Systems & VLSI	84

4. Eligibility for Admissions:

4.1 Admission to the M. Tech Program shall be made subject to the eligibility, qualification and specialization prescribed by the A.P. State Government/University from time to time.

4.2 Admissions shall be made either on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by A.P. State Government (APPGECET) for M.Tech. programmes an entrance test conducted by University/on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

5. Programme related terms:

5.1 ***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/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit

5.2 ***Academic Year:*** Two consecutive (one odd + one even) semesters constitute one academic year.

5.3 ***Choice Based Credit System (CBCS):*** The CBCS provides choice for students to select from the prescribed courses.

6. Programme Pattern:

6.1 Total duration of the of M.Tech. programme is two academic years

6.2 Each academic year of study is divided into two semesters.

6.3 Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

6.4 The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech. programme.

6.5 The medium of instruction of the programme (including examinations and project reports) will be in English only.

6.6 All subjects/courses offered for the M.Tech. degree programme are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Core Courses	Foundational & Professional Core Courses (PC)	Includes subjects related to the parent discipline / department / branch of Engineering/specialization.
2.	Elective Courses	Professional Elective Courses (PE)	Includes elective courses related to the parent discipline / department / branch of Engineering
		Open Elective Courses (OE)	Elective courses which include inter-disciplinary courses or courses in an area outside the parent discipline which are of importance in the context of special skill development
3.	Mandatory Courses	Quantum Technology and Application	To understand importance of latest technologies, research and process of creation of patents through research
		Research methodology & IPR	
4.		Skill Enhancement courses (SE)	Interdisciplinary / job-oriented / domain courses which are relevant to the industry
		Comprehensive Viva	To test the overall domain knowledge

S. No.	Broad Course Classification	Course Category	Description
		Short Term Industry Internship	To provide real time exposure
		Dissertation	To provide application of domain knowledge to solve real problems
5.	Audit Courses	Mandatory non-credit courses	Covering courses of developing desired attitude among the learners.

6.7 The college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

6.8 A faculty advisor/mentor shall be assigned to each specialization to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.

6.9 Preferably 25% course work for the theory courses in every semester shall be conducted in the blended mode of learning.

7. Attendance Requirements:

7.1 A student shall be eligible to appear for the Semester-End examinations if he/she acquires i) a minimum of 50% attendance in each course and ii) 75% of attendance in aggregate of all the courses.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

7.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence

7.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their semester-end examination of that class.

7.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

7.6 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek re-admission into that semester when offered next.

7.7 If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

7.8 If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

8. Evaluation – Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated course - wise (irrespective of credits assigned), for a maximum of 100 marks for theory and 100 marks for practical, based on Internal Evaluation and Semester-End Examination.

8.1 There shall be five units in each of the theory courses. For the theory courses 60 marks will be for the Semester-End Examination and 40 marks will be for Internal Evaluation.

8.2 Two Internal Examinations shall be conducted for 30 marks each, one in the middle of the Semester and the other immediately after the completion of instruction period. The

other 10 marks is awarded for continuous assessment in the form of assignments, quizzes, open book examination, presentation, etc. First mid examination shall be conducted for I & II units of the syllabus and second mid examination for III, IV & V units. Each mid exam shall be conducted for a total duration of 120 minutes with 3 questions (without choice) and each question carries 10 marks. Final Internal marks for a total of 40 marks shall be arrived at by considering the marks secured by the student in both the internal examinations with 80% weightage to the better internal exam and 20% to the other.

8.3 The following pattern shall be followed in the End Examination:

i. Five questions shall be set from each of the five units with either/or type for 12 marks each.
ii. All the questions have to be answered compulsorily.
iii. Each question may consist of one, two or more sub-questions.

8.4 For practical courses, 60 marks shall be for the Semester-End Examinations and 40 marks will be for internal evaluation based on the day-to-day performance.

The internal evaluation based on the day-to-day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The semester-end examination shall be conducted by the examiners, with a breakup mark of Procedure-10, Experimentation-25, Results-10, Viva-Voce-15.

8.5 There shall be Mandatory **Audit courses** in I & II semesters for zero credits. There is no external examination for audit courses. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 40 marks for every six months/semester satisfying the conditions mentioned in item 1 & 2 of the regulations.

8.6 A candidate shall be deemed to have secured the minimum academic requirement in a course if he secures a minimum of 40% of marks in the Semester-End Examination and a minimum aggregate of 50% of the total marks in the Semester-End Examination and Internal Evaluation taken together.

8.7 In case the candidate does not secure the minimum academic requirement in any of the courses he/she has to reappear for the Semester-End Examination either supplementary or regular in that course or repeat the course when next offered or do any other specified course as may be required.

8.8 The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

9. Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, students are allowed to do up to a maximum of 40% of the Professional and Open Electives in a semester through SWAYAM/SWAYAM Plus.

9.1 The college offers credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.

9.2 The online learning courses available on the SWAYAM platform will be considered for

credit transfer. SWAYAM course credits are as specified in the platform

9.3 Student registration for the MOOCs shall be only through the college, it is mandatory for the student to share necessary information with the college

9.4 The institution will list out the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculum in the offline mode.

9.5 The institution will notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.

9.6 Students may register for an 8-week (2 credits) or 12-week (3 credits) SWAYAM / SWAYAM plus course with the approval of the Head of the Department (HoD).

9.7 Examination fees, if applicable, shall be borne by the student. Pass marks and grading will be as per the JNTUA academic regulations.

9.8 A student must get minimum 40% marks for assignments and quizzes on the SWAYAM/ SWAYAM plus platform to be eligible for the semester-end examination. The students who are unable to get minimum internal marks in SWAYAM/ SWAYAM plus platform, they have to re-register for the course in subsequent semester through SWAYAM/ SWAYAM plus platform.

9.9 The semester-end exam may be conducted by the National Testing Agency (NTA), the National Programme on Technology Enhanced Learning (NPTEL) or the College during the regular end-term exams. Evaluation shall comprise 60% weightage for the semester-end examination and 40% for assignments and quizzes conducted by the SWAYAM/ SWAYAM plus course coordinator. The student has to get 50% marks for internal and external with minimum of 40% marks in the external examination to declare them as pass.

9.10 The institution also ensures that the student completes the course and produces the course completion certificate as per the academic schedule given for the regular courses in that semester. However, the credits will be transferred to the students who got minimum 50% marks with 40% marks in the external examination

9.11 The institution will designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

9.12 The college will ensure no overlap of SWAYAM MOOC exams with that of the semester-end examination schedule. In case of delay in SWAYAM results, the college will re-issue the marks sheet for such students.

9.13 Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the minimum 50% of marks and grades.

9.14 The institution maintains the following in the examination section and submits as and when demanded by the university:

a) List of students who have passed MOOC courses in the current semester along with the certificates of completion.
b) Undertaking form filled by the students for credit transfer.

9.15 The college will resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students are also be permitted to register for MOOCs offered through online platforms other than SWAYAM NPTEL. In such cases, credit transfer shall be permitted only after seeking approval of the Principal with the recommendations of the concerned HoD and Dean, Academics at least three months prior to the commencement of the semester.

10. Re-registration for Improvement of Internal Evaluation Marks:

A candidate shall be given one chance to re-register for each course provided the internal marks secured by a candidate are less than 50% and has failed in the end examination

10.1 The candidate should have completed the course work and obtained examinations results for **I, II and III** semesters.

10.2 The candidate should have passed all the courses for which the Internal Evaluation marks secured are more than 50%.

10.3 Out of the courses the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory course and for a maximum of **three** Theory courses for Improvement of Internal evaluation marks.

10.4 The candidate has to re-register for the chosen courses and fulfill the academic requirements.

10.5 For re-registration, the candidates have to apply to the Principal through the respective HoD by paying the requisite fees and get approval from the Principal before the start of the semester in which re-registration is required

10.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the Semester-End Examinations marks secured in the previous attempt(s) for the reregistered courses stand cancelled.

11. Evaluation of Project/Dissertation Work:

The Project work shall be initiated at the beginning of the III-Semester and the duration of the Project is of two semesters. Evaluation of Project work is for 300 marks with 200 marks for internal evaluation and 100 marks for external evaluation. Progress of the project work is monitored through three reviews:

- Project review – I at the beginning of the III semester for zero marks
- Project review – II at the end of the third semester for 100 marks
- Project review – III before submission of the thesis i.e., end of the IV semesters for 100 marks

External evaluation of final Project work viva voce in IV semester shall be for 100 marks.

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

11.1 A candidate is permitted to register for the Project Work in III Semester after satisfying the attendance requirements in all the courses, both theory and laboratory (in I & II semesters).

11.2 A candidate is permitted to submit Project dissertation with the approval of PRC. The candidate has to pass all the theory, practical and other courses before submission of the Thesis.

11.3 Project work shall be carried out under the supervision of teacher in the parent department concerned.

11.4 A candidate shall be permitted to work on the project in an industry/research organization on the recommendation of the Head of the Department. In such cases, one of the teachers from the department concerned would be the internal guide and an expert

from the industry/research organization concerned shall act as co-supervisor/external guide. It is mandatory for the candidate to make full disclosure of all data/results on which they wish to base their dissertation. They cannot claim confidentiality simply because it would come into conflict with the Industry's or R&D laboratory's own interests. A certificate from the external supervisor is to be included in the dissertation.

11.5 Continuous assessment of Project Work - I and Project Work – II in III & IV semesters respectively will be monitored by the PRC.

11.6 The candidate shall submit status report by giving seminars in three different phases (two in III semester and one in IV semester) during the project work period. These seminar reports must be approved by the PRC before submission of the Project Thesis.

11.7 After registration, a candidate must present in Project Review - I, in consultation with his Project Supervisor, the title, objective and plan of action of his Project work to the PRC for approval within four weeks from the commencement of III Semester. Student shall initiate the project work, only after obtaining the approval of the PRC.

11.8 The Project Review - II in III semester carries internal marks of 100. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work.

11.9 A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - II. Only after successful completion of Project Review – II, candidate shall be permitted for Project Work Review – III in IV Semester. The unsuccessful students in Project Review - II shall reappear after three months.

11.10 The Project Review - III in IV semester carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Project Work and decide whether or not eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - III. If student fails to obtain the required minimum marks, he/she has to reappear for Project Review - III after a month.

11.11 For the approval of PRC, the candidate shall submit the draft copy of dissertation to the Head of the Department and make an oral presentation before the PRC.

11.12 After approval from the PRC, the student is permitted to submit a report. The dissertation report will be accepted only when the plagiarism is within 30% checked through Turnitin software (repository mode). The plagiarism report shall be submitted along with the dissertation report.

11.13 Research paper related to the Project Work shall be published in an SCI/ESCI/Scopus/UGC Care listed journal, or in conference proceedings with ISBN number organized by professional societies such as IEEE, IEI, etc.

11.14 After successful plagiarism check and publication of research paper, three copies of the dissertation certified by the supervisor and HOD shall be submitted to the College.

11.15 The dissertation shall be adjudicated by an external examiner selected by the College. For this, a panel of three examiners shall be submitted by the supervisor concerned and department head for each student. However, the dissertation will be adjudicated by one examiner nominated by the Principal.

11.16 If the report of the examiner is not satisfactory, the candidate shall revise and resubmit

the dissertation, in the time frame as decided by the PRC. If report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the Principal.

11.17 If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva voce exam.

11.18 The Project Viva voce examinations shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who has adjudicated the dissertation. For Dissertation Evaluation (Viva voce) in IV Sem. there are external marks of 100 and it is evaluated by external examiner. The candidate has to secure a minimum of 50% marks in Viva voce exam.

11.19 If he fails to fulfill the requirements as specified, he will reappear for the Project Viva voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree.

12 Industry Internships:

Industry internship either onsite or virtual with a minimum of 06-08 weeks duration, done at the end of 1st year second semester. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the PG program. The student shall register for the internship as per course structure after commencement of academic year.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, Mentor/Supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. Internship will be evaluated for 100 marks with 50 marks for the report evaluated by the mentor and 50 marks for oral presentation. A student should secure minimum 50% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College.

13 Comprehensive Viva

A Comprehensive Viva shall be conducted after the II Semester examinations for 100 marks by a committee consisting of the Head of the Department, one senior faculty member of the same specialization, and an external subject expert appointed by the Principal. The student must secure a minimum of 50% marks to be declared as passed

14 Credits for Co-curricular Activities

A Student should earn 01 credits under the head of co-curricular activities, viz., attending Conference, Scientific Presentations and Other Scholarly Activities.

Following are the guidelines for awarding Credits for Co-curricular Activities

Name of the Activity	Maximum Credits / Activity
Participation in National Level Seminar / Conference / Workshop / Training programs (related to the specialization of the student)	0.5
Participation in International Level Seminar / Conference / Workshop / Training programs held outside India (related to the specialization of the student)	1
Academic Award/Research Award from State Level / National Agencies	0.5
Academic Award / Research Award from International Agencies	1
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	0.5
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	1

Note:

i) Credit shall be awarded only for the first author. Certificate of attendance and participation in a Conference/Seminar is to be submitted for awarding credit. A minimum participation of five days is required to earn the necessary credits. Alternatively, the student may attend five different one day programs to meet this requirement.

ii) Certificate of attendance and participation in workshops and training programs (Internal or External) is to be submitted for awarding credit. The total duration should be at least one week.

iii) Participation in any activity shall be permitted only once for acquiring required credits under cocurricular activities

15 Grading:

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

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the course fall	Grade	Grade points Assigned
≥ 90	S (Superior)	10
≥ 80 < 90	A (Excellent)	9
≥ 70 < 80	B (Very Good)	8
≥ 60 < 70	C (Good)	7
≥ 50 < 60	D (Pass)	6
< 50	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade "F" or Grade "Ab" in a course shall be considered failed and will be required to reappear for that course when it is offered the next supplementary examination.

ii) For noncredit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA / CGPA / Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$

where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

i) The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

   $CGPA = \Sigma (C_j \times S_i)/ \Sigma C_j$

   where "S_i" is the SGPA of the i^{th} semester and C_j is the total number of credits up to that semester.

ii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iii) While computing the SGPA the courses in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D and F.

16 Award of Class:

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

Class Awarded	CGPA to be secured
First Class with Distinction	≥7.5%
First Class	< 7,5≥ 6.5
Pass Class	< 6.5

17 **Exit Policy:**

The student shall be permitted to exit with a PG Diploma based on his/her request to the university through the respective institution at the end of first year subject to passing all the courses in first year.

The Academic Council shall resolve any issues that may arise in the implementation of this policy from time to time and shall review the policy in the light of periodic changes brought by UGC, AICTE and State government.

18 Withholding of Results:

If the candidate has any case of in-discipline pending against him/her, the result of the candidate shall be withheld, and he/she will not be allowed/promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

19 **Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent courses as and when courses are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

20 General:

20.1 The academic regulations should be read as a whole for purpose of any interpretation.

20.2 Disciplinary action for Malpractice / improper conduct in examinations is appended.

20.3 There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.

20.4 Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

20.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

20.6 The College may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the College.

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RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No.	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 course 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 course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
1.(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 the 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/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
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 for four consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of 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/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations if his

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
		involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course 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/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course 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 only.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around 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	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 shall not be permitted to appear for the remaining examinations of the courses of that semester / year. If the candidate physically assaults the invigilator / officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
	of the examination.	
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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possessany 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/year. 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.	Student of the colleges 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 / year. 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 / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course only or in that course and all other courses the candidate has appeared including practical examinations and project work of that semester / year

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
		examinations, depending on the recommendation of the committee.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

1. Malpractices identified by squad or special invigilators
2. Punishments to the candidates as per the above guidelines.
3. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
4. A show cause notice shall be issued to the college.
5. Impose a suitable fine on the college.
6. Shifting the examination center from the college to another college for a specific period of not less than one year.

Note:

Whenever the performance of a student is cancelled in any course/courses due to Malpractice, he has to register for End Examinations in that course/courses consequently and has to fulfil all the norms required for the award of Degree.

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COURSE STRUCTURE

M.Tech. GEOTECHNICAL ENGINEERING
I-SEMESTER

S. No.	Course Code	Course Title	Category	Hours per week			Credits
				L	T	P	
1.	2512101	Advanced Soil Mechanics	PC	3	0	0	3
2.	2512102	Sub surface Investigations and Instrumentation	PC	3	0	0	3
3.	**Program Elective-I**		PE	3	0	0	3
	2512103	Engineering Rock Mechanics					
	2512104	Critical Soil Mechanics					
	2512105	Environmental Geotechnology					
4.	**Program Elective-II**		PE	3	0	0	3
	2512106	Finite Element Methods in Geo mechanics					
	2512107	Computational Geomechanics					
	2512108	Soil Structure Interaction					
5.	2512151	Soil Mechanics – I Lab	PC	0	0	4	2
6.	2512152	Soil Mechanics –II Lab	PC	0	0	4	2
7.	2599153	GeoStudio	SE	0	1	2	2
8.	2599171	Research Methodology and Intellectual Property Rights	MC	2	0	0	2
9.	**Audit Course–I**		AC	2	0	0	2
	2599181	English for Research Paper Writing					
	2512181	Disaster Management					
	2598181	Essence of Indian Traditional Knowledge					
			TOTAL	**16**	**1**	**10**	**22**

2512101	M.Tech., I-SEMESTER ADVANCED SOIL MECHANICS (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Geotechnical Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Demonstrate the compressibility and consolidation behaviour of soils under various loading conditions.

CO2. Analyse the shear strength behaviour of soils under different drainage conditions.

CO3. Apply the stress path concepts to predict soil behaviour under various loading and boundary conditions.

CO4. Evaluate the behaviour of soils using critical soil mechanics concepts.

CO5. Distinguish between elastic and plastic deformations in soil.

SYLLABUS:

UNIT- I: GEOSTATIC STRESSES AND COMPRESSIBILITY OF SOILS (12 Periods)

Concept of stress for a particulate system, Effective stress principle, Geostatic stresses consolidation theory (one-, two-, and three-dimensional consolidation theories), consolidation in layered soil and consolidation for time dependent loading, determination of coefficient of consolidation (Casagrande method and Taylor's method)

UNIT- II: FLOW THROUGH SOILS AND STRENGTH BEHAVIOUR OF SOILS (08 Periods)

Permeability, seepage, mathematical analysis – Finite difference formulae for steady state and transient flows – flow nets – computation of seepage – uplift pressure, and critical hydraulic gradient. Mohr Circle of Stress; UU, CU, CD tests, drained and undrained behavior of sand and clay, significance of pore pressure parameters; determination of shear strength of soil; Interpretation of triaxial test results.

UNIT- III: STRESS PATH (08 Periods)

Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations.

UNIT- IV: CRITICAL STATE SOIL MECHANICS (09 Periods)

Critical state parameters, critical state for normally consolidated and over consolidated soil, Significance of Roscoe and Hvorslev state boundary surface; drained and undrained plane. critical void ratio, effect of dilation in sands, different dilation models.

UNIT- V: ELASTIC AND PLASTIC DEFORMATIONS (08 Periods)

Elastic wall, introduction to yielding and hardening, yield curve and yield surface, associated and non-associated flow rule.

Total Periods: 45

Textbooks:

T1. Advanced Soil Mechanics, Das, B.M., Taylor and Francis, 2nd Edition, 1997.

T2. Soil Mechanics in Engineering Practice, Terzaghi, K., and Peck, R.B., John Wiley & Sons, 1967.

Reference Books:

R1. The Mechanics of Soils: An introduction to Critical soil mechanics, Atkinson, J.H. and Brans by, P.L, McGraw Hill, 1978.

R2. An introduction to the Mechanics of soils and Foundation, Atkinson J.H, McGraw- Hill Co., 1993

Web Resources:

1. https://onlinecourse.nptel.ac.in/noc25 ce118/preview
2. https://nptel.ac.in/courses/105103177
3. https://nptel.ac.in/courses/105103207

2512102	M.Tech., I-SEMESTER SUBSURFACE INVESTIGATION AND INSTRUMENTATION (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Foundation Engineering

COURSE OBJECTIVES:

On successful completion of the course, student will be able to

CO1. Demonstrate the scope, objectives and stages of subsoil exploration and develop the ability to plan effective exploration programs for geotechnical projects

CO2. Demonstrate the various methods of open excavation and boring, including auger, wash, rotary, percussion, and core drilling techniques used for soil and rock investigation

CO3. Identify different types of soil samples and sampling equipment, and evaluate factors influencing sample quality, disturbance, and preservation

CO4. Gain practical knowledge of conducting and interpreting major in-situ tests such as SPT, CPT, vane shear, plate load, pressure meter, and field permeability tests

CO5. Demonstrate and apply geophysical methods, including electrical resistivity and seismic refraction techniques, for subsoil exploration and report preparation

SYLLABUS:

UNIT-I: INTRODUCTION TO SUBSURFACE EXPLORATION (08 Periods)

Scopes and objectives of explorations – Planning a subsurface exploration – Stages in sub surface exploration – Explorations for preliminary and detailed design – Spacing and depth of exploration

UNIT-II: OPEN EXCAVATION AND BORINGS OF EXPLORATION (08 Periods)

Pits and Trenches – Drifts and Shafts – Methods of boring – Auger Borings – Wash Borings – Rotary Drilling – Percussion Drilling – Core Drilling

UNIT-III: SOIL SAMPLES AND SAMPLERS (09 Periods)

Types of soil samples – Disturbed samples – Undisturbed samples – Design features affecting the sample disturbance – Split spoon samplers – Scraper Bucket Samplers – Shelby Tubes and Thin-walled Samplers – Piston Samplers – Denison Samplers – Preservation and handling of samples

UNIT-IV: IN-SITU TESTING (11 Periods)

Field tests – Standard Penetration Tests – Cone Penetration Tests – In-situ Vane Shear Test – Plate Load Test, monotonic and cyclic – Field Permeability Tests – In-situ Tests using Pressure meter – Observation of Ground Water Table – Instrumentation in soil engineering, strain gauges, resistance and inductance type.

UNIT-V: GEOPHYSICAL METHODS (09 Periods)

Introduction – Electrical Resistivity Methods – Electrical Profiling Method – Electrical Sounding Method – Seismic Methods – Seismic refraction method – Sub-soil Investigation Report

Total Periods: 45

Textbooks:

T1. Soil Mechanics and Foundation Engineering, Dr. K. R. Arora, Standard Publishers, New Delhi, 2020, 7th Edition Reprint.

T2. Soil Mechanics & Foundation Engineering, V. N. S. Murthy, CBS Publishers, New Delhi, 2018.

T3. Geotechnical Engineering, C. Venkat Ramaiah, New Age International, New Delhi, 2018, 6th Edition.

Reference Books:

R1. SP36- Compendium of Indian Standards on Soil Engineering – Part –II

R2. Sub Surface Exploration and Sampling of Soils for Civil Engineering Purpose, M. Juul Hvorslev, Water-ways Station, Vicksburg, Mississippi, 1949.

R3. A Short Course in geotechnical Site Investigation, Noel Simons, Bruce Menzies and Marcus Matthews, Thomas Telford.

R4. Introduction to Geophysical Prospecting, Milton B. Dobrin and Carl H. Savit, McGraw-Hill Publishers, New York.

Web Resources:

1. https://nptel.ac.in/course/105101005
2. https://nptel.ac.in/course/105105104
3. https://nptel.ac.in/course/105101006
4. https://nptel.ac.in/course/105107156

2512103	M.Tech., I-SEMESTER ENGINEERING ROCK MECHANICS (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Engineering Geology

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Classify intact rocks and rock masses using various geotechnical and geo engineering classification systems

CO2. Determine physical and mechanical properties of rocks through laboratory and in-situ testing, and interpret test results for engineering applications.

CO3. Analyze rock behavior under different stress conditions and apply strength criteria to evaluate rock performance in engineering structures.

CO4. Assess the stability of rock slopes and foundations, identify potential failure modes, and propose appropriate stabilizing or strengthening measures.

CO5. Design and plan safe blasting and excavation operations for both surface and underground projects

SYLLABUS:

UNIT- I: ENGINEERING CLASSIFICATION OF ROCKS (10 Periods)

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, Geo engineering classification.

UNIT- II: LABORATORY AND IN - SITU TESTING OF ROCKS (08 Periods)

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.

UNIT- III: STRENGTH, MODULUS AND STRESSES - STRAIN RESPONSES OF ROCKS (10 Periods)

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 visco plastic stress-strain models.

UNIT- IV: STABILITY OF ROCK SLOPES AND FOUNDATIONS ON ROCKS (10 Periods)

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.

UNIT- V: UNDERGROUND AND OPEN EXCAUVATIONS (07 Periods)

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

Total Periods: 45

Textbooks:

T1. Introduction to Rock mechanics, Goodman, Willey International (1980).
T2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall of India. (2007)
T3. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London. (1979)

Reference Books:

R1. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982.
R2. Brady, B. H. G. and Brown, E. T. - Rock Mechanics for Underground Mining, Chapman & Hall, 1993.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ce93/preview
2. https://onlinecourses.nptel.ac.in/noc23_ce13/preview
3. https://nptel.ac.in/courses/105107208

2512104	M.Tech., I-SEMESTER CRITICAL SOIL MECHANICS (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Geotechnical Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Analyze stress and strain states in soils and interpret stress-strain paths from laboratory tests

CO2. Determine critical state parameters from drained and undrained tests and construct state boundary surfaces

CO3. Demonstrate and predict behavior of normally consolidated and over consolidated clays using Hvorslev surface

CO4. Analyze behavior of sands using critical state framework including dilatancy and state parameter concepts

CO5. Apply elasto-plastic constitutive models (Cam-Clay, Modified Cam-Clay) to predict soil behavior before failure

SYLLABUS:

UNIT-I: STRESS AND STRAIN IN SOIL MECHANICS (09 Periods)

Review of continuum mechanics and tensor notation- State of stress in soils : total, effective, and neutral stresses - Stress invariants: mean stress (p), deviatoric stress (q) - Stress tensor, principal stresses and stress transformation- Mohr's circle representation in 3D stress space State of strain: volumetric and shear strains - Strain invariants and dilatancy - Stress paths and strain paths - Stress- dilatancy relationships - Laboratory experiments: triaxial, simple shear, direct shear- True triaxial and hollow cylinder apparatus-Interpretation of test data using stress and strain variants - Normalized soil behavior parameters

UNIT-II: CRITICAL STATE LINE AND ROSCOE SURFACE (09 Periods)

Critical state concept: historical development - Original Cam-Clay research (Roscoe, Schofield, Wroth)-Families of undrained triaxial tests- Plotting undrained test results in q-p and v-p spaces - Undrained stress paths and pore pressure response - Families of drained triaxial tests - Drained stress paths and volume change behavior - Constant p tests and K0 consolidation

Critical State Line (CSL): definition and significance - CSL in q-p space and v-ln p space - Uniqueness of CSL and testing considerations - Roscoe surface: isotropic normal compression line-State boundary surface concept- Drained and undrained surfaces for normally consolidated soils - Yield surfaces and plastic potential

UNIT-III: OVERCONSOLIDATED SOILS AND HVORSLEV SURFACE (09 Periods)

Over consolidation: Causes and definition - Over consolidation ratio (OCR)and stress history - Yield stress determination methods - Behavior of over consolidated samples in undrained tests- Pore pressure parameters A and B- Behavior of over consolidated samples in drained tests - Swelling and recompression behavior - Hvorslev surface: tension cutoff - Hvorslev parameters(φ'_{cv},c')- complete state boundary surface - Wet and dry sides of critical state - Volume changes during shearing - Dilatancy and contractancy behavior - Pore water pressure changes during undrained shear- Brittleness and ductility in over consolidated clays- Peak and residual strength relationships.

UNIT-IV: BEHAVIOUR OF SANDS (09 Periods)

Critical state framework for sands - Applicability and limitations for granular tests - Influence of particle characteristics - Normalized plots: q/p' vs. volumetric strain - State parameter concept (ψ) - Effect of initial density and confining pressure - Bolton's dilatancy theory - Dilatancy in dense sands- Contractancy in loose sands- Phase transformation line-Taylor's model for sand behavior - Steady state concept - Consequences and limitations of Taylor's model - Liquefaction and cyclic mobility - Norsand and other state parameter models

UNIT-V: ELASTO - PLASTIC MODELING (09 Periods)

Fundamentals of elasticity and plasticity theory - Elastic and plastic deformations: separation - Incremental stress-strain relationships - Plasticity theory: yield surface, flow rule, hardening- Associated and non-associated flow rules - Drucker's stability postulates- Development of elasto-plastic models based on CSSM - Derivation from thermodynamic principles - Original Cam-Clay model - Formulation: yield surface, flow rule, hardening law- Stress-strain predictions and limitations- Modified Cam-Clay model- Improvements over original model- Numerical implementation considerations

Total Periods: 45

Textbooks:

T1. Atkinson, J.H. and Brans P.L., The Mechanics of Soils: An Introduction to Critical State Soil Mechanics. London, UK: McGraw-Hill, 1978 ISBN: 978-0070841284

T2. Wood, D.M..Soil Behaviour and Critical State Soil Mechanics, Cambridge, UK: Cambridge University Press., 1990 ISBN: 978-0521337823

T3. Muir Wood, D., Geotechnical Modelling. London, UK: Spon Press., 2004 ISBN:978-0419237006

Reference Books:

R1. Schofield, A.N. and Wroth, C.P. (1968). Critical State Soil Mechanics. London, UK: McGraw- Hill. (Classic text, reprinted 2000 by McGraw-Hill)

R2. Bolton, M.D. (1986) "The strength and dilatancy of sands," Géotechnique, 36(1), pp. 65-78. (Seminal paper).

Web Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105202/(NPTEL-AdvancedSoil Mechanics)
2. https://www.soilmodels.com/(SoilConstitutiveModels Resource)
3. https://www.imperial.ac.uk/geotechnics/research/critical-state-soil-mechanics/
4. https://web.mit.edu/1.37/www/(MITSoilBehaviorCourse)
5. https://archive.nptel.ac.in/courses/105/106/105106051/
6. https://www.geoengineer.org/education/web-class/advanced-soil-mechanics
7. https://ocw.tudelft.nl/courses/advanced-soil-mechanics/
8. https://www.youtube.com/playlist?list=PLjZnhUwcjZmLgFq3WF9J7U1X-CSSM(Lecture Series)
9. https://www.civil.iisc.ac.in/~akg/Sandbook.pdf(SandMechanicsResources)

2512105	M.Tech., I-SEMESTER ENVIRONMENTAL GEOTECHNOLOGY (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Environmental Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Analyze the soil structure and multiphase interactions, Assess the soil-water relationship in various environmental settings

CO2. Demonstrate the major soil minerals and correlate with engineering properties, Employ modern tools for mineralogical assessment

CO3. Analyze the diffuse double layer models and ion exchange in soils, Predict contaminant behavior using modern interactive models

CO4. Design containment and remediation strategies for waste-impacted sites, Assess and analyze contaminant fate in subsurface media

CO5. Design landfill systems including liners, covers, leachate & gas management; assess their environmental performance

SYLLABUS:

UNIT-I: SOIL AS A MULTIPHASE SYSTEM & ENVIRONMENT INTERACTION (09 Periods)

Soil as a multiphase (solid-liquid-gas) system—basic concepts and modern advances - Properties of water in porous media: capillarity, surface tension, adsorption, permeability - Soil-environment interactions: heat, gases, moisture, contaminants - The hydrological cycle with emphasis on infiltration, runoff, and soil moisture dynamics - Latest developments: digital water cycle models, climate interaction with soil media

UNIT-II: SOIL MINERALOGY AND ITS ENGINEERING SIGNIFICANCE (09 Periods)

Soil minerals: clay, silt, sand, and their structures - Significance of mineralogy: swelling, compressibility, permeability, contaminant retention - X-ray diffraction, scanning electron microscopy, and modern spectroscopic techniques - Case studies: mineralogy and geotechnical problems

UNIT-III: SOIL-WATER-CONTAMINANT MECHANISMS (09 Periods)

Soil-water interaction: diffuse double layer, electric forces, and water structure - Attraction/ repulsion forces, vander Waals, and electrostatic interactions - Soil-water-contaminant interactions: sorption, desorption, diffusive and advective transport - Ion exchange, CEC, soil-organic/inorganic reactions - Modern DDL models (e.g., Stern, Gouy-Chapman) and their environmental relevance

UNIT-IV: WASTE CONTAINMENT, TRANSPORT, AND REMEDIATION (09 Periods)

Types, sources, and classification of wastes - Environmental laws (e.g., MSW, HW rules, RCRA) and regulatory standards - Soil and groundwater hydrology, contaminant pathways (advection, dispersion, reaction) - Physicochemical properties for retention and transport - Remediation technologies: in situ/ex situ, stabilization / solidification, biological and chemical treatment - Contaminated site risk assessment and remediation planning

UNIT-V: **SOIL CHARACTERIZATION, LANDFILL DESIGN & REMEDIATION**

(09 Periods)

Advanced soil characterization: water content, gas permeability, electrical/thermal property testing, pore-size distribution - Analytical techniques: spectroscopy, ICP-MS, contaminant detection - Landfill concepts: site assessment, landfill design (liners, covers, leachate/gas control, monitoring) - Remediation and stabilization of contaminated soils: barriers, slurry walls, performance and monitoring, risk assessment frameworks - End uses for remediated sites and reclamation practices

Total periods: 45

Textbooks:

T1. David E. Daniel (1993) Geotechnical Practice for Waste Disposal, First Edition
T2. James K Mitchelle, Kenichi Soga, Fundamentals of soil Behaviour, Third Edition
T3. Reddi, L.N. & Inyang, H., Geo environmental Engineering: Principles and Applications"

Reference Books:

R1. Sharma, H.D. & Reddy, L.N., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies"
R2. Gourc, J.P., "Waste Containment Systems, Waste Stabilization and Landfills"

Web Resources:

1. Frontiers in Soil Science – Water & Soil Quality
2. MIT OCW: Waste Containment and Remediation
3. Advanced Soil Characterization NPTEL
4. MIT OCW: Waste Containment and Remediation
5. NIUA: Landfill Remediation Training Manual

2512106	M.Tech., I-SEMESTER FINITE ELEMENTS METHODS IN GEOMECHANICS (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Finite Elements Methods

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Explain fundamental FEM concepts, discretization, and element formulation for geotechnical applications

CO2. Apply variational principles, Ritz method, and Galerkin method to formulate geotechnical boundary value problems

CO3. Analyze one-dimensional and two-dimensional problems including consolidation, seepage, and stress-deformation

CO4. Implement advanced constitutive models, solve nonlinear problems, and analyze coupled hydro-mechanical behavior

CO5. Apply commercial FEM software to practical geotechnical problems including foundations, slopes, excavations, and tunnels

SYLLABUS:

UNIT-I: FUNDAMENTALS OF FINITE ELEMENT METHOD (10 Periods)

Introduction to continuum mechanics, field equations, and PDEs in geomechanics. - Historical development, recent advances, and real-world applications of FEM - Discretization of geotechnical problems; mesh design concepts - Types of finite elements: 1D (bars), 2D (triangles/quadrilaterals), advances in 3D element technology - Shape functions and interpolation methods; superior element formulations (e.g., spectral, higher-order elements) - Process of assembling the global system - Application of boundary conditions, pre- and post-processing.

UNIT-II: VARIATIONAL METHODS AND WEAK FORMULATIONS (08 Periods)

Calculus of variations: motivation, historical trends, current developments (e.g., computer-aided symbolic solutions) - Euler-Lagrange equation; minimum potential energy - Principle of virtual work in modern computation - Weighted residual methods with focus on Galerkin and Ritz techniques - Weak formulations, error estimation, and advanced error control in modern FEM - Application to classical and modern geomechanics problems (including sustainability and multi-physics trends).

UNIT-III: ELEMENT FORMULATION AND 2D PROBLEMS (10 Periods)

Formulation of 1D bar and seepage elements - Assembly/solution for 1D and 2D mesh (focus on large-scale, high-speed current trends) - 2D elements: Constant Strain Triangle (CST), linear triangle, various quadrilaterals - Natural coordinate systems, numerical integration (Gaussian quadrature, contemporary integration) - Stress/strain calculations and advanced post-processing techniques.

UNIT-IV: ADVANCED FORMULATIONS AND NON-LINEAR ANALYSIS (09 Periods)

Isoperimetric element concept and formulation - Overview of 3D elements - Constitutive modeling: elastic and advanced elasto-plastic (Mohr-Coulomb, Drucker-Prager), current industry trends - Material/geometry nonlinearity and the Newton-Raphson method - Consolidation theory; coupled fluid-mechanical analysis - Dynamic analysis basics; survey of modern research applications.

UNIT-V: APPLICATIONS IN GEOTECHNICAL ENGINEERING (08 Periods)

Overview of commercial software used in geotechnical FEM (PLAXIS, SIGMA/W, Rocscience, FEAP) - Shallow foundation analysis (bearing capacity, settlement, safety) - Slope stability and deformation analysis using FEM—advanced failure and monitoring techniques - Retaining wall, seepage, and coupled analyses in practice - Meshing, boundary condition selection, result interpretation, validation - Case histories from recent literature and industry.

Total Periods: 45

Textbooks:

T1. Smith, I.M. and Griffiths, D.V. (2004). *Programming the Finite Element Method* (4th Edition). Chichester, UK: John Wiley & Sons. ISBN: 978-0470849705

T2. Potts, D.M. and Zdravkovic, L.(1999). *Finite Element Analysis in Geotechnical Engineering: Theory*. London, UK: Thomas Telford Publishing. ISBN: 978-0727727831

T3. Potts, D.M. and Zdravkovic, L. (2001). *Finite Element Analysis in Geotechnical Engineering: Application*. London, UK: Thomas Telford Publishing. ISBN: 978-0727729842

Reference Books:

R1. Zienkiewicz, O.C., Taylor, R.L., and Zhu, J.Z. (2013). *The Finite Element Method: Its Basis and Fundamentals* (7th Edition). Oxford, UK: Butterworth-Heinemann. ISBN: 978-1856176330

R2. Reddy, J.N. (2019). *Introduction to the Finite Element Method* (4th Edition). New York, USA: McGraw-Hill Education. ISBN: 978-1259861901

R3. Cook, R.D., Malkus, D.S., Plesha, M.E., and Witt, R.J. (2001). *Concepts and Applications of Finite Element Analysis* (4th Edition). New York, USA: John Wiley & Sons. ISBN: 978-0471356059

R4. Desai, C.S. and Kundu, T. (2001). *Introductory Finite Element Method*. Boca Raton, FL, USA: CRC Press. ISBN: 978-0849303999

R5. Brinkgreve, R.B.J., Kumarswamy, S., and Swolfs, W.M. (2018). *PLAXIS Manual*. Delft, Netherlands: PLAXIS

R6. GEO-SLOPE International Ltd. (2020). *Stress-Deformation Modeling with SIGMA/W*. Calgary, Canada: GEO-SLOPE International.

R7. Chen, W.F. and Mizuno, E. (1990). *Nonlinear Analysis in Soil Mechanics*. Amsterdam, Netherlands: Elsevier Science Publishers. ISBN: 978-0444874566

Web Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106051/
   https://www.colorado.edu/engineering/CAS/courses.d/IFEM.d/
2. https://feaforall.com/
3. https://archive.nptel.ac.in/courses/105/105/105105202/
4. https://www.12000.org/my_notes/index.htm
5. https://github.com/topics/finite-element-method
6. https://www.imperial.ac.uk/geotechnics/software/icfep/
7. https://www.plaxis.com/support/training/

8. https://www.geo-slope.com/support/video-tutorials
9. https://www.plaxis.com/support/tutorials-and-manuals/
10. https://www.geo-slope.com/resources/case-studies
11. https://www.geoengineer.org/education/web-based-courses
12. https://www.issmge.org/education/online-learning
13. https://www.rocscience.com/learning/webinars

2512107	M.Tech., I-SEMESTER COMPUTATIONAL GEOMECHANICS (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: NIL

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Apply iterative numerical techniques such as Bisection, Newton-Raphson, Jacobi, and Gauss- Seidel methods to solve engineering equations.

CO2. Implement finite difference and finite element methods for modeling soil behavior and solve boundary value problems in geotechnical engineering.

CO3. Perform statistical analysis including correlation and regression to interpret soil properties and geotechnical investigation results.

CO4. Analyze consolidation behavior of soils using theoretical, finite difference, and finite element solutions to predict settlement and pore pressure dissipation.

CO5. Conduct probabilistic risk assessments for geotechnical site characterization and design safer, more reliable foundation systems.

SYLLABUS:

UNIT- I: SOLUTION OF NON - LINEAR AND LINEAR EQUATIONS (09 Periods)

Bisection, False Position, Newton-Raphson, Successive Approximation Method, Iterative Methods, Jacobi's Method, Gauss Seidal Method, Successive over Relaxation Method.

UNIT- II: FINITE DIFFERENCE AND FINITE ELEMENT METHOD (08 Periods)

Two Point Boundary Value Problems – Disichlet Conditions, Neumann Conditions; Ordinary and Partial Differential Equations. Fundamentals, Constitutive Finite Element Models for Soils.

UNIT- III: CORRELATION AND REGRESSION ANALYSIS (10 Periods)

Correlation - Scatter Diagram, Karl Pearson Coefficient of Correlation, Limits of Correlation Coefficient; Regression – Lines of Regression, Regression Curves, Regression Coefficient, Differences between Correlation and Regression Analysis.

UNIT- IV: ONE DIMENSIONAL CONSOLIDATION (10 Periods)

Theory of Consolidation, Analytical Procedures, Finite Difference Solution Procedure for Multi layered Systems, Finite Element Formulation

UNIT-V: FLOW THROUGH POROUS MEDIA AND RISK ASSESSMENT IN GEOTECHNICAL ENGINEERING (08 Periods)

Geotechnical Aspects, Numerical Methods, Applications and Design Analysis, Flow in Jointed Media, Probabilistic Site Characterization and Design of Foundations

Total Periods: 45

Textbooks:

T1. Numerical Methods in Geotechnical Engineering, S. Chandra kant., Desai and John Christian,, Mc. Graw Hill Book Company, 1977.

T2. Numerical Methods for Scientific and Engineering Computations, M.K. Jain, S.R.K. Iyengar and R.K. Jain, Third Edition, New Age International(P) Ltd. Publishers, New Delhi.

Reference Books:

R1. Finite Elements in Geotechnical Engineering", D.J. Naylor and G.N. Pande, Pine ridge Press Ltd., UK.
R2. "Applied Soil Mechanics", Sam Helwany, John Wiley & Sons, Inc.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ma54/preview
2. https://nptel.ac.in/courses/105106222
3. https://onlinecourses.nptel.ac.in/noc20_ma30/preview

2512108	M.Tech., I-SEMESTER SOIL STRUCTURE INTERACTION (GEOTECHNICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Pre-Requisites: Foundation Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Explain the fundamental concepts of soil–foundation interaction and describe various soil, foundation, and interface behaviors.

CO2. Apply different soil response models such as Winkler, elastic continuum, and two-parameter models for foundation analysis.

CO3. Analyze the behavior of beams and plates resting on elastic media using theoretical and numerical approaches

CO4. Evaluate the response of axially and laterally loaded single piles and pile groups considering elastic and interaction effects.

CO5. Assess the influence of ground–foundation–structure interaction under static and dynamic loading conditions.

SYLLABUS:

UNIT-I: SOIL - FOUNDATION INTERACTION (12 Periods)

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

UNIT-II: BEAM ON ELASTIC FOUNDATION (08 Periods)

Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

UNIT-III: PLATE ON ELASTIC MEDIUM (10 Periods)

Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions.

UNIT-IV: ANALYSIS OF AXIALLY AND LATERALLY LOADED PILES AAND PILE GROUPS (10 Periods)

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, Sub grade reaction and elastic analysis, Interaction analysis, Pile-raft system.

UNIT-V: GROUND - FOUNDATION - STRUCTURE INTERACTION (05 Periods)

Effect of structure on ground-foundation interaction, Static and dynamic loads.

Total Periods: 45

Textbooks:

T1. Elastic Analysis of Soil-Foundation Interaction, Selvadurai, A.P.S, Elsevier, 1979.
T2. Pile Foundation Analysis and Design", Poulos, H.G. and Davis, F.H, Wiley and Sons 1980

Reference Books:

R1. Pile Foundation Analysis and Design, Poulos, H.G Davis, E.H., JohnWiley, 1980.
R2. Structures of Interaction State of Art Report, Institution of Structural Engineers, 1978.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

2512151	M.Tech., I-SEMESTER SOIL MECHANICS - I LAB (GEOTECHNICAL ENGINEERING)	L	T	P	C
		0	0	4	2

Pre-Requisites: Geotechnical Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Determine basic soil properties and interpret their significance in soil identification and classification.

CO2. Conduct Atterberg limits and visual classification tests and classify soils as per standard engineering systems.

CO3. Assess in-situ soil density using core cutter and sand replacement

CO4. Perform Proctor compaction tests to establish compaction characteristics of soils and relate them to field compaction requirements in engineering projects.

CO5. Evaluate engineering soil parameters through permeability and consolidation tests and interpret their influence on seepage, settlement, and overall soil behavior.

List of Experiments:

1. Determination of Moisture Content and Specific Gravity
2. Grain Size Analysis
3. Determination of Atterberg's Limits
4. Visual Classification Test for Soils
5. Determination of In-Situ Densities
   a) Core Cutter Method
   b) Sand Replacement Method
6. Proctor Compaction
   a) Standard Proctor Compaction
   b) Modified Proctor Compaction
7. Determination of Coefficient of Permeability
   a) Constant Head Method
   b) Variable Head Method
8. Consolidation Test

Textbooks:

T1. Soil Testing for Engineers, S.Mittal and JP Shukla, Khanna Publishers, New Delhi,2008.

T2. Soil Testing–Laboratory Manual & Question Bank, KVS Apparao and VCS Rao, University Science Press, New Delhi,2013.

Reference Books:

R1. Compendium of Indian Standards on Soil Engineering: Part–1 & 2, Laboratory and Field Testing of Soils for Civil Engineering Purposes.

R2. Braja M. Das, Soil Mechanics Laboratory Manual, Oxford University Press, New York, 2002

Web Resources:

1. https://nptel.ac.in/courses/105101160

2512152	M.Tech., I-SEMESTER SOIL MECHANICS-II LAB (GEOTECHNICAL ENGINEERING)	L	T	P	C
		0	0	4	2

Pre-Requisites: Geotechnical Engineering

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Determine shear strength parameters of soils and interpret their relevance in geotechnical design.

CO2. Evaluate bearing capacity characteristics of sub grade soils and apply results for pavement and foundation design.

CO3. Assess undrained shear strength of cohesive soils using the Laboratory Vane Shear test and relate the results to field stability problems.

CO4. Determine swelling characteristics of expansive soils using the Swell Pressure Test and interpret their impact on structures, pavements, and foundations.

CO5. Analyze soil chemical properties by determining Total Soluble Solids and Calcium Carbonate content and evaluate their influence on soil behavior and engineering performance.

List of Experiments:

1. Direct Shear Test
2. Unconfined Compression Test
3. Triaxial Shear Test– UU, CU, CD Tests
4. California Bearing Ratio
5. Laboratory Vane Shear Test
6. Swell Pressure Test
7. Total Soluble Solids Content in Soils
8. Calcium Carbonate Content in Soils

Textbooks:

T1. Soil Testing for Engineers, S. Mittal and JP Shukla, Khanna Publishers, New Delhi, 2008.

T2. Soil Testing–Laboratory Manual & Question Bank, KVS Apparao and VCS Rao, University Science Press, New Delhi, 2013.

Reference Books:

R1. Compendium of Indian Standards on Soil Engineering: Part–1 & 2, Laboratory and Field Testing of Soils for Civil Engineering Purposes.

R2. Soil Mechanics Laboratory Manual, Braja M .Das, Oxford University Press, New York, 2002

Web Resources:

1. https://nptel.ac.in/courses/105101160

2599153	M.Tech., I-SEMESTER GEOSTUDIO (SKILL ENHANCEMENT COURSE)	L	T	P	C
		0	1	2	2

Pre-Requisites: Nil

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Analyze rainfall-induced slope instability by coupling seepage and slope stability modules to determine safety factor variations

CO2. Evaluate the stability of embankments and dams under rapid drawdown conditions using transient seepage analysis

CO3. Apply various slip surface methods to assess the stability of natural and engineered soil and rock slopes

CO4. Able to apply appropriate Tools and Techniques to understand and analyse the problems following professional ethics with focus on societal and environmental aspects.

CO5. Work as a team and communicate results in an effective way.

CO6. Make decisions as an individual or as team member to manage tasks and also engage in independent and life-long learning with ability to adapt to new and technological changes.

SYLLABUS:

1. Coupling SEEP and SLOPE modules to obtain the change in safety factor of slopes after rainfall
2. Analysis of complex problems involving rapid water level changes
3. Stability assessment for soil and rock slopes using various slip surface methods
4. Static stress and deformation modeling in soil or rock, including settlement analysis
5. Seismic response analysis and computation of inertial forces during earthquakes
6. Assessment procedures examining how loose sands can collapse and liquefy at strengths below peak strength
7. Simulations of contaminant transport highly related to total head conditions
8. Heat and mass transfer analysis in soil and rock materials
9. Compaction and consolidation simulations for soil settlements
10. Modeling of dewatering systems and groundwater control
11. 3D finite element groundwater seepage analysis to generate complex water conditions
12. Analysis of air movement through porous media
13. Integration of SLOPE/W, SEEP/W, and SIGMA/W to solve complex real-world problems with realistic results

Textbooks:

T1. Krahn, J. (2020). GeoStudioModeling with SLOPE/W: An Engineering Methodology. GEO-SLOPE International Ltd., Calgary, Alberta, Canada.

T2. Krahn, J. (2019). GeoStudioModeling with SEEP/W: An Engineering Methodology. GEO-SLOPE International Ltd., Calgary, Alberta, Canada.

T3. Krahn, J. (2019). GeoStudioModeling with SIGMA/W: An Engineering Methodology. GEO-SLOPE International Ltd., Calgary, Alberta, Canada.

T4. Duncan, J.M., Wright, S.G., and Brandon, T.L. (2014). Soil Strength and Slope Stability. 2nd Edition, John Wiley & Sons, Hoboken, New Jersey.
T5. Fredlund, D.G. and Rahardjo, H. (1993). Soil Mechanics for Unsaturated Soils. John Wiley & Sons, New York.

Reference Books:

R1. GEO-SLOPE International Ltd. (2021). SLOPE/W User's Guide: Stability Modeling with SLOPE/W. Calgary, Alberta, Canada.
R2. GEO-SLOPE International Ltd. (2021). SEEP/W User's Guide: Groundwater Modeling with SEEP/W. Calgary, Alberta, Canada.
R3. GEO-SLOPE International Ltd. (2021). SIGMA/W User's Guide: Stress-Deformation Modeling with SIGMA/W. Calgary, Alberta, Canada.
R4. GEO-SLOPE International Ltd. (2021). QUAKE/W User's Guide: Dynamic Earthquake Modeling with QUAKE/W. Calgary, Alberta, Canada.
R5. Abramson, L.W., Lee, T.S., Sharma, S., and Boyce, G.M. (2002). Slope Stability and Stabilization Methods. 2nd Edition, John Wiley & Sons, New York.
R6. Das, B.M. (2015). Principles of Foundation Engineering. 8th Edition, Cengage Learning, Stamford, CT.
R7. Kramer, S.L. (1996). Geotechnical Earthquake Engineering. Prentice Hall, Upper Saddle River, New Jersey.
R8. Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice Hall, Englewood Cliffs, New Jersey.
R9. Holtz, R.D., Kovacs, W.D., and Sheahan, T.C. (2011). An Introduction to Geotechnical Engineering. 2nd Edition, Pearson, Upper Saddle River, New Jersey.

Web Resources:

1. https://www.geoslope.support/
2. https://www.seequent.com/help-support/geostudio/
3. https://www.geoslope.support/kb/article/10-geostudio-reference-manuals/
4. https://www.geoslope.com/support/support-resources/tutorial-videos/
5. https://www.classcentral.com/subject/geotechnical-engineering

		L	T	P	C
2599171	**M.Tech., I-SEMESTER** **RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS** (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) **(MANDATORY COURSE)**	**2**	**0**	**0**	**2**

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Demonstrate the research process, types and methods, use data correctly, follow ethical rules, and use proper citation styles.

CO2. Apply appropriate data collection methods, identify data types and sources, ensure quality, and follow ethical practices using suitable tools.

CO3. Apply multivariate analysis and experimental design to study cause-effect relationships, ensure measurement validity, and write structured research papers and proposals.

CO4. Demonstrate the concept, evolution, and types of Intellectual Property Rights (IPR), recognize global IPR practices and institutions like WIPO, WTO, and UNESCO, and identify key agreements, trade secrets, and biodiversity-related rights.

CO5. Demonstrate the concept, features, and benefits of patents; identify types of patent applications and the filing process; and explain the roles of patent agents, licensing, and patent regulations.

SYLLABUS:

UNIT-I: FUNDAMENTALS OF RESEARCH METHODOLOGY (09 Periods)

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences.

UNIT-II: DATA COLLECTION AND SOURCES (09 Periods)

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection.

UNIT-III: DATA ANALYSIS AND REPORTING (09 Periods)

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals.

UNIT-IV: UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS (09 periods)

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT-V: PATENTS (09 Periods)

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of

patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Total Periods: 45

Textbooks:

T1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
T2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.

References Books:

R1. Cooper Donald R, Schindler Pamela S and Sharma JK, Business Research Methods, Tata McGraw Hill Education, 2012, Eleventh Edition,
R2. David Hunt, Long Nguyen, Matthew Rodgers, Research Methodology: A Step-by-Step Guide for Beginners, Wiley, 2007.
R3. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Cengage, 2024, Sixth Edition,
R4. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, University of Chicago Press, 2024, Fifth Edition.
R5. Professional Programme Intellectual Property Rights, Law and practice, The Institute of Company Secretaries of India, Statutory body under an Act of parliament, September, 2013.

Web Resources:

1. Research Methodology and Data Analysis courses, Coursera / edX
2. Latest journals on research design and statistics, Springer Link & ScienceDirect
3. Free access to research papers Google Scholar
4. Open-access research methodology resources, NCBI Bookshelf
5. For fundamentals of hypothesis testing, regression, and ANOVA. Khan Academy (Statistics & Probability)

2599181	M.Tech., I-SEMESTER ENGLISH FOR RESEARCH PAPER WRITING (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) (AUDIT COURSE-I)	L	T	P	C
		2	0	0	2

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Demonstrate proficiency in academic English by applying MAP principles, using clear, precise, and objective language, structuring coherent paragraphs, integrating references, and employing paraphrasing and appropriate tone in writing.

CO2. Exhibit critical reading skills to analyze academic texts, differentiate between article types, identify arguments and methodologies, evaluate findings, and make effective notes.

CO3. Apply advanced grammar and punctuation to construct clear, accurate, and complex sentences with proper voice, tense consistency, subject-verb agreement, and unambiguous references.

CO4. Revise and refine written work by editing for clarity, coherence, and grammar; proofread for accuracy; and apply effective strategies for professional correspondence and creative writing.

CO5. Demonstrate digital literacy by critically evaluating online content, using AI tools ethically in research writing, generating accurate citations, and practicing plagiarism-free writing with awareness of fair practices.

SYLLABUS:

UNIT-I: FUNDAMENTALS OF ACADEMIC ENGLISH (05 Periods)

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings

UNIT-II: READING SKILLS FOR RESEARCHERS (06 Periods)

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT-III: GRAMMAR REFINEMENT FOR RESEARCH WRITING (06 Periods)

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active-Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences.

UNIT-IV: MASTERY IN REFINING WRITTEN CONTENT/EDITING SKILLS (07 Periods)

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing.

UNIT-V: TECHNOLOGY AND LANGUAGE FOR RESEARCH (06 Periods)

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

Total Periods: 30

Textbooks:

T1. Routledge, Bailey. S. Academic Writing: A Handbook for International Students. London and New York: 2015.

T2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference books:

R1. Craswell, G., Writing for Academic Success, Sage Publications, 2004.

R2. Peter Elbow, Writing With Power, E-book, Oxford University Press, 2007

R3. Oshima, A. & Hogue, A., Writing Academic English, Addison-Wesley, New York, 2005

R4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks, Michigan University Press, 2012.

R5. Goldbort R., Writing for Science, Yale University Press (available on Google Books), 2006

R6. Day R., How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

Web Resources:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester http://www.phrasebank.manchester.ac.uk
5. OWL (Online Writing Lab) – Purdue University, https://owl.purdue.edu *(Resources on APA/MLA formats, grammar, structure, paraphrasing)*
6. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources.

2512181	M.Tech., I-SEMESTER DISASTER MANAGEMENT (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) (AUDIT COURSE - I)	L	T	P	C
		2	0	0	0

Pre-Requisites: Nil

COURSE OUT COMES:

On successful completion of the course, student will be able to

CO1. **Identify and map** disaster-prone areas and understand the epidemiological consequences of disasters.

CO2. **Define and distinguish** between hazards and disasters, and explain their types, nature, and impacts.

CO3. **Assess** the economic, social, and ecological repercussions of major natural and man-made disasters.

CO4. **Apply** risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.

CO5. **Demonstrate knowledge** of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.

SYLLABUS:

UNIT–I: INTRODUCTION (06 Periods)

Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT-II: REPERCUSSIONS OF DISASTERS AND HAZARDS (06 Periods)

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT-III: DISASTER PREPAREDNESS AND MANAGEMENT (06 Periods)

Preparedness - Monitoring of Phenomena - Triggering a Disaster or Hazard - Evaluation of Risk-Application of Remote Sensing - Data from Meteorological and Other Agencies -Media Reports-Governmental and Community Preparedness

UNIT-IV: RISK ASSESSMENT (06 Periods)

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People's participation Risk Assessment – Strategies for Survival

UNIT-V: DISASTER MITIGATION (06 Periods)

Meaning, Concept and Strategies of Disaster Mitigation – Emerging Trendsin Mitigation - Structural Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India

Total Periods: 30

Textbooks:

T1. Gupta, H. K, Disaster Management, Universities Press, 2003
T2. Singh, R. B., Natural Hazards and Disaster Management, Rawat Publications, 2006.

Reference Books:

R1. Coppola, D. P., Introduction to International Disaster Management, Elsevier, 4th ed., 2020.
R2. Shaw, R., & Izumi, T., Science and Technology in Disaster Risk Reduction in Asia, Springer, 2022.
R3. Wisner, B., Gaillard, J. C., & Kelman, I., Handbook of Hazards and Disaster Risk Reduction and Management, Routledge, 2nd ed., 2021.
R4. Saini, V. K., Disaster Management in India: Policy, Issues and Perspectives, Sage India, 2021.
R5. Kelman, I., Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2022
R6. Sahni, P. &Dhameja, A., Disaster Mitigation: Experiences and Reflections, Prentice Hall of India, 2004.

Web Resources:

1. https://ndma.gov.in – official guidelines, reports, and policy frameworks.
2. https://www.undrr.org – Sendai Framework, global risk reduction strategies.
3. https://www.gdacs.org – real-time disaster alerts
4. https://www.undrr.org – Sendai Framework, global risk reduction strategies.

		L	T	P	C
2598181	**M.Tech., I-SEMESTER** **ESSENCE OF** **INDIAN TRADITIONAL KNOWLEDGE** (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) **(AUDIT COURSE - I)**	**2**	**0**	**0**	**2**

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Illustrate traditional knowledge, its nature, characteristics, and scope

CO2. Demonstrate the need for protecting traditional knowledge and its significance in the global economy

CO3. Explain the legal framework and policies related to traditional knowledge protection

CO4. Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology

CO5. Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change, relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

SYLLABUS:

UNIT-I: INTRODUCTION TO TRADITIONAL KNOWLEDGE (06 Periods)

Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge

UNIT-II: PROTECTION OF TRADITIONAL KNOWLEDGE (06 Periods)

Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

UNIT-III: LEGAL FRAME WORK AND TRADITIONAL KNOWLEDGE (06 Periods)

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act).

The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 Geographical Indicators Act 2003.

UNIT-IV: TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY (06 Periods)

Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT-V: TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS (06 Periods)

Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs -

Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Total Periods: 30

Textbooks:

T1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt. Ltd. Delhi, 2022 1st Edition.

T2. Basanta Kumar Mohanta and Vipin Kumar Singh, Traditional Knowledge System and Technology in India, Pratibha Prakashan 2012 1st Edition.

Reference Books

R1. Samskrita Bharati, Pride of India: A Glimpse into India's Scientific Heritage, New Delhi 2006.

R2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987

R3. Subbarayappa, B.V. and Sarma, K.V. Indian Astronomy: A Source Book, Nehru Centre, Mumbai, 1985.

R4. Bag, A.K. History of Technology in India, Vol. I, Indian National Science Academy, New Delhi, 1997.

R5. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi, 1996.

R6. Banerjea, P. Public Administration in Ancient India, Macmillan, London, 1961.

R7. Kapoor Kapil, Singh Avadhesh, Indian Knowledge Systems Vol – I & II, Indian Institute of Advanced Study, Shimla, H.P., 2022

Web Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/12110600