REGULATIONS,
COURSE STRUCTURE AND
SYLLABUS

For

Civil Engineering

With effective from the Academic Year

2021-2022

B. Tech Regulations

1.1 Short title and Commencement

The regulations listed under this head are common for all degree level under graduate programs (B.Tech.) offered by the college with effect from the academic year 2021-22 and they are called as "SITE21" regulations.

The regulations here under are subject to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program, as may be decided by the Academic Council.

1.2. Definitions

a. "Commission" means University Grants Commission(UGC)
b. "Council" means All India Council for Technical Education(AICTE)
c. "University" Means Jawaharlal Nehru Technological University Kakinada(JNTUK)
d. "College" means Sasi Institute of Technology & Engineering, Tadepalligudem.
e. "Program" Means any combination of courses and /or requirements leading to award of a degree
f. "Course" Means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.
g. For example, (Fluid Mechanics) is a course offered at third semester of B.Tech (ECT) and its code is (21CECET3030)
h. "Degree" means an academic degree conferred by the university upon those who complete the undergraduate curriculum
i. "Regular Student" means student enrolled into the four year programme in the first year
j. "Lateral entry Students" Means student enrolled into the four year programme in the second year

1.3. Academic Programs

1.3.1. Nomenclature of Programs

The nomenclature and its abbreviation given below shall continue to be used for the degree programs under the University, as required by the Council and Commission. The name of specialization shall be indicated in brackets after the abbreviation. For e.g. UG engineering degree in Mechanical Engineering program is abbreviated as B.Tech. (ME). Bachelor of Technology (B.Tech.) degree program offered in:

1. Artificial Intelligence & Machine Learning(AIM)
2. Civil Engineering(CE)
3. Computer Science and Engineering(Artificial Intelligence and Machine learning)-CSM
4. Computer Science and Engineering (IoT and Cyber Security including Block Chain Technology) (CIS)
5. Computer Science and Engineering(Data Science)-CSD
6. Computer Science and Engineering(CSE)
7. Computer Science and Technology(CST)
8. Electronics and Communication Engineering(ECE)
9. Electronics and Communication Technology(ECT)
10. Electrical and Electronics Engineering(EEE)
11. Information Technology(IT)
12. Mechanical Engineering(ME)

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– Curriculum framework is important in setting the right direction for a Degree program

as it takes into account the type and quantum of knowledge necessary to be acquired by a student to qualify for a award in his/her chosen branch or specialization.

- Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to be studied and the total number of credits to be earned by a student to fulfill the requirements for conferment of degree.
- Each theory course shall consist of five units.

1.3.2. Curriculum Structure

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

1.3.3. Induction Program

The Induction Program for two weeks is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students and building of character. Induction program covers

Physical activity
Creative arts
Universal human values
Literary and Proficiency modules
Lectures by Eminent peoples

1.4Admission Criteria

The eligibility criteria for admission into UG engineering programs are as per the norms approved by government of Andhra Pradesh from time to time. The sanctioned seats in each program in the college are classified into CATEGORY-A and CATEGORY-B at first year level and Lateral Entry at second year level.

- **CATEGORY – A Seats:** These seats will be filled as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – B Seats:** These seats will be filled by the College as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – Lateral Entry Seats** : Lateralentry candidates shall be admitted into the Third semester directly as per the norms approved by government of Andhra Pradesh. The percentages of Category-A, Category-B and Lateral Entry Seats are decided time to time by the Government of Andhra Pradesh.

2. Award of B. Tech. Degree

a) A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:
   i. A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall forfeit their seat in B.Tech course and their admission stands cancelled.
   ii. The candidate shall register for 160 credits and secure all the 160 credits.

b) The medium of instruction for the entire under graduate programmer in Engineering &Technology will be in **English** only.

3. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years
b) Each Academic year of study is divided into Two Semesters.
c) Minimum number of instruction days in each semester is 90.
d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
e) The total credits for the Programme is 160.
f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
g) Student is introduced to "Choice Based Credit System (CBCS)".
h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
i) A student has to register for all courses in a semester.
j) All the registered credits will be considered for the calculation of final CGPA.
k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'.Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.
l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.
m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.
n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration / career growth/placements/opportunities for higher studies/ GATE / other competitive exams etc.

4. Registration for Courses:

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.

b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

c) The concerned college shall thoroughly verify and upload the data/courses registered by each student in the university examination center within 20 days. The Principal of the concerned college shall ensure that there no wrong registration courses by the student. The university registration portal will be closed after 20 days.

5. (a) Award of B. Tech. Degree: A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.
ii. The student shall register for 160 credits and must secure all the 160 credits.
iii. All students shall mandatorily register for the courses like Environmental Sciences,

Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure at least 40% of the marks allotted in the internal evaluation for passing the course and shall maintain 75% of attendance in the subject.

iv. All students shall mandatorily register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

v. Credits are defined as per AICTE norms.

(b) Award of B. Tech. (Honor):

- Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline
- A student shall be permitted to register for Honors program at the beginning of 4 th semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2 nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.
- Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
- In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
- It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses
- The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall 16 explore the possibility of introducing virtual labs for such courses with lab component.
- MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

- The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
- In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

(c) **Award of B. Tech. (Minors):**

- Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.
- The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.
- The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.
- There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
- The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

- A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.
- Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.
- A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
- If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
- In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

6. Attendance Requirements

a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.
c) Shortage of Attendance below 65% in aggregate shall not be condoned.
d) A student who is short of attendance in a semester may seek re-admission into that

semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.
f) A stipulated fee of Rs. 1000/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.
g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.
h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
i) For induction programme attendance shall be maintained as per AICTE norms.
j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

7. Evaluation-Distribution and Weightage of marks

i. Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.
ii. To maintain the quality, external examiners and question paper setters shall be selected from reputed institutes like IISc, IITs, IIITs, IISERs, NITs and Universities.
iii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.
iv. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

v. **Distribution and Weightage of marks:** The assessment of the student's performance in each course will be as per the details given:

S.No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programs/Research Project	-	50	50
5	Project Work	60	140	200

vi. Continuous Internal Theory Evaluation:

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (20 multiple choice questions) for 10 marks for duration of 20 minutes (ii) one descriptive examination (3 full questions for 5 marks each) for 15 marks for duration of 90 minutes and (iii) one assignment for 05 marks. All the internal exams shall be conducted as per university norms from first 50% of the syllabi.
b) In the similar lines, the second online, descriptive examinations assignment shall be conducted on the rest of the 50% syllabus.
c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination

section within one week after completion of first mid examination.

d) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

e) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

f) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

g) Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for other mid exam.
   a. Example: **Mid-1 marks** = Marks secured in
   b. (Online examination-1 + descriptive examination-1 +one assignment-1)
   c. **Mid-2 marks** = Marks secured in
   d. (Online examination-2+descriptive examination-2+one assignment-2)
   e. **Final internal Marks** = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

h) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

vii. Semester End Theory Examinations Evaluation:

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.

c) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% weightage for better of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work.

Evaluation of the summer internships:

- Two summer internships each with a minimum of six weeks duration, done at the end of second and third years, respectively are mandatory. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs.
- 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. The report and the oral presentation shall carry 40% and 60% weightages respectively.

- In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner
- The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.
- It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion.

d) Curricular Framework for Skill oriented :

- The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.

- For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
- Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
- A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list
- The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS
- The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand
- If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.
- If a student prefers to take a certificate course offered by external agency, the department

shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

- A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

- Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.
- **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

g) ***Major Project (*****Project - Project work, seminar and internship in industry):**

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

Evaluation*:* The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

8 Results Declaration:

i. Before results declaration, an academic council meeting shall be conducted and results

shall be placed before the academic council for approval.

ii. With the approval of academic council, the results shall be submitted to the University to get the Approval from Honorable Vice-Chancellor.

iii. The University may normalize the result, if required, before declaration of the result (Guidelines for normalization will be provided separately)

iv. A copy of approved results in a CD shall be submitted to the University examination Center.

9. Academic Audit: Academic audit in each semester will be conducted as per norms.

10. Recounting or Re-evaluation of Marks in the End Semester Examination: A student can request for recounting of revaluation of his/her answer book on payment of a prescribed fee as per norms.

11. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

12. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

13. Promotion Rules: The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.5 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

14. Course Pattern

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

15. Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

Marks Range Max:100	Marks range Max:50	Level	Letter Grade	Grade point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5

<40	<20	Fail	F	0
-		Absent	AB	0

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 B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

17. Minimum Instruction Days:

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

18. Withholding of Results:

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

19. Transitory Regulations

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

20. Gap – Year:

Gap Year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

21. General:

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

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

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

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

ACADEMIC REGULATIONS (SITE21) FOR B.Tech (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2022-23 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 121 credits and secure all the 122 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech (lateral entry)

3. **Promotion Rules:** A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. **Award of Class**

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 121 Credits from II Year to IV Year
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme**

COMMUNITY SERVICE PROJECT

Introduction

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development

2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.

3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative

to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

1. Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation
2. Each class/section should be assigned with a mentor.
3. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc.
4. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded. The log book has to be countersigned by the concerned mentor/faculty in charge.
5. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
6. The final evaluation to be reflected in the grade memo of the student.
7. The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
8. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
9. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
2. The Community Service Project is a twofold one –

a) First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.

b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

- Agriculture
- Health
- Marketing and Cooperation
- Animal Husbandry

- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES **BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

Learning Outcomes

1. Positive impact on students' academic learning.
2. Improves students' ability to apply what they have learned in "the real world".
3. Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
4. Improved ability to understand complexity and ambiguity.

Personal Outcomes

1. Greater sense of personal efficacy, personal identity, spiritual growth, and moral development.
2. Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

1. Reduced stereotypes and greater inter-cultural understanding
2. Improved social responsibility and citizenship skills
3. Greater involvement in community service after graduation

Career Development

1. Connections with professionals and community members for learning and career opportunities
2. Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

1. Stronger relationships with faculty
2. Greater satisfaction with college
3. Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

1. Satisfaction with the quality of student learning
2. New avenues for research and publication via new relationships between faculty and community
3. Providing networking opportunities with engaged faculty in other disciplines or institutions
4. A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

1. Improved institutional commitment
2. Improved student retention
3. Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

1. Satisfaction with student participation

2. Valuable human resources needed to achieve community goals
3. New energy, enthusiasm and perspectives applied to community work
4. Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programs
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programs and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people

39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complementing the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs are;

Programs for School Children:

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharat
7. AIDS awareness camp
8. Anti-Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programs
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programs
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture

vi. Fisheries
vii. Sericulture
viii. Revenue and Survey
ix. Natural Disaster Management
x. Irrigation
xi. Law & Order
xii. Excise and Prohibition
xiii. Mines and Geology
xiv. Energy

Role of Students:

1. Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
2. For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
3. As and when required the College faculty themselves act as Resource Persons.
4. Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
5. And also, with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
6. An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

a) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.

b) A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.

c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (Two Weeks)

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Four Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

Course Numbering Scheme

The Course number code consists of 11alphabets. A typical course number code is illustrated in the followingFigure-1.

Mechanical Engineering (ME) **Example: ED** in 3rd semester for ECT with S. No 3

Course Code: 21ETETT3030

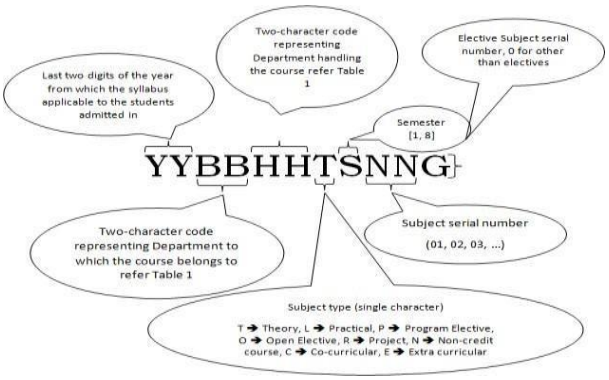


Figure 1: Course Numbering Scheme

The department codes ar e in given in following table 1.

Table 1: Department Codes

Department	Two-character code
Artificial Intelligence and Machine Learning	AM
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communications Engineering	EC
Electronics & Communications Technology	ET
Computer Science and Engineering(Artificial Intelligence and Machine Learning)	CA
Computer Science and Engineering(IoT and Cyber Security including Block Chain Technology)	CI
Computer Science and Engineering (Data Science)	CD
Computer Science and Engineering	CS
Computer Science and Technology	CT
Information Technology	IT

Management Science	MS
Mathematics	MA
Physics	PH
Chemistry	CH
English	EG
Biology	BI
Common to All Branches	CM

Table 2: Comparison of Number of credits given by AICTE and Approved credits

S. No.	Category	No. of Credits			
		CE		CSE/IT/CST	
		AICTE	Approved	AICTE	Approved
1	Humanities and Social Sciences	**12**	**10.5**	12	**10.5**
2	Basic Science courses	**26**	**21**	24	**21**
3	Engineering Science courses	**29**	**24**	29	**24**
4	Professional Core courses	**47**	**51**	49	**51**
5	Professional Elective Courses	**23**	**15**	18	**15**
6	Open elective courses	**11**	**12**	12	**12**
7	Project work, Seminar and Internship	**12**	**16.5**	15	**16.5**
8	Mandatory Courses	**--**	**--**	-	**--**
9	Soft skill courses	**--**	**10**	-	**10**

Malpractice

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMS

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 subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject 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 subject 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 subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects 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 and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects 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. 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject.
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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
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.	

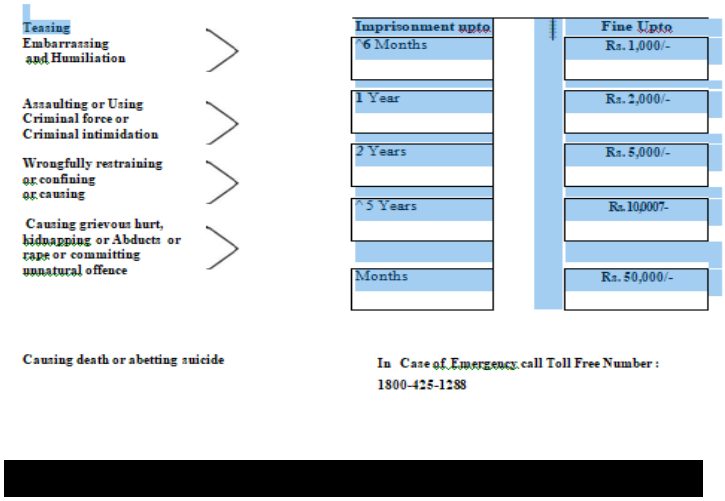
MALPRACTICES

- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of student at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997 Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.



Program Outcomes for an Engineering Graduates:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as,

being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE STRUCTUREAND SYLLABUS

SITE-21 REGULATIONS

For

B.Tech.

Civil Engineering

With effective from the Academic Year 2021-22

Course structure for the Academic Year 2021-22

B. Tech. (Civil Engineering)
Semester I (First Year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMMAT1010	Engineering Mathematics - I	3	1	0	3
2	21CEPHT1020	Engineering Physics	3	0	0	3
3	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	21CMCST1040	Programming for Problem solving	3	0	0	3
5	21CEMEL1050	Engineering Graphics	2	0	2	3
6	21CEPHL1060	Engineering Physics Lab	0	0	3	1.5
7	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMMSN1090	Constitution of India, Professional ethics and Human values	2	0	0	0
					Total Credits	19.5

B.Tech. (Civil Engineering)
Semester II (First year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMEGT2010	Technical English	3	0	0	3
2	21CMMAT2020	Engineering Mathematics - II	3	1	0	3
3	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	21CMCST2040	Python Programming	2	0	2	3
5	21ETETT2050	Engineering Mechanics	3	0	0	3
6	21CMEGL2060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	21CEMEL2080	Engineering Workshop Lab	0	0	3	1.5
9	21CMCHN2090	Environmental Science	2	0	0	0
					Total Credits	19.5

B.Tech. (Civil Engineering)
Semester III (Second year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT3010	Engineering Mathematics - III	3	0	0	3
2	21CECET3020	Mechanics of Solids	3	0	0	3
3	21CECET3030	Fluid Mechanics	3	0	0	3
4	21CECET3040	Building Materials, Construction & Concrete Technology	3	0	0	3
5	21CECET3050	Surveying and Geomatics	3	0	0	3
6	21CECEL3060	Concrete Technology Lab	0	0	3	1.5
7	21CECEL3070	Surveying Field Work	0	0	3	1.5
8	21CECEL3080	Strength of Materials Lab	0	0	3	1.5
9	21CECES3090	Computer Aided Civil Engineering Drawing (SOC)	1	0	2	2
10	21CECEN3100	Essence of Indian Traditional Knowledge Mandatory course (AICTE suggested)	2	0	0	0
					Total Credits	21.5

B.Tech. (Civil Engineering)
Semester IV (Second year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT4010	Engineering Mathematics - IV	3	0	0	3
2	21CECET4020	Structural Analysis	3	0	0	3
3	21CECET4030	Engineering Geology	3	0	0	3
4	21CECET4040	Hydraulic & Hydraulics Machinery	3	0	0	3
5	21CMMST4050	Engineering Economics & Financial Management	3	0	0	3
6	21CECEL4060	Engineering Geology Lab	0	0	3	1.5
7	21CECEL4070	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5
8	21CECEL4080	Building Planning & Drawing	1	0	2	1.5
9	21CECES4090	Advanced Surveying (SOC)	1	0	2	2
					Total Credits	21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4

B.Tech. (Civil Engineering)
Semester V (Third year)

S. No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECET5010	Soil Mechanics	3	0	0	3
2	21CECET5020	Transportation Engineering	3	0	0	3
3	21CECET5030	Design and Drawing of Reinforced Concrete Structures	3	0	0	3
4	21CECEP504x	Professional Elective - I	3	0	0	3
5	21CExxO505x	Open Elective course - I	2	0	2	3
6	21CECEL5060	Soil Mechanics Lab	0	0	3	1.5
7	21CECEL5070	Transportation Engineering Lab	0	0	3	1.5
8	21CMAHS5080	Soft Skills & Aptitude Builder - 1	1	0	2	2
9	21CECEN5090	Disaster Management Mandatory course (AICTE suggested)	2	0	0	0
10	21CECER5100	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester	0	0	3	1.5
					Total Credits	21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE1	21CECEP504a	Advanced Concrete Technology	3	0	0	3
2		21CECEP504b	Open Channel flow	3	0	0	3
3		21CECEP504c	Advanced Structural Analysis	3	0	0	3
4		21CECEP504d	Remote Sensing and GIS	3	0	0	3

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

B.Tech. (Civil Engineering)
Semester VI (Third year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECET6010	Hydrology and Water Resources Engineering	3	0	0	3
2	21CECET6020	Design and Drawing of Steel Structures	3	0	0	3
3	21CECET6030	Environmental Engineering	3	0	0	3
4	21CECEP604x	Professional Elective - II	3	0	0	3
5	21CExxO605x	Open Elective course - II	2	0	2	3
6	21CECEL6060	Environmental Engineering Lab	0	0	3	1.5
7	21CECEL6070	RS & GIS LAB	0	0	3	1.5
8	21CECEL6080	Irrigation Design and Drawing Lab	0	0	3	1.5
9	21CEAHS6090	Soft Skills & Aptitude Builder - 2	1	0	2	2
10	21CMBIT6100	Biology for Engineers	2	0	0	0
			Total Credits			21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4
Industrial/Research Internship (Mandatory) 2 months during summer vacation						

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE2	21CECEP604a	Foundation Engineering	3	0	0	3
2		21CECEP604b	Offshore Structures	3	0	0	3
3		21CECEP604c	Pavement Design	3	0	0	3
4		21CECEP604d	Urban Hydrology	3	0	0	3

Open Electives:

S.No	**Subject Code**	**Name of the subject**	**L**	**T**	**P**	**Cr**
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

B.Tech. (Civil Engineering)
Semester VII (Fourth year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECEP701x	Professional Elective - III	3	0	0	3
2	21CECEP702x	Professional Elective - IV	3	0	0	3
3	21CECEP703x	Professional Elective - V	3	0	0	3
4	21CExxO704x	Open Elective courses - III	2	0	2	3
5	21CExxO705x	Open Elective courses - IV	2	0	2	3
6	21CEMST7060	Management Science	3	0	0	3
7	21CECES7070	Software Applications in Civil Engineering Lab (SOC)	1	0	2	2
Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)			0	0	6	3
		Total Credits				23
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE3	21CECEP701a	Prestressed Concrete	3	0	0	3
2		21CECEP703b	Ground Water Development & Management	3	0	0	3
3		21CECEP703c	Soil Dynamics and Machine Foundation	3	0	0	3
4		21CECEP703d	Air and Noise Pollution and Control	3	0	0	3
1	PE4	21CECEP702a	Solid Waste & Hazardous Waste Management	3	0	0	3
2		21CECEP702b	Ground Improvement Techniques	3	0	0	3
3		21CECEP702c	Hydraulic Structures	3	0	0	3
4		21CECEP702d	Bridge Engineering	3	0	0	3
1	PE5	21CECEP703a	Construction, Specifications and Project Management	3	0	0	3
2		21CECEP703b	Railway, Airport Docks and Harbors	3	0	0	3
3		21CECEP703c	Repair and rehabilitation of structures	3	0	0	3
4		21CECEP703d	Earth and rock fill dams	3	0	0	3

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

B.Tech. (Civil Engineering)
Semester VIII (Fourth year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECER8010	Project work, seminar and internship in industry	0	0	24	12
					Total Credits	12

Humanities and Social Sciences courses:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMEGT2010	Technical English	3	0	0	3
2	21CMMST4050	Engineering Economics & Financial Management	3	0	0	3
3	21CEHMS7060	Management Science	3	0	0	3
4	21CMEGL2060	English Communication Skills Lab	3	0	0	1.5
					Total	10.5

Basic Sciences courses and Labs

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMMAT1010	Engineering Mathematics - I	3	0	0	3
2	21CEPHT1020	Engineering Physics	3	0	0	3
3	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	21CMMAT2020	Engineering Mathematics - II	3	0	0	3
5	21CEMAT3010	Engineering Mathematics - III	3	0	0	3
6	21CEMAT4020	Engineering Mathematics - IV	3	0	0	3
7	21CEPHL1060	Engineering Physics Lab	0	0	3	1.5
8	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
Total						21

Engineering Sciences courses and Labs

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMCST1040	Programming for Problem solving	3	0	0	3
2	21CEMEL1050	Engineering Graphics	3	0	0	3
3	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	21CMCST2040	Python Programming	3	0	0	3
5	21ETETT2050	Engineering Mechanics	3	0	0	3
6	21CECET4030	Engineering Geology	3	0	0	3
7	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
8	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
9	21CEMEL2080	Engineering Workshop Lab	0	0	3	1.5
10	21CECEL4060	Engineering Geology Lab	0	0	3	1.5
Total						24

Professional Core courses and Labs

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECET3020	Mechanics of Solids	3	0	0	3
2	21CECET3030	Fluid Mechanics	3	0	0	3
3	21CECET3040	Building Materials & Concrete Technology	3	0	0	3
4	21CECET3050	Surveying and Geomatics	3	0	0	3
5	21CECET4020	Structural Analysis	3	0	0	3
6	21CECET4040	Hydraulic & Hydraulics Machinery	3	0	0	3
7	21CECET5010	Geotechnical Engineering	3	0	0	3
8	21CECET5020	Transportation Engineering	3	0	0	3

9	21CECET5030	Design and Drawing of Reinforced Concrete Structures	3	0	0	3
10	21CECET6010	Hydrology and Water Resources Engineering	3	0	0	3
11	21CECET6020	Design and Drawing of Steel Structures	3	0	0	3
12	21CECET6030	Environmental Engineering	3	0	0	3
13	21CECEL3060	Concrete Technology Lab	0	0	3	1.5
14	21CECEL3070	Surveying Field Work	0	0	3	1.5
15	21CECEL3080	Strength of Materials Lab	0	0	3	1.5
16	21CECEL4070	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5
17	21CECEL4080	Building Planning & Drawing	0	0	3	1.5
18	21CECEL5060	Geotechnical Engineering Lab	0	0	3	1.5
19	21CECEL5070	Transportation Engineering LAB	0	0	3	1.5
20	21CECEL6060	Environmental Engineering Lab	0	0	3	1.5
21	21CECEL6070	RS & GIS LAB	0	0	3	1.5
22	21CECEL6080	Irrigation Engineering Drawing Lab				1.5
					Total Credits	51

Professional Electives

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE1	21CECEP504a	Advanced Concrete Technology	3	0	0	3
2		21CECEP504b	Open Channel flow	3	0	0	3
3		21CECEP504c	Advanced Structural Analysis	3	0	0	3
4		21CECEP504d	Remote Sensing and GIS	3	0	0	3
1	PE2	21CECEP604a	Advanced Foundation Engineering	3	0	0	3
2		21CECEP604b	Offshore Structures	3	0	0	3
3		21CECEP604c	Advanced Transportation Engineering	3	0	0	3
4		21CECEP604d	Construction, Specifications and Project Management	3	0	0	3
1	PE3	21CECEP701a	Prestressed Concrete	3	0	0	3
2		21CECEP703b	Ground Water Development	3	0	0	3
3		21CECEP703c	Ground Improvement Techniques	3	0	0	3
4		21CECEP703d	Air and Noise Pollution and Control	3	0	0	3
1	PE4	21CECEP702a	Solid Waste & Hazardous Waste Management	3	0	0	3
2		21CECEP702b	Soil dynamics and machine foundation	3	0	0	3
3		21CECEP702c	Hydraulic Structures	3	0	0	3
4		21CECEP702d	Bridge Engineering	3	0	0	3
1	PE5	21CECEP703a	Urban Hydrology	3	0	0	3
2		21CECEP703b	Railway, Airport Docks and Harbors	3	0	0	3
3		21CECEP703c	Repair and rehabilitation of structures	3	0	0	3
4		21CECEP703d	Earth and rock fill dams	3	0	0	3
						Total Credits	15

Honors

S.No	Honors	Subject Code	Name of the subject	L	T	P	Cr
1	POOL I		Finite Element Methods	4	0	0	4
2			Earthquake Resistant Design of Structures	4	0	0	4
3			Advanced Structural Design	4	0	0	4
4			Bridge engineering	4	0	0	4
1	POOL 2		Rock Mechanics	4	0	0	4
2			Foundation Engineering	4	0	0	4
3			Advanced Foundation Engineering	4	0	0	4
4			Earth and Rock Fill Dams	4	0	0	4
1	POOL 3		Highway Engineering	4	0	0	4
2			Pavement Analysis design	4	0	0	4
3			Intelligent transport systems	4	0	0	4
4			Traffic Engineering and Management	4	0	0	4
1	POOL 4		Environmental Laws and Policy	4	0	0	4
2			Environmental Change and sustainable development	4	0	0	4
3			Physico-Chemical Processes for Water and Wastewater Treatment	4	0	0	4
4			Environmental Impact Assessment and Management	4	0	0	4

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution And Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3
Total credits						12

Skill oriented course:

S.No	Subject Code	Title of the certificate course	L	T	P	Cr
1	21CECES3090	Computer Aided Civil Engineering Drawing	1	0	2	2
2	21CECES4090	Advanced Surveying (SOC)	1	0	2	2
3	21CEAHS5080	Soft Skills & Aptitude Builder - 1	1	0	2	2
4	21CEAHS5080	Soft Skills & Aptitude Builder - 2	1	0	2	2
5	21CECES7070	Software Applications in Civil Engineering Lab (SOC)	1	0	2	2
					Total credits	10

MOOC courses

S.No	Name of the subject	https://onlinecourses.swayam2.ac.in/nou20_cs11/preview	L	T	P	Cr
1	Building Cost Estimation Simplified	https://nptel.ac.in/courses/105103207	2	0	0	2
2	Advanced soil Mechanics	https://onlinecourses.nptel.ac.in/noc21_ce08/preview	2	0	0	2
3	Digital Land Surveying And Mapping (DLS&M)	https://nptel.ac.in/courses/105107181	2	0	0	2
4	Environmental Remediation of Contaminated Sites	https://onlinecourses.nptel.ac.in/noc22_ce26/preview	2	0	0	2
5	Geographic Information Systems	https://nptel.ac.in/courses/105106052	2	0	0	2
6	Geosynthetics and Reinforced Soil Structures	https://onlinecourses.nptel.ac.in/noc22_ce45/preview	2	0	0	2
7	Rural water resources management	https://archive.nptel.ac.in/courses/105/106/105106202/	2	0	0	2
8	Maintenance and repair of concrete structures	https://nptel.ac.in/courses/105106053	2	0	0	2
9	Modern construction materials	https://onlinecourses.nptel.ac.in/noc22_ce31/preview	2	0	0	2
10	Probability methods in civil engineering	https://onlinecourses.swayam2.ac.in/nou20_cs11/preview	2	0	0	2

Mandatory courses

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CMCHN1090	Constitution of India, Professional ethics and Human rights	2	0	0	0
2	21CMCHN2090	Environmental Science	2	0	0	0
3	21CMCHN3090	Essence of Indian Traditional Knowledge	2	0	0	0
4	21CECEN5090	Disaster Management	2	0	0	0
5	21CMBIT6100	Biology for Engineers	2	0	0	0

SUGGESTED COURSES FOR MINOR PROGRAM IN CE

The following are the Offline and MOOC courses offered by CE Departmet for the Minors program

Starting from IV semster.

S.No	Subject Code	Name of the subject	Offered Semester	L	T	P	Cr
1		Building materials	IV Semester	3/4	0	0/2	4
2		Solid Waste & Hazardous Waste Management	V Semester	3/4	0	0/2	4
3		Traffic engineering	VI Semester	3/4	0	0/2	4
4		Ground Improvement Techniques	VII Semester	3/4	0	0/2	4

MOOC/NPTEL Courses for Minor program:

S.No	Name of the subject	Link	L	T	P	Cr
1	Digital Land Surveying and Mapping (DLS&M)	https://nptel.ac.in/courses/105107181	2	0	0	2
2	Environmental Remediation of Contaminated Sites	https://onlinecourses.nptel.ac.in/noc22_ce26/preview	2	0	0	2
3	Geographic Information Systems	https://nptel.ac.in/courses/105106052	2	0	0	2

S.No	Name of the subject	Link	L	T	P	Cr
1	Rural water resources management	https://archive.nptel.ac.in/courses/105/106/105106202/	2	0	0	2
2	Modern construction materials	https://onlinecourses.nptel.ac.in/noc22_ce31/preview	2	0	0	2
3	Probability methods in civil engineering	https://onlinecourses.swayam2.ac.in/nou20_cs11/preview	2	0	0	2

Note:

1. Students has to study all four regular/offline minor courses starting from **IV semster** and complete by **VII semester** by taking **one course per semester**.
2. Additionally, TWO MOOC courses of minimum EIGHT-week duration a total covering of 4 credits (offered by CE Department only).
3. Students can register for any two MOOC courses and one from each pool out of three courses listed in the each pool in the above table via the NPTEL online platform from IV semester to VII semester by prior information to concerned department.

CREDIT DISTRIBUTION FOR B.TECH. CE PROGRAM

Department	S. No	Category	Code	SITE								Total Credits	Suggested breakup of Credits (APSCHE)	Suggested breakup of Credits (AICTE)
				SEM-1	SEM-2	SEM-3	SEM-4	SEM-5	SEM-6	SEM-7	SEM-8			
CE	1	Humanities and social science including Management courses	HSMC		**4.5**		**03**			**03**		**10.5**	**10.5**	**12**
	2	Basic Science courses	BSC	**12**	**03**	**03**	**03**					**21**	**21**	**26**
	3	Engineering science courses	ESC	**7.5**	**12**		**4.5**					**24**	**24**	**29**
	4	Professional core Courses	PCC			**16.5**	**9**	**12**	**13.5**			**51**	**51**	**47**
	5	Open Elective Courses	OEC					**03**	**03**	**06**		**12**	**12**	**11**
	6	Professional Elective Courses	PEC					**03**	**03**	**09**		**15**	**15**	**23**
	7	Skill oriented courses	SOC			**02**	**02**	**02**	**02**	**02**		**10**	**10**	**--**
	8	Internship, seminar, project wok	PROJ					**1.5**		**3**	**12**	**16.5**	**16.5**	**12**
	9	Mandatory courses	MC									**Non-credit**	**Non-credit**	**Non-credit**

I B. Tech I Semester Course structure for the Academic Year 2021-2022
Common to AIML, CSA, CE, CST, ECT, EEE, ME

S. No	Subject Code		L	T	P	C
1	21CMMAT1010	Engineering Mathematics - I	3	0	0	3
2	21CEPHT1020	Engineering Physics	3	0	0	3
3	21CMCHT1030	Engineering Chemistry	3	0	0	3
4	21CMCST1040	Programming for Problem Solving	3	0	0	3
5	21CEMEL1050	Engineering Graphics	2	0	2	3
6	21CEPHL1060	Engineering Physics Lab	0	0	3	1.5
7	21CMCHL1070	Engineering Chemistry Lab	0	0	3	1.5
8	21CMCSL1080	Programming for Problem Solving Lab	0	0	3	1.5
9	21CMMSN1090	Constitution of India, Professional Ethics & Human Rights	2	0	0	0
		Total Credits				**19.5**

I B. Tech II Semester Course structure for the Academic Year 2021-2022
Common to AIML, CSA CE, CST, ECT, EEE, ME

S.No	Subject Code	Course	L	T	P	C
1	21CMEGT2010	Technical English	3	0	0	3
2	21CMMAT2020	Engineering Mathematics - II	3	0	0	3
3	21CMEET2030	Basic Electrical Engineering	3	0	0	3
4	21CMCST2040	Python Programming	1	0	4	3
5	21CECET2050	Engineering Mechanics	3	0	0	3
6	21CMEGL2060	English Communication Skills Lab	0	0	3	1.5
7	21CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	21CMMEL2080	Engineering Workshop Lab	0	0	3	1.5
9	21CMCHN2090	Environmental Science	2	0	0	0
		Total Credits				**19.5**

ENGINEERING MATHEMATICS-I Common to all the branches SEMESTER I			
Subject Code	21CMMAT1010/1020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

1. To solve the differential equations related to various engineering fields
2. To enlighten the learners in the concept of differential equations.
3. To familiarize with functions of several variables which is useful in optimization
4. To solve the partial differential equations of first order
5. To apply double integration techniques in evaluating areas bounded by region.

Unit -1	**Hours**
Differential Equations of first order and first degree: Linear differential equations - Bernoulli's equations – Exact equations and Equations reducible to exact form. Applications: Newton's law of cooling - Law of natural growth and decay - Orthogonal trajectories.	**10**
Unit -2	
Linear differential equations of higher order: Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^n V(x) – Method of Variation of parameters. Applications: LCR circuit.	**10**
Unit – 3	
Partial differentiation: Introduction – Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method.	**10**
Unit – 4	
PDE of first order: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.	**08**
Unit – 5	
Multiple integrals: Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates. Applications: Finding Areas and Volumes.	**12**

Course outcomes:

On completion of this course, students are able to

1. Solve the differential equations related to various engineering fields (L3)

2. Solve the differential equations of higher order related to various engineering fields (L3)
3. familiarize with functions of several variables which is useful in optimization (L3)
4. Solve the partial differential equations of first order (L3)
5. Apply double integration techniques in evaluating areas bounded by region (L3).

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

2. Joel Hass, Christopher Heil and Maurice D. Weir, Thomas calculus, 14thEdition, Pearson.

3. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press, 2013.

4. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

ENGINEERING PHYSICS (Introduction to Mechanics) (Common for ME & CE in I-Semester)			
Subject Code	**21CEPHT1020** **21MEPHT1020**	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To explore** the knowledge of fundamental vibrations.
- **To impart** the concept of Newton's law of motion in central force field.
- **To enable** the students to understand the Rigid body dynamics.
- **To study** the structure- property relationship exhibited by solid materials with in the elastic limits.

Unit -1	
One Dimensional motion: Newton's Equation of motion in one dimension-examples of particle falling under a gravity, Simple harmonic motion (Mechanical oscillator) and its characteristics, Damped harmonic motion (Mechanical oscillator) and damping conditions (over-damped, critically damped and under damped conditions), Forced oscillations (Mechanical oscillator) - un damped and damped conditions, Resonance.	**Hours – 10**
Unit -2	
Two dimensional motions: Two Dimensional motion in the Cartesian coordinate system – Example of Projectile motion without air drag; Two Dimensional motion in Radial polar coordinate system- Example of planetary motion, Kepler's laws and their deduction, Newton equations for variable mass system (rocket), Calculations of Centre of mass and its characteristics .	**Hours – 10**
Unit -3	
Conservative & Non Conservative motion: Invariance of Newton's equations-Under shift of coordinate system - Galileo transformation - Accelerating frames of reference, Reference frame rotating with a constant angular velocity, Centrifugal Force-Apparent gravitational acceleration, Coriolis force -Effect of Coriolis force on a freely falling body. Conservative and Non-Conservative forces.	**Hours – 9**
Unit – 4	
Rigid body dynamics: Angular momentum of a single particle and system of particle, conservation of angular momentum; Equation of motion of a rigid body; Kinetic energy of a rigid rotating body; Moment of Inertia, Calculations of moment of inertia-rectangular lamina and Uniform cylinder (rod, circular disc); Parallel axis theorem and perpendicular axis theorem and their applications; Euler's equation describing rigid body motion.	**Hours – 10**

Unit – 5	
Elasticity: Stress, Strain, Hook's law, stress strain curve, generalized Hook's law with and without thermal strains for isotropic materials, Factors affecting the elastic behavior, energy stored per unit volume in stretched wire, different types of moduli and their relations, bending of beams, Bending moment of a beam, Depression of cantilever.	**Hours –9**

COURSE OUTCOMES:

On completion of the course student will able to

1. **Distinguish** the various harmonic motions and resonance.
2. **Apply** Newton's law of motion to understand the motions of mechanical systems.
3. **Recognize** the invariance of Newton's equation of motion.
4. **Illustrate** the concept of conservative and non-conservative motions.
5. **Formulate** the rigid body dynamics.
6. **Study** the structure- elastic property correlation under load within the elastic limits.

QUESTION PAPER PATTERN:

1. It will have 5 questions with internal choice.
2. Each question carries 14 marks.

   Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. Introduction to Mechanics — MK Verma.
2. A Text Book of Engineering Physics- M.N.Avadhanulu, 11e , S.CHAND,

REFERENCE BOOKS:

1. S.L Gupta& D.L. Gupta, Unified physics
2. An Introduction to Mechanics — D Kleppner & R Kolenkow
3. Principles of Mechanics — JL Synge & BA Griffiths.
4. Engineering Physics- Ch. Srinivas, Ch. Sesubabu Cengage learning.

WEB SOURCES:

1. W1: http://www.physics.org/news.asp
2. W2: http://www.phys.lsu.edu/newwebsite/lecturedemo/
3. W3: http://www.nptl.ac.in
4. W3: American Association of Physics Teachers [http://www.aapt.org/]
5. W3: Society of Physics Students [http://www.aip.org/education/sps/sps.htm]

ENGINEERING CHEMISTRY SEMESTER - I			
Subject Code	21CMCHT1030/21CMCHT2030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:
The objectives of this course, help the students to

1. Explain the mechanism of corrosion
2. Interpret various boiler troubles and importance of water quality standards.
3. Learn preparation of semiconducting materials, nano materials and liquid crystals – their applications
4. Acquire knowledge on nonconventional energy resources and different types of batteries
5. Know various spectroscopic techniques.
6. Acquire knowledge on volumetric analysis.

Unit -1	Hours
Electrochemistry and Corrosion Electro chemistry: Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. Corrosion: Introduction, Mechanism of Wet chemical corrosion, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	9
Unit -2	
Water Chemistry and Surface Properties Water chemistry: Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, Hardness of water, Temporary and Permanent hardness, Units, determination of hardness by complex metric method. Boiler troubles, Caustic Embrittlement, Priming and foaming, Boiler corrosion. Break point chlorination. Surface properties: Determination of surface tension and viscosity of liquids.	9
Unit -3	
Material Chemistry Non-elemental semiconducting materials: Stoichiometric, controlled valency and chalcogen photo/semiconductors and preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion and ion implantation). Liquid crystals: Introduction, types and applications. Nanoparticles: Introduction, preparation methods – Sol-gel method, Chemical reduction method – Preparation of carbon nanotubes (Arc discharge, chemical vapour deposition and laser ablation methods) properties and applications.	10
Unit -4	

ENERGY SOURCES: Non-conventional energy sources, Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion. Batteries and fuel cells: Primary and secondary batteries - Dry cell, Lead Acid Cell, Lithium-ion battery and Zinc air cells and fuel cells - H_2-O_2, CH_3OH-O_2, Phosphoric acid and molten carbonate.	10
Unit -5	
SPECTROSCOPY AND CHROMATOGRAPHY TECHNIQUES Regions of electromagnetic spectrum - Principles of vibrational and rotational spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – Thin Layer & Paper Chromatography.	10

COURSE OUTCOMES:

On completion of the course student will be able to

1. Interpret the mechanism of corrosion
2. Summarize the problems faced in industries due to boiler troubles.
3. Recall the properties and applications of advanced materials.
4. Summarize the advantages of non-conventional energy resources and batteries.
5. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
6. Determine the strength of acid, base and some elements by volumetric and instrumental analysis.

TEXT BOOKS:

1. P.C. Jain and M. Jain “Engineering Chemistry”, 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, “Engineering Chemistry”, Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, “A Textbook of Engineering Chemistry”, S.Chand & Co, (2010).
4. Shashi Chawla, “Engineering Chemistry”, Dhanpat Rai Publicating Co. (Latest edition).
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.

REFERENCE BOOKS:

1. K. Sesha Maheshwarammam and Mridula Chugh, “Engineering Chemistry”, Pearson India Edn.
2. O.G. Palana, “Engineering Chemistry”, Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) “Preparation and characterization of materials” Academic press, New York (latest edition)

PROGRAMMING FOR PROBLEM SOLVING SEMESTER I (Common to All)			
Subject Code	21CMCST1040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

The Objectives of Programming for problem solving are:

- To learn about C programming language syntax, semantics, and the runtime environment
- To be familiarized with general computer programming concepts like data types, conditional statements, loops and functions.
- Tobefamiliarizedwithgeneralcodingtechniquesandprocedure-orientedprogramming.

Unit -1	**Hours**
History & Hardware: Computer Hardware, Components, Types of Software, Memory Units. **Introduction to Problem solving**: Algorithm, Characteristics of Algorithms, Pseudo Code, Flowchart, Types of Languages, Relation between Data, Information, Input and Output. **Basics of C**: History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program Development Steps, Programming Errors.	**10**
Unit -2	
Overview of C: Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator Precedence and Associativity, Evaluation of C-Expressions, Input/output Functions. **Conditional Branching:** if statement, if...else statement, Nested if...else statement, If…else…if ladder, switch statement. **Unconditional Branching:** go to**. Control flow Statements:** break, continue**. Looping Constructs:** do-while statement, while statement, for statement	**10**
Unit -3	
Arrays: Introduction,1-DArrays,Character arrays and string representation, 2-D Arrays(Matrix),Multi-Dimensional Arrays. **Strings**: Working with Strings, String Handling Functions (both library and user defined).**Functions:** Basics, Necessity and Advantages, Types of Functions, Parameter Passing Mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and Vice-Versa.	**10**
Unit -4	
Pointers: Understanding Pointers, Pointer Expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memory Allocation:** Introduction to Dynamic Memory Alloca-tion-malloc(),calloc(),realloc(),free().	**10**

Structures and Unions: Defining a Structure, type def, Advantage of Structure, Nested Structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures andPointers,DefiningUnions,Self-ReferentialStructures,Bitfields,Enumerations.	
Unit -5	
Preprocessing Directives: () acro Substitution, File Inclusion, Conditional Compilation and Other Directives. **File Management In C:**)Introduction to File Management, Modes and Operations on Files, Types of Files, Error Handling during I/O Operations.	**10**

COURSE OUTCOMES:

On completion of the course student will be able to

- Demonstrate computer components, algorithms, translate them into programs.
- Choose the suitable control structures for the problem to be solved.
- Make use of arrays, pointers, structures, and unions effectively.
- Organize reusable code in a program into functions.
- Demonstration of file operations.

TEXT BOOKS:

1) Programming in C ,Pradip Dey, Manas Ghosh, OXFORD
2) Programming in, C Reema Thareja, Second Edition, OXFORD
   Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.

REFERENCE BOOKS:

1) Computer Fundamentals and Programming, Sumithabha Das, McGrawHill.
2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.

ENGINEERING GRAPHICS

B. Tech. (Common to CE, EEE &ME)

(Proposed syllabus for the academic year 2021 -22)

Subject Code	21CEMEL1050/21EEMEL 1050/21MEMEL1050	IA Marks	30
Number of Lecture Hours/Week	1(L)+04(P)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES: On successful completion of the course, **s**tudents should be able to

1. construct polygons, scales, engineering curves (parabola, ellipse, hyperbola, cycloids, involutes)
2. draw orthographic projections of points, lines and planes.
3. draw the orthographic projections of simple solids
4. draw sectional views of solids
5. convert given isometric view into orthographic view and vice versa using AutoCAD software.

Unit -1	**Teaching Hours**
Introduction to Engineering Drawing covering Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (Eccentricity method only); plain Cycloid, and Involutes; Scales – Plain and Vernier scales only.	10
Unit -2	
Projections of Points, Projections of straight lines and the line inclined to both planes; Projections of planes (inclined to one reference plane only).	08
Unit – 3	
Projections of regular polyhedrons – tetrahedron, hexahedron, octahedron (axis inclined to one reference plane only). Projections of irregular polyhedrons – Prisms, Pyramids, Cones and Cylinders(axis inclined to one reference plane only).	08
Unit – 4	
Sectional Views of Right Angular Solids covering Prism, Cylinder, Pyramid and Cone	12
Unit – 5	
Introduction to AutoCAD - The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension Tools), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and Windows. Isometric Projections, Principles of Isometric projection – Isometric Scale, Isometric Views,Conventions; Isometric Views of lines, Planes, Simple and compound Solids;Conversion of Isometric Views to Orthographic Views and Vice-versa.	12

COURSE OUTCOMES: On the successful completion of this course, the students will be able to

1. construct polygons, scales and engineering curves
2. draw the orthographic views of points, lines and planes
3. construct the projections of regular and irregular polyhedrons
4. draw the sectional views of solids
5. draw isometric/orthographic views using AutoCAD

Text/Reference Books

1. N.D. Bhatt, Engineering Drawing, Charotar Publications
2. R.B.Choudary, Engineering Drawing, Anuradha Publishers
3. Agarwal & Agarwal, Engineering Drawing, Tata McGraw Hill Publishers
4. K.L.Narayana & P.Kannaiah, Engineering Drawing, Scitech Publishers
5. K.C. John, Engineering Graphics for Degree, PHI Publishers
6. PI Varghese, Engineering Graphics, Mc GrawHill Publishers
7. K Venugopal, V. Prabhu Raja, Engineering Drawing + AutoCAD, New Age

ENGINEERING PHYSICS LAB (Common for ME & CE in I-Semester)			
Subject Code	**21MEPHL1060 21CEPHL1060**	IA Marks	15
Number of Practice Hours/Week	03	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students

- **To apply** the theoretical knowledge of Physics through hands on the experimental instruments
- **To improve** the experimental knowledge in the later studies
- **To understand** the basic need of experiments.
- **To know** how to measure the different physical quantities.
- **To acquire** ability to use instrumentation techniques.
- **To train** the students to develop techniques based on the principles related to various devices or components.

List of Experiments

1. Investigation of the Motion of Coupled Oscillators.
2. Determination of the rigidity modulus η of wire-Torsional pendulum.
3. Determination of acceleration due to gravity g and radius of gyration K - Compound pendulum.
4. Determination of the Frequency of an electrically maintained tuning fork by Melde's Experiment.
5. Determination of the velocity of sound in air-Volume resonator.
6. Verification of the laws of transverse vibrations of stretched wire.
7. Determination of the Young's modulus and draw load depression graph in uniform bending.
8. Determination of the Moment of Inertia of a Flywheel.
9. Verification of the parallel axis and perpendicular axis theorems and determine the moment of inertia of a regular rectangular body -Bifilar pendulum.
10. Determination of the frequency of the AC Source using Sonometer.

Demonstration experiments:

1. Determination of Young's Modulus, Modulus of rigidity and Poisson's ratio of the material of a given wire by Searle's dynamical method
2. Study of the variation of moment of inertia of a system with the variation in the distribution of mass and hence to verify the theorem of parallel axes (Maxwell' needle method).

COURSE OUTCOMES:

On completion of the course student will able to

1. **Compare** the theory and correlated with experiments
2. **Design** experiments
3. **Analyze** the experimental result
4. **Apply** appropriate techniques to perform the experiments
5. **Apply** the knowledge in simple harmonic motions and resonance to understand the rigid body dynamics**.**
6. **Verify** the parallel axis and perpendicular theorems of moment of inertia**.**

ENGINEERING CHEMISTRY LABORATORY

(Common to All)

Subject Code	21CMCHL1070/21CMCHL2070	IA Marks	15
Number of Practice Hr/Week	3	Exam Marks	35
Total Number of Practice Hr	36	Exam Hours	03

Credits – 1.5

List of Experiments

(Any 10 experiments must be conducted)

1. Determination of HCl using standard Na2CO3 solution
2. Determination of alkalinity of a sample containing Na2CO3 and NaOH
3. Determination of surface tension
4. Determination of viscosity of a liquid by Ostwald viscometer
5. Determination of chloride content of water
6. Determination total hardness of water by EDTA.
7. Determination of Mg^{+2}using standard oxalic acid solution.
8. Determination of Cu^{+2}using standard hypo solution.
9. Determination of the rate constant of first order reaction (Ester hydrolysis)
10. Determination of strength of strong acid using conductometeric titration.
11. Determination of strength of weak acid using conductometeric titration .
12. Determination of Ferrous iron using potentiometer.
13. Chemical oscillations- Iodine clock reaction
14. Estimation of Vitamin C.

Demonstration Experiments

1. Thin Layer Chromatography
2. Determination of $Fe^{+3}$by a colorimetric method.

PROGRAMMING FOR PROBLEMSOLVING LAB (Common to All) SEMESTER I			
Subject Code	21CMCSL1080	Internal Marks	15
Number of Lecture Hours/Week	3	External Marks	35
Total Number of Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to

1. To understand the various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs.
4. To learn to write programs (using structured programming approach) in C to solve problems.
5. To introduce basic data structures such as lists, stacks and queues.

Exercise1(Familiarization with programming environment)

a) Familiarization of CODEBLOCKS C++Editor to edit, compile, Execute, Test and debugging C programs.

b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control. Acquaintance with basic LINUX commands.

Exercise2(Simple computational problems using arithmetic expressions)

a) Write a C Program to display real number with 2 decimal places.

b) Write a C Program to convert Celsius to Fahrenheit and vice versa.

c) Write a C Program to calculate the area of triangle using the formula

area = √ (s(s−a)(s−b)(s −c) where =a+b+c/2

d) Write a C program to find the largest of three numbers using ternary operator.

e) Write a C Program to swap two numbers without using a temporary variable.

Exercise3(Problems involving if-then-else structures)

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shif operator and arithmetic operator.

b) Write C program to find the roots of a quadratic equation.

c) Write a C Program to display grade basedon6subjectmarks using if…else…if ladder.

d) Write a C Program, which takes two integer operands and one operator form the user, performs the operation &then prints the result using switch control statement.(Consider the operators +, -,*,/,%)

Exercise4(Iterative problems)

a) WriteaCProgramtocountnumberof0'sand1's in a binary representation of a given number.

b) WriteaCprogramtogenerateallthepri menumbersbetweentwonumberssuppliedbytheuser.

c) Write a C Program to print the multiplication table corresponding to number supplied as input

Exercise5(Iterative problems)

a) Write a C Program to Find Whether the Given Number is i)Armstrong Number) Palindrome Number

b) Writea C Program to print sum of digits of a given number

Exercise6(Series examples)

a) Write a C Program to calculate sum of following series

b) 1+2+3+….n b) 1+1/2+1/3+……+1/nc)1+x+x2+x3……+xn

Exercise7(1DArraymanipulation)

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array SA SASSASI

Exercise8(Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message **"Incompatible matrix sizes" otherwise.**
c) Write a C program to check given matrix is symmetric or not.

Implementthefollowingstringoperationswithandwithoutlibraryfunctions.i)copy ii)concatenate iii)length iv)compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
b) With arguments and with return value.
c) With arguments and without return alue
d) Without arguments and without return value.
e) Without arguments and with return value.
f) Write a C Program illustrating call by reference

Exercise 10 (Recursive functions)

Write a C Program illustrating the following with Recursion without Recursion
a)Factorial b) GCD c) Power d) Fibonacci

Exercise 11(Pointers and structures)

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function. Note: Understand the difference between the above two programs.
c) Write a C Program to read and print student details using structures.

Exercise 12 (File operations)

a) Write a C program to open a file and to print it contents on screen.
b) Write a C program to copy files
c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

Course outcomes:

Text Books:

1. ComputerProgramingANSIC,EBalagurusamy,McGrawHillEducation(Private),Limited (TB1)
2. Programming in C,Reema Thareja, Second Edition, Oxford Higher Education(TB2)

Reference Books:

1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI (RB1)

Course Outcomes:

2. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step- wise refinement.
4. Demonstrate conversion of iterative functions to recursive and vice-versa.
5. Implement the concepts of arrays, structures, Unions and files.

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS (Common to all Branches)			
Subject Code	21CMMSN1090/21CMMSN2090	IA Marks	30
Number of Lecture Hr/week	03	Exam Marks	70
Total Number of Lecture Hr	50	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Unit - I	**Hours**
Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**10**
Unit - II	
Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**10**
Unit – III	
State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**10**
Unit –IV	
Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	**10**
Unit – V	
Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**10**

COURSE OUTCOMES:

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

TEXT BOOKS:

1. Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice – Hall EEE, 19th / 20th Edn., 2001

2. Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.

REFERENCE BOOKS:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M.Govindarajan, Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

TECHNICAL ENGLISH SEMESTER I/II			
Subject Code	21CMEGT1010/2010	IA Marks	30
Number of Lecture Hours/ Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exams Hours	03
Credits -03			

Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:

1. Technical English Vocabulary
2. Writing Skills
3. Common Errors in Writing
4. Nature and Style of Sensible Technical Writing
5. Writing Technical Reports and Letters

Unit I	
Principles of Scientific Vocabulary • Principles of Scientific vocabulary: short and simple words-compact substitutes for wordy phrases- redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words • The role of roots in word building, prefixes and suffixes, confusing words and expressions.	10 hours
Unit II	
Writing Skills • Distinguishing between academic and personal styles of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing • Measuring the clarity of a text through Fog Index or Clarity Index	10 hours
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • Avoiding the pitfalls	10 hours
Unit IV	

Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying • Effective use of charts, graphs, and tables	10 hours
Unit V	
Report writing and Letter writing • Writing Technical Reports, Précis writing ,Letter Writing &Essay writing	10 Hours

COURSE OUTCOMES

On Completion of the course student will acquire

1. Ability to understand Scientific vocabulary and use them confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently

Text Books

1. **Effective Technical Communication by Barun K Mitra**, Oxford University Publication

Non-detailed Text

1. **Karmayogi: A Biography of E Sreedharan by M S Ashokan**

Reference Books

1. *Communication Skills* by Sanjay Kumar & Pushpa Latha, OUP
2. Study Writing by Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian 2007
4. *Practical English Usage* by Michael Swan Oxford University Press
5. *English Collocations in Use* by Michael McCarthy & Felicity O'Dell
6. *Effective Technical Communication* by Arsahf Rizvi,
7. *Essential English Grammar by Raymond Murphy, CUP, 2017*

Unit	Title	Text books/Reference Books
I	Principles of Scientific Vocabulary	Text Book 1/Reference Book 5
II	Writing Skills	Text Book 1Reference Book 2 Reference Book 6
III	Common Errors in Writing	Text Book 1,Reference Book 3 Reference Book 4,Reference Book 7
IV	Nature and Style of Sensible Technical Writing	Text Book 1,Reference Book 1 Reference Book 2
V	Report writing and Letter writing	Text Book 1,Reference Book 1 Reference Book 2

ENGINEERING MATHEMATICS-II

(Linear algebra, Laplace transforms & Numerical Methods)

Common to all the branches

Subject Code	21CMMAT2010/2010	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course objectives:

To enable students to apply the knowledge of Mathematics in various engineering

fields by making them to learn the following'

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications and solve system of linear equations
2. To find the inverse and power of a matrix by Cayley-Hamilton theorem and reduce the Quadratic form
3. To solve initial value problems by using Laplace transforms
4. To find the solution of algebraic/ transcendental equations and also interpolate the functions.
5. To apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations.

Unit -1	**Hours**
Solving systems of linear equations: Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non homogeneous linear equations – Gauss Elimination method- Jacobi and Gauss-Seidel methods for solving system of equations numerically.	**10**
Unit -2	
Eigen values and Eigen vectors, Cayley–Hamilton theorem and Quadratic forms: Eigen values and Eigen vectors and properties- Cayley-Hamilton theorem (without proof) – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation, Diagonalisation and Lagrange's reduction	**10**
Unit – 3	
Laplace Transforms: Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta function Periodic function – Inverse Laplace transforms– Convolution theorem (without proof).	**10**

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.	
Unit – 4	
Numerical Methods: Introduction - Method of false position - Newton-Raphson method (One Variable) Introduction– Errors in polynomial interpolation – Finite differences– Forward differences– Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula.	**10**
Unit – 5	
Numerical integration, Solution of ordinary differential equations with initial conditions: Trapezoidal rule - Simpson's 1/3rd and 3/8th rule - Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge -Kutta method (second and fourth order).	**10**

Course outcomes:

On completion of this course, students are able to,

1. Develop the use of matrix algebra techniques that is needed by engineers for practical applications and solve system of linear equations (L6)
2. Find the inverse and power of a matrix by Cayley-Hamilton theorem and reduce the Quadratic form (L3)
3. Solve initial value problems by using Laplace transforms (L3)
4. Find the solution of algebraic/ transcendental equations and also interpolate the functions(L3)
5. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3).

Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.
3. B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006

Reference Books:

1. Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, "Engineering Mathematics, Volume II" Scitech Publications, 2017.
2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata McGraw Hill Education, 4th Edition, 2018
3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications, 3rd Edition, 2020.
4. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press, 1st Edition 2014.

BASIC ELECTRICAL ENGINEERING

SEMESTER I/ II

(Common to All)

Subject Code	21CMEET1030/2030	IA Marks	30
Number of Lecture Hours/Week	3L + 1T	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits-03

Course Objectives:

This course will enable student to

1. Understand basic electrical circuit operation.
2. Understand the concept of Alternating Voltage and Current.
3. Understand the operation of DC machines.
4. Understand the working of measuring instruments.
5. Understand the operation of different types of ac machines.
6. Understand the concept of Electrical Safety.

Unit -1	**Hours**
Basic Electrical Circuits: Basic definitions(Electric Charge, Current, Electro Magnet Force, Potential Difference; Electric Power and Energy) – types of network elements – Ohm's Law – Kirchhoff's Laws –series & parallel circuits - network theorems (Super position, Thevinen's, Norton's, Maximum power transfer theorems)	**10**
Unit -2	
AC Fundamentals & Basic Electromagnetic Laws: Study of AC Voltage and Current, RMS and Average Values, Three phase Star-Delta connections, Alternating Voltage applied to Pure Resistance, Inductance, Capacitance and their combinations, Concept of Power and Power Factor in AC Circuit. Concept of Magnetic Field, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws,	**10**
Unit – 3	
DC Machines: DC Machine -Principle of operation & construction – emf equation- torque equation - speed control methods – losses and efficiency – brake test. Applications of DC motors.	**10**
Unit – 4	
AC Machines: Single Phase Transformers - Construction and Operation-Principles - Classification - Applications-OC & SC test of single phase transformer-regulation & Efficiency. Three Phase Induction Motors: working principle- construction, speed- torque characteristics-losses and efficiency.	**10**
Unit – 5	
Electrical Safety: Electrical Shock and Precautions against it, Treatment of Electric Shock; Concept of Fuses and Their Classification, Selection and Application; Concept of Earthing.	**10**

Course Outcomes: The student should be able to

1. Understand basic electrical circuit operation.
2. Understand the concept of Alternating Voltage and Current.
3. Understand the operation of DC machines.
4. Understand the working of measuring instruments.
5. Understand the operation of different types of ac machines.
6. Understand the concept of Electrical Safety.

Text Books:

Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group.
Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand and Company Limited.

Reference Books:

i. Theory and Performance of Electrical Machines by J.B. Gupta, S.K.Kataria & Sons.
ii. A Textbook of Electrical Technology – Volume II: AC & DC Machines by B.L.Theraja & A.K. Theraja, S.Chand and Company Limited.
iii. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.
iv. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
v. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
vi. Electrical Technology by Surinder Pal Bali, Pearson Publications.

PYTHON PROGRAMMING

Common to All

SEMESTER II

Subject Code	21CMCST2040	Internal Marks	30
Number of Lecture Hours/Week	1	External Marks	70
Total Number of Lecture Hours		Exam Hours	03
Pre-requisite		Credits – 03	

The Objectives of Python Programming are:

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with general computer programming concepts like data types, conditional statements, loops and functions.
- To be familiarized with general coding techniques and object-oriented programming and Graphical User Interfaces.

Unit -1	**Hours**
Introduction:(TB1:22-30,TB2:1.1-1.4,TB2:1.21-1.33) Introduction Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Variables, Reading Input from the Keyboard, Operators. **Data Types, and Expression: (TB1:41-59)** Strings Assignment, and Comment, Numeric Data Types and Character Sets, Type conversions, Expressions, Using functions and Modules. **Decision Structures and Boolean Logic:(TB1:77-85)** if, if-else, if-else if-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.	08
Unit -2	
Control Statement:(TB1:65-72,TB1:86-91) Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration, The While Loop, Nested Loops. **Strings and Text Files:(TB1:103-125)** Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods, Text Files.	10
Unit -3	
ListandDictionaries:(TB1:135-145,TB1:153-158) Lists,Tuples,Sets,Dictionaries. **Design with Function:(TB1:146-149, TB1:169-190)**Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System. **Modules**:**(TB2:8.1-8.5)**Modules, Standard Modules, Packages.	12
Unit – 4	
File Operations:(TB1:122-123) Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and write lines(). **Object Oriented Programming:(TB2:5.1-5.20, TB2:6.1-6.17)**Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance. **Design with Classes:(TB1:294-301, TB1:309-330)** Objects and Classes, Data modeling Examples, Case Study an ATM.	12
Unit – 5	

Errors and Exceptions:(TB2:7.1-7.8) Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions**.** **Graphical User Interfaces:(TB1:245-288)** The Behavior of Terminal Based Programs and GUI –Based Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.	8

Course outcomes:

On completion of the course student will be able to

1. Able to learn the fundamental concepts in the Python language
2. Implementation of python iterative statements and strings
3. Demonstrate python lists, dictionaries and functions
4. Understand the concepts of modules and packages in python
5. Complete coding challenges relating to object-oriented programming's essential concepts and techniques.
6. Apply variety of error handling and GUI programming techniques

Text Books

1. Fundamentals of Python First Programs, Kenneth.A.Lambert,Cengage.
2. Python Programming: A Modern Approach,Vamsi Kurama,Pearson.

ReferenceBooks:

1)Introduction to Python Programming ,Gowrishankar.S,VeenaA,CRCPress.

2)Introduction to Programming Using Python,Y.DanielLiang,Pearson.

E-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf

ENGINEERING MECHANICS			
Subject Code	21CMMET2050	IA Marks	
Number of Lecture Hours/Week	3(L)	Exam Marks	
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 03

Course objectives

This course will enable the students to

1. understand the effect of forces and moments on the solid rigid bodies
2. analyze static problems using free body diagrams by considering friction.
3. locate centroid and calculate moment of inertia for different cross sections.
4. calculate velocity and acceleration of particles having rectilinear motion and rotation
5. analyze dynamic problems using work energy method and impulse- momentum method.

Unit -1	**Teaching Hours**
Introduction to engineering mechanics: Basic terminologies in mechanics, laws of mechanics, characteristics of force, system of force. **Resultant system of forces**: Resolution of forces, method of composition of forces, resultant of coplanar concurrent force system, moment of a force and couple. **Friction:** Frictional force, laws of Coulomb friction, angle of friction, limiting friction and angle of repose, problems on blocks resting on horizontal and inclined planes.	10 Hours
Unit -2	
Equilibrium of system of forces: Equilibrium of a rigid body subjected to coplanar concurrent forces and coplanar non-concurrent forces, free body diagrams, Lami's theorem, equilibrium of connected bodies.	9 Hours
Unit – 3	
Centroid and centre of gravity: Centre of gravity, centroid, use of axis symmetry determination of centroid of simple figures from first principles, centroid of composite sections. **Moment of inertia**: Moment of inertia, polar moment of inertia, theorems of moment of inertia, moment of inertia of rectangle, triangle, circle, semi circle, quarter circle from first principles, moment of inertia of L, T and I sections only. Mass moment of inertia, radius of gyration, mass moment of inertia of uniform rod, rectangular plate and circular plate only.	12 Hours
Unit-4 **Kinematics:** General principles in dynamics, types of motion, rectilinear motion, motion curves, motion with uniform velocity, motion with uniform acceleration, motion with varying acceleration, angular motion, relationship between linear and angular motions. **Kinetics:** Bodies in rectilinear translation, kinetics of bodies rotating about fixed axes, Newton's second law of motion, D-Alembert's principle.	10 Hours
Unit - 5 Work-Energy Method: Equation of Translation, work energy application to particle motion, connected system - Fixed axis rotation and plane motion, Impulse momentum method.	9 Hours

Course outcomes

On completion of this course, students will be able to

1. determine resultant force and moment for different force systems.
2. analyse the rigid bodies associated with frictional forces using conditions of equilibrium
3. locate the centroid / center of gravity and determine the moment of inertia of plane sections/solids.
4. understand the behaviour of moving bodies in rectilinear motion and solve kinematic equations of motion curves.
5. solve the problem using work energy method and impulse momentum method.

Text Books

1. S.S. Bhavikatti and K.G. Rajashekarappa, Engineering Mechanics, New Age, 2012.
2. N.H. Dubey, Engineering Mechanics, Mc Graw Hill, 2012

Reference Books

1 F. L. Singer, Engineering Mechanics, Harper–Collins, 1994
2. B. Bhattacharya, Engineering Mechanics, Oxford University Press, 2008
3. A.K.Tayal, Engineering Mechanics, Umesh Publications, 2012.
4. R.K.Bansal, Engineering Mechanics, Laxmi Publications, 1996.
5. R.K.Rajput, A Text book of Applied Mechanics, Laxmi Publications, 2011.
6. S.Timoshenko and D.H.Young, Engineering Mechanics, 4th Ed. , Mc Graw Hill
7. A.Nelson, Engineering Mechanics - Statics and Dynamics, TMG, New Delhi, 2009.

WEB REFERENCES

W1. https://nptel.ac.in/courses

W2. http://learnmech.com/

ENGLISH LANGUAGE COMMUNICATION SKILLS LAB			
Subject Code	21CMEGL1050/2050	IA Marks	15
Number of Practical Hr./week	02	Exam Marks	35
Total Number of Practical Hr	32	Exam Hours	03
Credits – 01			

Objectives: To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentation Skills

List of Experiments

UNIT I: Listening Comprehension

UNIT II: Pronunciation , Stress, Intonation & Rhythm

UNIT III: Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

UNIT IV: Interpersonal Communication Skills- Group discussions and debates

UNIT V: Formal Presentations

Outcomes:

By the end of the course the students will be able to acquire basic Proficiency in English by practicing the following:

1. Listening Comprehension
2. Pronunciation
3. Dialogues
4. Interpersonal Communication Skills
5. Presentation Skills
6. Discussions and Debates

Learning Resources:

1. Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan
2. Ted Talks, Interviews with Achievers and select movies
3. Toastmaster's speeches and table topics
4. Book Reviews and movie reviews
5. Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad.
6. Oxford Guide to Effective Writing and Speaking by John Seely
7. https://www.ted.com/talk

BASIC ELECTRICAL ENGINEERING LABORATORY (Common to All)			
Subject Code	21CMEEL1070/21CMEEL2070	IA Marks	15
Number of Lecture Hours/Week	3P	Exam Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits-1.5			

Course Objectives:

This course will enable the student to

1. Verify the Kirchhoff's laws, network theorems for a given circuit.
2. Analyze the performance of DC shunt generator.
3. Control the speed of DC motor.
4. Predetermine the efficiency DC machine.
5. Analyze performance of three phase induction motor.
6. Determine the regulation of an alternators.

List of Experiments(Any ten experiments must be conducted)

1. Verification of Kirchoff's laws.
2. Verification of Thevenin's Theorem.
3. Verification of Norton's Theorem.
4. Verification of Superposition theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Speed control of D.C. shunt motor.
7. Brake test on DC shunt motor.
8. Calibration of wattmeter.
9. OC & SC tests on single-phase transformer.
10. Brake test on 1-phase Induction motor.
11. Brake test on 3-phase Induction motor.
12. Study experiment on Ear thing.

COURSE OUTCOMES:

On completion of the course student will be able to:

1. Verify the Kirchoff's laws.
2. Verify network theorems for a given circuit.
3. Control the speed of DC motor.
4. Analyze performance of single phase induction motor
5. Analyze performance of three phase induction motor.
6. Identify different types of earthling's

ENGINEERING WORKSHOP LAB			
Subject Code	21CEMEL2080/21ECMEL2080 21ETMEL2080/21EEMEL2080/ 21MEMEL2080	IA Marks	15
Number of Lecture Hours/Week	L(0)+T(0)+P(3)	Exam Marks	35
Total Number of Lecture Hours	36	Exam Hours	3
Credits – 1.5			

Course objectives: On completion of the course students should be able to

1. Learn basic use of hand tools along with the techniques and methods applicable to the carpentry trade
2. Learn basic use of hand tools along with the techniques and methods applicable to the fitting trade
3. Learn basic use of hand tools along with the techniques and methods applicable to the forging trade
4. Learn basic use of hand tools along with the techniques and methods applicable to the casting trade
5. Learn basic use of hand tools along with the techniques and methods applicable to the welding trade

EXPERIMENTS

1. Preparation of T Lap joint using carpentry.
2. Preparation of Cross Lap joint using carpentry.
3. Preparation of Square fit using mild steel specimen.
4. Preparation of V fit using mild steel specimen.
5. Conversion of round rod to square rod by forging operation.
6. Preparation of *S* hooks by forging operation.
7. Preparation of green sand mold for a single piece pattern
8. Preparation of green sand mold for a split piece pattern
9. Preparation of a Butt joint using arc welding
10. Preparation of a Lap joint using arc Welding

ADDITIONAL EXPERIMENTS

1. Preparation of electrical wiring connections using wiring (one lamp controlled by one switch)
2. Preparation of house wiring (stair case wiring)

Course outcomes: On successful completion of this course, the students will be able to

1. Perform the joinery work of wooden pieces using carpentry.
2. Perform the joinery work of metallic pieces using fitting.
3. Produce the required shaped metallic products using black smithy.
4. Make the green sand molds using different patterns
5. Fabricate different components using welding.

ENVIRONMENTAL SCIENCE			
Subject Code	21CMCHN2090	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	32	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Acquire knowledge on global environmental challenges.
2. Learn different types of natural resources
3. Create awareness on biodiversity and ecology.
4. Gain scientific knowledge on environmental pollution
5. Acquire knowledge on water conservation methods and environmental legislation

Unit -1	**Hours**
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **Environment -** Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Role of Information Technology in Environment and human health.	**6**
Unit -2	
NATURAL RESOURCES Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use, deforestation - Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Floods, drought, dams – benefits and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: Effects of modern agriculture - fertilizer-pesticide problems, water logging, eutrophication, biological magnification and salinity. Energy resources: Renewable and non-renewable energy resources Role of an individual in conservation of natural resources.	**6**
Unit – 3	

ECOSYSTEM AND BIODIVERSITY **Ecosystem** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the Forest and grassland ecosystem. **Biodiversity** - Introduction - Definition: genetic, species and ecosystem diversity. – Value of biodiversity: consumptive use, productive use, social, ethical and optional values - Hot-spots of biodiversity - Threats to biodiversity: habitat loss - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**8**
Unit – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Noise pollution e. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.	**6**
Unit – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act .	**6**
COURSE OUTCOMES: On completion of the course student will be able to 1. Obtain knowledge on global warming & climate change - Acid rains, ozone layer depletion. 2. Preserve several natural resources 3. Summarize the concept of ecosystem	

4. Control different types of pollution
5. Understand social issues and environmental legislation

TEXT BOOKS:

1. E. Bharucha (2003), "Environmental Studies", University Publishing Company, New Delhi.
2. J.G. Henry and G.W. Heinke (2004), "Environmental Science and Engineering", Second Edition, Prentice Hall of India, New Delhi.
3. G.M. Masters (2004)" Introduction to Environmental Engineering and Science", Second Edition, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeksha Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.
3. Environmental Studies, P.N. Palaniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

B.Tech. (Civil Engineering)
Semester III (Second year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT3010	Engineering Mathematics - III	3	0	0	3
2	21CECET3020	Mechanics of Solids	3	0	0	3
3	21CECET3030	Fluid Mechanics	3	0	0	3
4	21CECET3040	Building Materials, Construction & Concrete Technology	3	0	0	3
5	21CECET3050	Surveying and Geomatics	3	0	0	3
6	21CECEL3060	Concrete Technology Lab	0	0	3	1.5
7	21CECEL3070	Surveying Field Work	0	0	3	1.5
8	21CECEL3080	Strength of Materials Lab	0	0	3	1.5
9	21CECES3090	Computer Aided Civil Engineering Drawing (SOC)	1	0	2	2
10	21CECEN3100	Essence of Indian Traditional Knowledge (Mandatory course)	2	0	0	0
					Total Credits	21.5

B.Tech. (Civil Engineering)
Semester IV (Second year)
Approved Course structure

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT4010	Engineering Mathematics – IV	3	0	0	3
2	21CECET4020	Structural Analysis	3	0	0	3
3	21CECET4030	Engineering Geology	3	0	0	3
4	21CECET4040	Hydraulic & Hydraulics Machinery	3	0	0	3
5	21CMMST4050	Engineering Economics & Financial Management	3	0	0	3
6	21CECEL4060	Engineering Geology Lab	0	0	3	1.5
7	21CECEL4070	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5
8	21CECEL4080	Building Planning & Drawing	**1**	**0**	**2**	**1.5**
9	21CECES4090	Advanced Surveying (SOC)	1	0	2	2
					Total Credits	21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4

Semester III (Second year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT3010	Engineering Mathematics - III	3	0	0	3
2	21CECET3020	Mechanics of Solids	3	0	0	3
3	21CECET3030	Fluid Mechanics	3	0	0	3
4	21CECET3040	Building Materials, Construction & Concrete Technology	3	0	0	3
5	21CECET3050	Surveying and Geomatics	3	0	0	3
6	21CECEL3060	Concrete Technology Lab	0	0	3	1.5
7	21CECEL3070	Surveying Field Work	0	0	3	1.5
8	21CECEL3080	Strength of Materials Lab	0	0	3	1.5
9	21CECES3090	Computer Aided Civil Engineering Drawing (SOC)	1	0	2	2
10	21CECEN3100	Essence of Indian Traditional Knowledge (Mandatory course)	2	0	0	0
					Total Credits	21.5

MATHEMATICS-III
(Vector Calculus and Complex analysis)
Common to CE, EEE, ME, ECE and ECT
SEMESTER - III

Subject Code	21CEMAT3010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03

Credits – 03

Course Objectives:

1. To Interpret the physical meaning of different operators such as gradient, curl and divergence.
2. To Estimate the work done against a field, verify integral theorems.
3. To apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic
4. To find the differentiation and integration of complex functions used in engineering problems.
5. To make use of the Cauchy residue theorem to evaluate certain integrals.

Unit -1	
Vector Differentiation: Gradient– Directional derivative – Divergence – Curl - Scalar Potential.	**Hours – 08**
Unit -2	
Vector Integration: Line integral - Work done – Area - Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.	**Hours – 10**
Unit – 3	
Function of a complex variable Introduction –continuity –differentiability- analyticity – properties – Cauchy – Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.	**Hours – 10**
Unit – 4	
Integration and series expansions Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs) Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series.	**Hours – 10**
Unit – 5	
Singularities and Residue Theorem Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,** Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semi-circle.	**Hours – 10**

Course outcomes:

On completion of this course, students are able to

1. Interpret the physical meaning of different operators such as gradient, curl and divergence(L5)

2. Estimate the work done against a field, and verify integral theorems (L5)
3. apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
4. find the differentiation and integration of complex functions used in engineering problems(L3)
5. make use of the Cauchy residue theorem to evaluate certain integrals (L3)

Question paper pattern:

Question paper consists of 10 questions.

1. Each full question carrying 14 marks.
2. Each full question will have sub question covering all topics under a unit.
3. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9th edition,
4. N.P.Bali and Manish Goyal, "A text book of Engineering mathematics", Laxmi publications, 7th Edition.
5. H.K. Dass and Er. RajnishVerma, "Higher Engineerig Mathematics", S.Chand publishing, 1st edition, 2011.

MECHANICS OF SOLIDS SEMESTER –III			
Subject Code	**21CECET3020**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Understand Strength of Material and Principles of Elasticity and Plasticity Stress strain behaviour of materials and their governing laws. Introduce student the moduli of Elasticity and their relations.
2. Understand Bending Moment and Shear force for beams with different boundary and loading conditions and to draw the diagrams of variation across the length.
3. Understand Stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections.
4. Measuring deflections in beams under various loading and support conditions
5. Classification of cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Unit -1	
Simple Stresses And Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. **Principal Stresses and Strains**: Introduction – Stresses on an inclined section of a bar under axial loading – Normal and tangential stresses on an inclined plane for biaxial stresses Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.	**10**
Unit -2	
Shear Force And Bending Moment: Definition of beam – Types of beams-Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam. **Torsion:** Theory of pure torsion-Derivation of Torsion equations: $T/J = q/r = N\varphi/L$ –Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus	**10**
Unit – 3	
Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis – Determination bending stresses– section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections. **Shear Stresses**: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, built up	**10**

beams, shear centre. **Columns:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio	
Unit – 4	
Deflection Of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. Uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams. **Analysis Of Pin-Jointed Plane Frames:** Determination of Forces in members of plane pin- jointed perfect trusses by (i) method of joints and (ii) method of sections.	**10**
Unit – 5	
Thin And Thick Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains– changes in diameter, and volume of thin cylinders – Thin spherical shells. **Thick Cylinders:** Introduction Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders	**10**
Course outcomes: Upon successful completion of the course student will be able to 1. Study the basic materials behaviour under the influence of different external loading conditions and the support conditions. 2. Draw the diagrams indicating the variation of the key performance features like bending moment and shear forces 3. Understand bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions 4. Assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using lame`s equation. 5. Analyse the stresses in thin and thick cylinders	
Text Books: 1. Strength of Materials by Strength of materials, R. K. Rajput, S. Chand & Co, NewDelhi 2021 2. Strength of Materials by S. Ramamrutham. 20th edition 2020	
Reference Books: 1. Strength of Materials by R.K Bansal, Lakshmi Publications 6th edition 2019 2. Strength of Materials by R. Subramanian, Oxford Publications 3rd edition 2016	
Online sources 1. Strength Of Materials - Course (nptel.ac.in)	

FLUID MECHANICS SEMESTER –III			
Subject Code	**21CECET3030**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Explain the properties of the fluid, pressure exerted by the fluid and fluid pressure measurement
2. Describe the different types of fluid flows.
3. Apply the laws of conservation of mass, energy, and momentum for fluid flow.
4. Analyze the phenomenon of flow in pipes.
5. Explain the concept of Laminar and Turbulent flows.
6. Describe the boundary layer theory concept.

Unit -1	**Hours**
Introduction to Fluid Mechanics-Basic Concepts and Definitions – Dimensions and units; Distinction between a fluid and a solid; Physical properties of fluids – density, specific gravity, viscosity, surface tension, bulk modulus of elasticity, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.	10
Unit -2	
Fluid Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure. **Fluid Kinematics:** Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non- uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two, three dimensional flows, Potential and stream functions	10
Unit – 3	
Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Momentum principle; Forces exerted by fluid flow on pipe bend	10
Unit – 4	
Laminar and Turbulent flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen- Poiseulle Formula, Flow through circular pipe, Flow between parallel plates; hydrodynamically smooth and rough flows. **Closed Conduit Flow:** Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line.	10
Unit – 5	

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs. **Boundary layer Theory:** Basic Concepts-Definitions; Energy thickness, momentum thickness and displacement thickness. Concept of lift and drag	10

Course outcomes:

Upon successful completion of the course student will be able to

1. Understand definitions of the basic terms used in fluid and measurement of fluid pressure
2. Calculate the forces that act on submerged planes and curves, identify various types of fluid flows and solve fluid kinematic problems
3. Apply the continuity, momentum and energy principles to solve simple problems
4. Apply appropriate equations and principles to analyze a variety of pipe flow problems
5. Apply the concepts of measurement of flows and understand the basic concepts of Boundary layer.

Text Books:

1. Hydraulics and Fluid Mechanics Including Hydraulic Machines by P. N. Modi and M. Seth, ", Standard Book House, Raj sons Publications Private Limited, 21st edition 2017.
2. A text of Fluid mechanics and hydraulic machines, R. K. Bansal - Laxmi Publications (P) ltd., New Delhi, 2019.
3. Fluid mechanics and Hydraulic Machines by Ds Kumar, Sk.Kataria and sons publications New Delhi, 2009.

Reference Books:

1. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan, CENGAGE Learning, 2016.
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education, 2010.
3. Fluid Mechanics by Victor Streeter and E. Benjamin Wylie, K.W.Bedford McGraw Hill, 9th Edition, 2017.

Online Resources

1. https://nptel.ac.in/courses/105/103/105103192/
2. https://nptel.ac.in/courses/105/101/105101082/
3. https://nptel.ac.in/courses/112/105/112105269/
4. https://nptel.ac.in/courses/112/105/112105171/

BUILDING MATERIALS, CONSTRUCTION AND CONCRETE TECHNOLOGY SEMESTER –III			
Subject Code	**21CECET3040**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits –03			

Course Objectives:

This course will enable Students to:

1. Understand the different building materials like stones, bricks etc.,
2. Understand about the products of works, steel alloy.
3. Learn about building components
4. Understand about preparation of concrete
5. Learn about concrete mix design

Unit -1	Hours
Building Stones: Building stones, classification of building stones, quarrying procedures, structural Requirement, dressing, and tools for dressing of stones. **Bricks:** Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, structural requirements, classification and testing of bricks, field and lab test, special types of bricks and their uses, AAC blocks, other types of building blocks. **Tiles:** Types of tiles and their use in buildings. Manufacturing of tiles, structural requirement of tiles, Terracotta, stoneware.	10
Unit -2	
Timber and Wood based products: Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses. **Steel:** Types of steel-mild steel, high carbon steel, high strength steel- properties and uses, commercial forms of steel and their uses. **Alloys:** Types, properties and uses - aluminium alloys, copper alloys. Auxiliary Materials: Glass Types of glasses, manufacturing of glass. Properties and their uses, Paints-Constituents of paints, types of paints, properties and their uses, admixtures - classification, properties and their uses. Plastics, Paints, Plasticizers, AAC brick, Fibre Reinforced polymer, geopolymer, Ferro cement	10
Unit – 3	
Building Components: Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Prefabricated roofs. Masonry, Wall Elements and Formwork: Brick masonry: Types, bonds. **Stone Masonry:** Types, composite masonry, concrete reinforced bricks, and glass - reinforced brick. Finishing slope: plastering, pointing, and cladding- Types of ACP (Aluminium composite panel), High pressure laminations, composites - FRP, wall panelling elements -Types of roof sheeting -cold formed & light gauge steel. **Formwork:** requirements, standards, scaffolding, shoring, under pinning	10
Unit – 4	

Concrete Making Materials: Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures. **Hydration of Cement:** Bogue's compounds, Hydration, Gel formation, Types of cement, pore & capillary water. **Quality tests on cement:** Different test on cement as per Indian standards. **Aggregates:** Classification, Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis – Grading.	10
Unit – 5	
Fresh concrete: Properties of fresh concrete- Workability – different tests of workability, Factors influencing workability compaction, finishing, curing. **Hardened concrete**: Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT Techniques. **Durability:** Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack. **Concrete Mix design:** Different methods of mix design – factors affecting mix design –exercises.	10

Course Outcomes:

At the end of this course the student will be able to

1. Determine the characteristics and properties of a good building stone, good building bricks and tiles.
2. Know more about timber and wood-based products, steel and some new materials.
3. Know various building components
4. Identify Quality Control tests on concrete making materials.
5. Comprehend the behaviour of fresh and hardened concrete and Design concrete mixes as per IS and ACI code

TEXT BOOKS

1. Building Materials, S. S. Bhavikatti, Vices publications House private Ltd
2. Shetty M. S., Concrete Technology", S. Chand & Co., 2006
3. Building Materials, B. C. Punmia, Laxmi Publications private Ltd.
4. Neville A.M.,"Properties of Concrete", Trans-Atlantic Publications, Inc.; 2012

REFERENCE BOOKS

1. Building Materials, S. K. Duggal, New Age International Publications
2. R. Santhakumar „ Concrete Technology", Oxford Universities Press, 2006
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

SURVEYING AND GEOMATICS SEMESTER – III			
Subject Code	**21CECET3050**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Know the principle and method of surveying
2. Measure the horizontal and vertical distances and angles.
3. Recording of observations accurately.
4. Perform calculations based on observations.
5. Identification of source of errors and rectification methods.
6. Apply surveying principles to determine areas and volumes and setting out curves.
7. Use modern survey equipments for accurate results.

Unit -1	**Hours**
Introduction-Definition Principles of surveying Classifications **Traditional Measuring Instruments:** Importance, Elemental details, Measurement details Applications, Errors and Advantages and disadvantages of Chain, Tape, Compass & Plane Table Surveying	**10**
Unit -2	
Leveling : Concept of leveling and terminology, Adjustments of leveling Methods in leveling, Basics of Trigonometric Leveling **Contouring:** Introduction Characteristics and uses of contours Method of conducting contour surveying **Areas-Measurement of areas of** regular and irregular boundaries **Volumes-**Determination of volume of earth work in cutting and embankment for level section, volume of barrow pits	**10**
Unit – 3	
Theodolite Surveying: Definitions and terms -Measurements of horizontal and vertical angles Principles& construction of electronic theodolite **Traversing-** Methods of traversing, Traverse computations and adjustments. -Introduction to omitted measurements **Tachometric Surveying:** Stadia and tangential methods of tachometry -Distance and elevation formulas for staff held vertical position	**10**
Unit – 4	
Curves: Introduction to curves Design and setting out simple and compound curves Types vertical curves **Modern Surveying Methods:** Principles and types of E.D.M instruments- Total station-advantages and applications-Introduction to Global Positioning System.	**10**
Unit – 5	

Photogrammetric Surveying: Introduction, basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning. **Stereoscopy:** Ground control extension for photographic mapping-aerial triangulation, radial triangulation, methods-photographic mapping, mapping using sterio-plotting instruments-, map substitutes.	**10**

Course Outcomes: Upon successful completion of the course student will be able to

1. Apply the knowledge to calculate the angles and distances.
2. Interpret the survey data and compute areas and volumes and levels by different types of equipment's.
3. Identify data collection methods and prepare field notes
4. Construct the curves and know the use of modern survey instruments.
5. Apply the knowledge of photogrammetry survey for mapping.

TEXT BOOKS

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
3. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.

REFERENCE BOOKS

1. Text book of Surveying, S .K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. Fundamentals of surveying, S.K. Roy – PHI learning ltd.
3. Surveying and Levelling (Oxford Higher Education) by R. Subramanian

Online Resources

1 https://nptel.ac.in/courses/105/107/105107122/
2. https://nptel.ac.in/courses/105/104/105104101/
3. http://sl-iitr.vlabs.ac.in/sl-iitr/

CONCRETE TECHNOLOGY LAB SEMESTER – III			
Subject Code	**21CECEL3060**	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

To study basic properties ingredients of concrete, fresh and hardened concrete properties

List of Experiments

1. Determination of normal Consistency and fineness of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Determination of grading and fineness modulus of Coarse aggregate by sieve analysis.
6. Determination of specific gravity of coarse aggregate
7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.
8. Determination of bulking of sand.
9. Determination of workability of concrete by compaction factor method.
10. Determination of workability of concrete by slump test
11. Determination of workability of concrete by Vee-bee test.
12. Determination of compressive strength of cement concrete and its young's modulus
13. Determination of split tensile strength of concrete.
14. Non-Destructive testing on concrete (for demonstration)
15. Determination of Modules of the rupture of concrete

Course Outcomes

After studying this course, students will be able to:

1. Determine consistency, fineness of cement, setting times of cement, specific gravity and soundness of cement.
2. Determine compressive strength of cement, workability of cement concrete by compaction factor, slump and Vee – Beetests
3. Determine specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
4. Determine flakiness and elongation index of aggregates and bulking of sand
5. Understand non-destructive testing procedures on concrete

List of Equipments:	
1. Standard set of sieves for coarse aggregate and fineaggregate	6. Compaction Factor Test Apparatus.
2. Vicat's apparatus	7. Vee- Bee test apparatus
3. Specific gravity bottle.	8. Longitudinal compresso-meter
	9. Universal testing Machine (UTM)/Compression Testing Machine

4. Lechatlier's apparatus. 5. Slump Test Apparatus.	(CTM). 10. Rebound hammer, Ultrasonic pulse velocity machine, micro cover meter etc.
Reference: 1) Concrete Manual by M.L.Gambhir	

SURVEYING FIELD WORK SEMESTER – III			
Subject Code	**21CECEL3070**	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to:

1. Describe the applications of basic instruments in civil engineering construction
2. Operation of various types of various types of compass
3. Efficient application of compass and plane table for areas computation
4. Operate an automatic level to perform differential and profile levelling; properly record notes; mathematically reduce and check levelling measurements
5. Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.

List of Field Works:

1. Survey by chain survey of road profile with offsets in case of road widening.
2. Survey in an area by chain survey (Closed circuit)
3. Determination of distance between two inaccessible points by using compass.
4. Finding the area of the given boundary using compass (Closed Traverse)
5. Plane table survey; finding the area of a given boundary by the method of Radiation
6. Plane table survey; finding the area of a given boundary by the method of intersection.
7. Two Point Problem by the plane table survey.
8. Fly levelling: Height of the instrument method (differential levelling)
9. Fly levelling: rise and fall method.
10. Fly levelling: closed circuit/ open circuit.
11. Fly levelling; Longitudinal Section and Cross sections of a given road profile.
12. Fly levelling and Fly chaining (complete field work).

Note: Any 10 field work assignments must be completed.

Course outcomes:

Upon successful completion of the course student will be able to

1. Calculate angles, distances
2. Measurement of angles and distances by modern instruments
3. Finding of reduced Level Identify data collection methods and prepare field notes
4. Determinate the elevations of the various surface details
5. Operation& application of advance equipment

Text Books:

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
3. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.

Reference Books:

1. Text book of Surveying, S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co.

Ltd. New Delhi.
2. Fundamentals of surveying, S.K. Roy – PHI learning ltd.
3. Surveying and Levelling (Oxford Higher Education) by R. Subramanian

STRENGTH OF MATERIALS LAB SEMESTER – III			
Subject Code	**21CECEL3080**	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course Objective:

Students learn about the procedures to determine the properties of solid materials such as mild steel, tor steel and wood etc.

1. To study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M.
2. To find the Compressive strength of wood and concrete.
3. To find the Brinnel's and Rockwell's hardness numbers of (a) Steel (b) Brass (c) Aluminum (d) Copper by conducting hardness test.
4. To determine the Modulus of rigidity by conducting Torsion test on a Solid shaft.
5. To find the Modulus of rigidity of the material of a spring by conducting Compression test.
6. To find the Energy absorbed by material by conducting Izod and Charpy impact test.
7. Shear & Punching Shear test on Mild Steel rods, Thin Plates.
8. Verification of Maxwell's Reciprocal theorem on beams.
9. To determine the Young's modulus of the material by conducting deflection test on a simply supported beam.
10. To determine the Modulus of elasticity of the material by conducting deflection test on a Cantilever beam.
11. To determine the Modulus of elasticity of the material by conducting deflection test on a continuous beam.
12. Use of Electrical resistance strain gauges.

Course outcomes:

After studying this course, students will be able to.

1. Find the basic parameters of Mild steel and Tor strength parameters.
2. Determine strength parameters of spring, wood and concrete.
3. Determine flexural and torsion values & elastic constants of Solid material.
4. Determine hardness of metals.
5. Determination of Modulus of elasticity of the material and Electrical resistance strain gauges.

Hardware/Software Requirements:

1. UTM for conducting tension test on rods.
2. Compression testing machine.
3. Brinnel's / Rock well's hardness testing machine.
4. Torsion testing machine.
5. Spring testing machine.
6. Izod Impact machine.
7. Shear testing machine.
8. Beam setup for Maxwell's theorem verification.
9. Simply supported wooden beam setup.
10. Cantilever steel beam setup.
11. Continuous beam setup.
12. Electrical Resistance gauges.

COMPUTER AIDED CIVIL ENGINEERING DRAWING (SOC) SEMESTER – III			
Subject code	**21CECES3090**	Internal Marks	
Number of Hours/Week	1+2	Exam Marks	50
Total Number of Lecture hours		Exam Hours	3

Credits -2

Course Objectives:

This course will enable students to:

1. Introduce to the Auto CAD software Package
2. Draw the drawings through Auto CAD Software

LIST OF EXPERIMENTS:

1. Introduction to computer aided drafting and different coordinate system
2. Drawing of Regular shapes using Editor mode
3. Introduction GUI and drawing of regular shapes using GUI
4. Exercise on Draw tools
5. Exercise on Modify tools
6. Exercise on other tools (Layers, dimensions, texting etc.)
7. Drawing of building components like walls, lintels, Doors, and Windows. using CAD software
8. Drawing a plan of Building and dimensioning
9. Drawing a plan of a residential building using layers

Course outcomes:

On completion of this course, the students will be able to

1. Students able to use Auto CAD software Effectively
2. Students able draw the drawings Auto CAD Software

Text Book

1. Computer Aided Design Laboratory by M. N. Sesha Praksh & Dr. G. S. Servesh – Laxmi publications.
2. 2. Engineering Graphics by P. J. Sha – S. Chand &Co.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE SEMESTER – III			
Subject Code	**21CECEN3100**	Internal Marks	30
Number of Lecture Hours/Week	02	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

Course Objectives:

The objectives of this course is enable the students to

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.

Unit -1	**Hours**
Introduction to Traditional Knowledge Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the 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	**10**
Unit -2	
Protection of Traditional Knowledge Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	**10**
Unit – 3	
Legal framework and TK: A: 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); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003	**10**
Unit – 4	
Traditional Knowledge and Intellectual Property: 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.	**10**
Unit – 5	
Traditional Knowledge in Different Sectors: 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. 139.	**10**

Course Outcomes:

At the end of this course the student will be able to

1. Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes on traditional knowledge system.
2. Describe the significance of traditional knowledge protection to communicate the traditional knowledge information
3. Recognize the role of government on traditional knowledge to measure its impact on global economy.
4. Explain the acts related to schedule tribes, traditional forest dwellers, plants protection and farmers to inculcate the legal protection information.
5. Illustrate the rules of biological diversity and geographical indicators for the protection of traditional knowledge bill.

TEXT BOOKS

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

REFERENCES

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

Semester IV (Second year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CEMAT4010	Engineering Mathematics – IV	3	0	0	3
2	21CECET4020	Structural Analysis	3	0	0	3
3	21CECET4030	Engineering Geology	3	0	0	3
4	21CECET4040	Hydraulic & Hydraulics Machinery	3	0	0	3
5	21CMMST4050	Engineering Economics & Financial Management	3	0	0	3
6	21CECEL4060	Engineering Geology Lab	0	0	3	1.5
7	21CECEL4070	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5
8	21CECEL4080	Building Planning & Drawing	**1**	**0**	**2**	**1.5**
9	21CECES4090	Advanced Surveying (SOC)	1	0	2	2
					Total Credits	21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4

ENGINEERING MATHEMATICS - IV
(Fourier series, Applications of PDE and Probability & Statistics)
(Common to CE, ME)
SEMESTER - IV

Subject Code	**21CEMAT4010**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

1. To Find the Fourier series of a periodic functions.
2. To Identify solution methods for partial differential equations that model physical processes
3. To know the Basic Concepts of Probability and corresponding Discrete and Continuous probability distributions
4. To obtain the estimate of a parameter from sample statistic
5. To test the hypothesis.

Unit -1	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series.	**Hours – 10**
Unit -2	
Applications of PDE: Method of Separation of variables, Solution of One-dimensional wave, Heat and two-dimensional Laplace equation.	**Hours – 10**
Unit – 3	
Discrete random Variables and Distributions: Introduction Random variables -Discrete random variables-Distribution Function-Mathematical Expectation. Discrete distributions: Binomial and Poisson distributions and their fitting to data. **Continuous random Variables and Distributions:** Introduction - Continuous random variables-Distribution function- Expectation. Continuous distributions: Uniform and Normal distributions, Normal approximation to Binomial distribution.	**Hours – 10**
Unit – 4	
Sampling theory Introduction-Population and samples-Sampling distribution of means and Variance (definition only)-Central limit theorem (without proof).	**Hours – 10**
Unit – 5	
Test of Hypothesis: Introduction-Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of Significance-One tail and two tail tests-Tests concerning one mean and two means (Large and Small samples), z test, t-distribution, Test of Goodness of fit - Tests on proportions: z-test and t-test.	**Hours – 10**

Course outcomes:

On completion of this course, students are able to

1. Find the Fourier series of a periodic functions (L3)

2. Identify solution methods for partial differential equations that model physical processes (L3).
3. Apply the Concepts of Probability and Find the statistical Parameters of Discrete and Continuous distributions (L3)
4. Estimate the properties of population from samples. (L5)
5. Design the Components of classical Hypothesis test, Conclude the statistical inferential methods based on small and large samples. (L6)

Text Books:

1. Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. B.V.Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006.

Reference Books:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics for Engineers and the Scientists,8th edition, Pearson 2007.
2. Jay L Devore, Probability and Statistics for Engineering and the Sciences, 8thEdition, Cengage.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and Scientists,4thEdition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied Staistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.
5. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press.

STRUCTURAL ANALYSIS SEMESTER – IV			
Subject Code	**21CECET4020**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 3			

Course Objectives:

This course will enable students to:

1. Understand the propped cantilever and fixed beams.
2. Get familiarise with continuous beams
3. Get familiarise with the moment distribution methods
4. Know the Horizontal thrust, bending moment, normal thrust and radial shear to arches
5. Know the Cables subjected to concentrated and uniformly distributed loads, familiarize cables and suspension bridges

Unit -1	**Hours**
Propped cantilevers: Concept of Static and Kinematic Indeterminacy, Cantilever beams on elastic and rigid props for point loads and Uniformly distributed Load. only. Calculation of reactions, B.M. and S.F. diagrams, and deflections. **Fixed Beams**: Determination of shear force, bending moment slope and deflection in fixed beams with and without sinking of supports for (i) point loads (ii) Uniformly distributed Load. (iii) uniformly varying load over entire span.	**10**
Unit -2	
Continuous Beams: Introduction-Clapeyron's theorem of three moments-Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams**.** **Slope deflection method**: Application of the method to continuous beams with and without sinking of supports, single bay - portal frames (Degree of freedom not exceeding two), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.	**10**
Unit – 3	
Moment distribution method: Application of the method to continuous beams with and without sinking of supports, portal frames (static indeterminacy not exceeding two), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.	**10**
Unit – 4	
Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear –effect of temperature. Hinges with supports at different levels. **Two Hinged Arches**: Determination of horizontal thrust, bending moment,	**10**

normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches.	
Unit – 5	
Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Analyse the behaviour of Propped cantilever and fixed beams
2. Analyse the continuous beams using slope deflection methods
3. Analyse the continuous beams using moment distribution methods
4. Calculate bending moment, normal thrust and radial shear to arches
5. Analyse cables which are subjected to concentrated and uniformly distributed loads,

Text Books:

1. Structural Analysis, T. S. Thandavamoorthy, Oxford university press, India.2019
2. Structural Analysis, R.C. Hibbeler, Pearson Education, India 2017
3. Theory of Structures – II, B. C. Punmia, Jain & Jain, Laxmi Publications, India.2019
4. Structural Analysis, C.S. Reddy, Tata Mc-Graw hill, New Delhi.2017

Reference Books:

1. Intermediate Structural Analysis, C. K. Wang, Tata McGraw Hill, India 2017
2. Theory of structures, Ramamuratam, Dhanpatrai Publications.2014
3. Analysis of structures, Vazrani & Ratwani – Khanna Publications.1999.
4. Comprehensive Structural Analysis-Vol. I & 2, R. Vaidyanathan & P. Perumal-Laxmi Publications Pvt. Ltd., New Delhi 2019

Online sources

1. Structural Analysis-I - Course (nptel.ac.in)

ENGINEERING GEOLOGY SEMESTER – IV			
Subject code	**21CECET4030**	Internal Marks	30
Number of Hours/Week	03	Exam Marks	70
Total Number of Lecture hours	50	Exam Hours	03
Credits -03			

Course Objectives:

The student should able to understand the concepts of

1. Weathering: Weathering of rocks, Geological agents, weathering process of Rock, River process and their development.
2. Different methods of study of mineral and rock
3. Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities
4. Water table, Cone of depression, Geological controls of Ground Water Movement,
5. Life of Reservoirs Purpose of Tunnelling, effects, Lining of Tunnels

Unit- I Introduction	
Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies **Weathering:** Weathering of rocks, Geological agents, weathering process of Rock, River process and their development.	10
Unit –II Mineralogy and Petrology	
Mineralogy And Petrology: Definitions of mineral, Structures of silicates and rock, Different methods of study of mineral and rock, The study of physical properties of minerals and rocks for megascopic study for the following minerals and rocks, Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite And Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate and their importance in Civil Engineering.	10
UNIT –III Structural Geology & Indian Stratigraphy	
Structural Geology: Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering. Indian stratigraphy. Aims of stratigraphy, Principles, Geological time scour, Geological division in India, Major stratigraphic units in India.	10
Unit –IV Ground Water & Earthquakes and Land Slides	
Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.	10

Earthquakes and Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides. Case studies.	
Unit –V Geophysics & Dams, Reservoirs and Tunnels	
Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Geology of Dams: Reservoirs and Tunnels: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Life of Reservoirs Purpose of Tunnelling, effects, Lining of Tunnels.	10

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Identify and classify the geological minerals
2. Measure the rock strengths of various rocks
3. Classify and measure the earthquake prone areas to practice the hazard zonation
4. Classify, monitor and measure the Landslides and subsidence
5. 5. Prepares, analyses and interpret the Engineering Geologic maps

TEXT BOOKS:

1. 'Engineering Geology' by Subinoy Gangopadhay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. Chenn kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
4. 4. 'Engineering Geology' by Vasudev Kanithi, University Press.

REFERENCES:

1. 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd.
2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3 rd edition
3. 'Fundamentals of Engineering Geology' by P.G.Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S.Valdiya, McGraw Hill Publications, 2nd ed.

Online Resources:

1. https://nptel.ac.in/courses/105/105/105105106/

HYDRAULICS AND HYDRAULIC MACHINERY SEMESTER – IV			
Subject Code	**21CECET4040**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			
Course Objectives: This course will enable Students to 1. Study about uniform flow in open channels and also to learn about it 2. Study about non uniform flow in open channels and also to learn about it 3. Learn dimensional analysis for fluid flow problems 4. Understand the working principles of various types of hydraulic machines 5. Understand the working principles of various types of Pumps.			
Unit -1			Hours
Flow in Open channels: Velocity distribution of a flow in a channel section, Classification of open channel flows. **Uniform Flow:** Velocity of uniform flow-Chazy's equation-Manning's equation. Most Economical sections of channel flow for different shapes. Computation of uniform flow-Specific energy and critical depth-Momentum in open channel flow and specific force, Critical flow and its computation, Application of specific energy and discharge diagrams to channel transitions.			10
Unit -2			
Non-Uniform Flow in Open channels: Dynamic equation for gradually varied flow. Classification of channel slopes, Classification and characteristics of surface profiles. Length of flow profile-direct step method. Hydraulic jump-Hydraulic jump in rectangular channels- Types of hydraulic jump.			10
Unit – 3			
Dimensional Analysis, Similitude, and Model investigation: Methods of dimensional analysis-Rayleigh and Buckingham pi methods. Types of similarities, Force ratios-dimensionless numbers, Similarity laws. Types of models, Scale effects in models. Basics of hydraulic machinery: Impact of free jet-force exerted by a fluid jet on stationary and moving bodies (flat plates and curved vanes, Torque exerted on a wheel with radial curved vanes.			10
Unit – 4			
Turbines: Head and efficiencies of hydraulic turbines, Classification of turbines. Work done and efficiencies of Pelton wheel, Design of Pelton turbine runner. Design of Pelton turbine runner. Work done and efficiencies of Francis turbine--Design of Francis turbine runner-draft tube-work done and efficiency of Kaplan Turbine-Design of Kaplan turbine runner, Performance of turbines.			10
Unit – 5			
Pumps: Working of a centrifugal pump-work done by the impeller-Head of pump, losses in pump, and efficiencies of centrifugal pumps-Minimum starting speed-diameter of impeller and pipes-specific speed-Model testing of pumps-Performance of pumps-characteristic curves. Main components of a reciprocating pump-Work done by a reciprocating pump-Coefficient of discharge, slip, percentage slip, and negative slip of reciprocating pump-effect of acceleration of piston on velocity and pressure in the suction and delivery pipes-indicator diagrams-operating characteristic curves			10

Course outcomes:

Upon successful completion of the course student will be able to

1. Solve uniform open channel flow problems.
2. Solve non-uniform open channel flow problems.
3. Apply the principles of dimensional analysis and similitude in hydraulic model testing.
4. Understand the working principles of various hydraulic turbines.
5. Understand the working principles of various pumps.

Text Books:

1. Hydraulics and Fluid Mechanics Including Hydraulic Machines" by P. N. Modi and M. Seth, Standard Book House, Raj sons Publications Private Limited, 21st edition 2017.
2. A text of Fluid mechanics and hydraulic machines", R. K. Bansal - Laxmi Publications (P) ltd., New Delhi, 2019.
3. Fluid mechanics and Hydraulic Machines" by Ds Kumar, Sk.Kataria and sons publications New Delhi 2009.

Reference Books:

1. Fluid Mechanics and Machinery", C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, Oxford Higher Education, 2010.
2. Open Channel Hydraulics" by VenTechow, McGraw-Hill burn press illustrated reprint,2009.

Online Resources:

1. https://nptel.ac.in/courses/112103249
2. https://nptel.ac.in/courses/105107059

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT			
Subject Code	**21CMMST4050**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits-03			

Course objectives:

1. To understand the concept and nature of Managerial Economics and Concept of Demand and Demand forecasting.
2. To understand the concept of Production function, Input Output relationship, Cost Concepts and Concept of Cost-Volume-Profit Analysis.
3. To understand the Market structures, significance of various pricing methods and different forms of Business organization and the concepts of Business Cycles.
4. To understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation
5. To understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods.

Unit -I: Introduction to Managerial Economics and demand Analysis	
Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concepts of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement- Demand forecasting and its Methods.	**10 Hours**
Unit -II: Production and Cost Analysis	
Production function- Law of Variable proportions- Isoquants and Isocost-Cobb-Douglas Production function-Economics of Scale-Cost Concepts- Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems).	**10 Hours**
Unit-III: Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles	
Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price,Output Determination – Methods of Pricing: Strategies of Pricing & process for selecting final price-. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles –Phases of Business Cycle	**10 Hours**
Unit –IV: Introduction to Accounting & Financing Analysis	
Introduction to Double Entry Systems – Journal entry-Ledger-Trail Balance-Final Accounts-Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis.	**10 Hours**
Unit-V: Capital and Capital Budgeting	
Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	**10 Hours**

Course outcomes:

1. Students are equipped with the knowledge of managerial economics and estimating demand for a product.
2. Students understand Production and Cost concepts, estimating Cost Break even Analysis.

3. Students are equipped with the knowledge on Markets and Pricing methods along with Business Cycles.
4. Students are able to understand Accounting Concepts and Prepare Financial Statements-Analysis
5. Students are able to analyse various investment project proposals with the help of Capital Budgeting techniques.

Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.
2. B. Kuberadu Managerial Economics and Financial Analysis, 1/e, HPH, 2013
3. Dr. P. Vijaya Kumar & Dr. N. Apparao Management Science Cengage, Delhi, 2012.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Koontz and weihrich: Essentials of management, TMH 2011
4. Seth& Rastogi: Global management systems, cengage learning,delhi,2011
5. V. Maheswari: Managerial Economics, Sultan Chand.
6. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
7. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.
8. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
9. Maheswari : Financial Accounting, Vikas Publications.
10. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

ENGINEERING GEOLOGY LAB SEMESTER – IV			
Subject code	**21CECEL4060**	Internal Marks	15
Number of Hours/Week	03	Exam Marks	35
Total Number of Lecture hours	36	Exam Hours	03
Credits -1.5			

Course Objectives:

1. To identify the megascopic types of Ore minerals & Rock forming minerals.
2. To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks.
3. To identify the topography of the site & material selection.

LIST OF EXPERIMENTS

1. Physical properties of minerals: Mega-scopic identification of a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmaline, Calcite, Gypsum, etc…
2. Physical Properties of Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc…
3. Megascopic description and identification of Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
4. Megascopic description and identification of Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglomerate, etc.
5. Megascopic description and identification of Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc.
6. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
7. Simple Structural Geology problems.
8. Bore hole data.
9. Strength of the rock using laboratory tests.
10. Field work – To identify Minerals, Rocks, and Geomorphology & Structural Geology.

Course Outcomes:

1. Upon the successful completion of this course, the students will be able to:
2. Identify Megascopic minerals & their properties.
3. Identify Megascopic rocks & their properties.
4. Identify the site parameters such as contour, slope & aspect for topography.
5. Know the occurrence of materials using the strike & dip problems.

REFERENCES:

1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age International Publishers, 2nd Edition.
2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3rd edition, 2009.

FLUID MECHANICS AND HYDRAULICS MACHINERY LAB SEMESTER – IV			
Subject Code	**21CECEL4070**	Internal Marks	15
Number of Lecture Hours/Week	03	Exam Marks	35
Total Number of Lecture Hours	**36**	Exam Hours	03
Credits 1.5			

Course Objectives:

This course will enable students to:

1. **Develop** practical knowledge in verification of principles of fluid flow.
2. **Calculate** pressure, discharge, and velocity of fluid flow and Understand Major and Minor Losses.
3. **Develop** knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.
4. **Describe** the performance of turbines.
5. **Describe** the performance of pumps.

EXPERIMENTS:

1. Calibration of Venturi meter & Orifice meter.
2. Calibration of contracted Rectangular Notch / Triangular Notch.
3. Determination of Coefficient of discharge for a small orifice by constant head method.
4. Determination of Coefficient of discharge for a mouthpiece by constant head method.
5. Determination of friction factor of a pipe.
6. Verification of Bernoulli's equation.
7. Impact of jet on vanes.
8. Performance test on Pelton wheel turbine.
9. Performance test on Francis's turbine.
10. Performance characteristics of a single stage centrifugal pump
11. Performance characteristics of a multi-stage centrifugal pump.
12. Performance characteristics of a reciprocating pump.

Course outcomes: On completion of the course, the students will be able to:

1. **Demonstrate** fluid flow principles.
2. **Apply** the knowledge in calculating performance analysis in turbines and pumps that can be used in power plants and Analyse practical problems in all power plants.
3. **Measure** discharge in pipes and demonstrate the characteristics curves of turbines and pumps.
4. **Measure** discharge in pipes.
5. **Demonstrate** the characteristics curves of turbines.

BUILDING PLANNING AND DRAWING LAB

SEMESTER – IV

Subject Code	**21CECEL4080**	IA Marks	15
Number of Lecture Hours/Week	03	Exam Marks	35
Total Number of Lecture Hours	36	Exam Hours	03

Credits 1.5

Course objectives:

This course will enable students to:

1. Initiating the student to different building bye-laws and regulations.
2. Imparting the planning aspects of residential buildings and public buildings.
3. Giving training exercises on various signs and bonds and different building units.
4. Imparting the skills and methods of planning of various buildings.
5. Elevations and Cross Sections of given sloped and flat roof buildings

List of Experiments

1. Introduction to building drawing Definition, Need and importance of drawing in civil engineering, Drawing sheets, Graphical and numerical scale, lines, lettering and dimensioning.
2. Building components, Section of wall through door/window, Sketches of building components, Conventional signs, symbols and abbreviations
3. Aspects of planning within and with respect to surroundings, Modular planning concept.
4. Building Bye-Laws Objectives, importance of bye-laws, F.S.I., Principles underlying building bye laws, rules governing light, parking, fire, water supply etc.
5. Residential Building Drawing Introduction to plan, elevation and section of the building, Development of detailed plan from line diagram, Drawings for building services like (electric lines & points for concealed wiring, plumbing /sewage pipes, fire water, etc)
6. Submission and Detailed drawings Concept, key plan, site plan, structural drawing foundation plan, furniture arrangement, sanitary lines and traps, plumbing etc.
7. Planning of public buildings for different purposes like Education, Health, Recreation, Industry and Transportation, Spatial and land use planning,

Text Books:

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
3. Planning, designing and Scheduling, Gurucharan Singh and Jagadish Singh
4. Building planning and drawing by M. Chakravarthi.

REFERENCES:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. Building Materials, P. C. Verghese, PHI learning (P) ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New

ADVANCED SURVEYING SEMESTER – IV			
Subject Code	**21CECES4090**	Internal Marks	-
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 02			

Course Objectives:

This course will enable students to:

1. Familiarize with basic operations of Total Station
2. Understand the various concepts Land Surveying using Total Station
3. Familiarize with basic operations of Global Positioning System
4. Understand the various concepts finding the position of stations using GPS

LIST OF EXPERIMENTS: — **36 Hours**

Introduction to Total Station (TS)

1. Remote distance measurement – Radial
2. Remote distance measurement – Continuous
3. Measurement of Horizontal and Vertical Plane by Total Station
4. Determine of area using Total Station
5. Determination of Remote height using total station
6. Traversing using Total Station
7. Contouring using Total Station
8. Curve setting-different methods
9. Distance, gradient, difference in height between two inaccessible points using total station

Introduction to Global Positioning System (GPS)

10. Collection of Point Data using GPS
11. Collection of Line Data using GPS
12. Collection of Polygon Data using GPS

Course Outcomes:

On completion of the course, the students will be able to:

1. Measure Remote Distance and Height using Total Station and Measure the Horizontal and Vertical Planes with Total Station
2. Find the area of Plot by using Total Station
3. Determine Distance, gradient, difference in height between two inaccessible points using Total Station
4. Setout curves, contouring and traversing using Total Station
5. Find the position of stations using Global Positioning System

Hardware/Software Requirements:

Total Station

Global Position System

B.Tech. (Civil Engineering)
Semester V (Third year)

S. No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECET5010	Soil Mechanics	3	0	0	3
2	21CECET5020	Transportation Engineering	3	0	0	3
3	21CECET5030	Design and Drawing of Reinforced Concrete Structures	3	0	0	3
4	21CECEP504x	Professional Elective - I	3	0	0	3
5	21CExxO505x	Open Elective course - I	2	0	2	3
6	21CECEL5060	Soil Mechanics Lab	0	0	3	1.5
7	21CECEL5070	Transportation Engineering Lab	0	0	3	1.5
8	21CEAHS5080	Soft Skills & Aptitude Builder - 1	1	0	2	2
9	21CECEN5090	Disaster Management (Mandatory course)	2	0	0	0
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester			0	0	3	1.5
					Total Credits	21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE1	21CECEP504a	Advanced Concrete Technology	3	0	0	3
2		21CECEP504b	Open Channel flow	3	0	0	3
3		21CECEP504c	Advanced Structural Analysis	3	0	0	3
4		21CECEP504d	Remote Sensing and GIS	3	0	0	3

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxx	Smart Cities	3	0	0	3
4	21xxCEOxxx	Building Materials	3	0	0	3
5	21xxCEOxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxx	Watershed Management	3	0	0	3
7	21xxCEOxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxx	Green Buildings	3	0	0	3

SOIL MECHANICS SEMESTER – V			
Subject code	**21CECET5010**	Internal Marks	30
Number of Hours/Week	03	External Marks	70
Total Number of Lecture hours	50	Exam Hours	03
Credits -03			

Course Objectives:
This course will enable students to

1. Understand the significance of the basic principles of soil mechanics and their applications.
2. Understand basic definitions, simple tests, plasticity characteristics, flow of water through soils, permeability, seepage and effective stress principle.
3. Bring out the importance of concepts of stresses due to vertical loads, compression, consolidation and shear strength of soil and their applications.

UNIT-1	**Hours**
Introduction: Soil formation and soil types; clay mineralogy, clay structures, regional soil deposits of India **Basic Definitions and Relations:** Phase diagrams; Simple definitions; relationships **Index Properties:** Water content, specific gravity, Grain size distribution; Atterberg Limits, indices, field density, Relative density; sensitivity, thixotropy and activity of clays	**10**
UNIT-2	
Soil Classification: Introduction; Particle size classification as per IS-code; Unified soil classification system; Indian standard soil classification system, Applications of Soil Classification. **Principles of Effective Stress:** Introduction, Principle of effective stress; physical meaning of effective stress; capillarity in soil	**10**
UNIT-3	
Permeability of Soils: Darcy's law and its Validity; Determination of coefficient of permeability: constant and variable head methods, Factors affecting permeability; Permeability of stratified soil deposits**.** **Seepage through Soils:** Head, Gradient and Potential; Seepage pressure, Quick sand condition; Two-dimensional flow- Laplace's equation; flow nets-properties and uses; seepage calculation; graphical method for obtaining flow nets; unconfined flow; seepage in anisotropic condition; protective filters.	**10**
UNIT-4	
Vertical Stresses Below Applied Loads: Introduction; Boussinesq's equation; vertical stress distribution diagrams; vertical stress beneath loaded areas- point load, line load, strip load, Circular, rectangular load; Newmark's influence chart; Approximate stress distribution methods for loaded areas; Westergaard's equation. **Compaction of Soils:** Introduction; Laboratory tests; Factors affecting compaction; Structure and engineering behavior of compacted cohesive soils; Compaction in the field; Compaction specifications and field control.	**10**

UNIT-5	
Compressibility of Soil and Consolidation: Introduction; Compressibility; Spring Analogy, Time-rate of consolidation, Mechanics of consolidation and Terzaghi's one dimensional consolidation; Consolidation test; Computation of settlement; Secondary consolidation settlement. **Shear Strength of Soils:** Introduction; Stress at a point- Mohr Circle of stress; Mohr-coulomb Failure Criterion; Modified failure envelope; Measurement of Shear Strength- Direct shear test, Triaxial test, Unconfined compression test and Vane shear tests; Shear strength of Clayey soils; Shear Strength of Sands; Drainage conditions and Strength parameters; liquefaction.	**10**

Course Outcomes:

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

1. Understand index properties of soils
2. Classify the soil, calculate the effective stress
3. Calculate the permeability coefficient and seepage flow through soils.
4. Able to determine the vertical stress increase due to applied loads and compaction characteristics of soil.
5. Assess engineering properties of soils like consolidation, shear strength and their importance

TEXT BOOKS:

1. Basic and Applied Soil Mechanics - Gopal Ranjan and A.S.R.Rao, New Age International Publishers, 4th Edition, 2022.
2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers, 2nd Edition, 2018

REFERENCES:

1. Soil Mechanics and Foundation Engineering by B.N.D. Narasinga Rao, Wiley Publishers, 3rd Edition, 2019
2. VNS Murthy, “Soil Mechanics and Foundation Engineering”, CBS publishers, 2018.
3. Soil mechanics & foundation engineering by Arora, Standard Publisher Dist, 2020.
4. A Textbook of Soil Mechanics and Foundations by B.C. Punmia, Laxmi Publications, 17th Edition , 2021
5. Geotechnical Engineering: A Practical Problem-Solving Approach, J. Ross Publishing, Edition 2010.
6. Foundation Analysis and Design’ by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, New York.

Codes:

1. IS 2720-1, 1983 “Methods of test for soils”

Online resources:

1. https://archive.nptel.ac.in/courses/105/101/105101201/
2. https://archive.nptel.ac.in/courses/105/105/105105168/

TRANSPORTATION ENGINEERING SEMESTER –V			
Subject Code	**21CECET5020**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Impart different concepts in the field of Highway Engineering
2. Acquire design principles of Highway geometries and Pavements
3. Understanding the basic principles of Traffic Engineering
4. Understand about various Highway construction materials
5. Learn various construction and maintenance procedures

Unit -1 Highway Planning & Alignment	**Hours**
Highway Network Planning: Different modes of transportation, role of highway transportation, classification, network patterns, planning surveys, preparation of plans, final report, master plan, 20-year road development plans, salient features. Highway Alignment: Principles of highway alignment, requirements, controlling factors, engineering surveys, Drawings and Reports	**10**
Unit -2 Highway Geometric Design	
Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment Gradients- Vertical curves.	**10**
Unit – 3 Traffic Engineering	
Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies, Speed studies – spot speed and speed & delay studies; Parking Studies; Road Accidents - Causes and Preventive measures-Condition Diagram and Collision Diagrams; PCU Factors, Capacity of High ways– Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals– Webster Method–IRC Method.	**10**
Unit – 4 Pavement Materials & Pavement Design	
Pavement Materials and Mix Design: Sub grade soil properties, CBR test, aggregates, desirable properties, tests, bituminous materials, bitumen and tar, tests. Bituminous mixes, requirements, design, Marshall Method. Design of Pavements: Types of pavement structures, functions of pavement components, design factors. Design of flexible pavements, methods, GI method, CBR method, IRC method, Burmister's method. Design of rigid pavements, design considerations, wheel load stresses, temperature stresses, frictional stresses, design of joints, IRC method of rigid pavement design.	**10**
Unit – 5 Highway Construction & Maintenance	

Highway Construction: Types of highway construction, construction of earth roads, gravel roads, WBM roads. Bituminous pavements, Cement concrete pavements. Highway Maintenance: Pavement failures, causes. Maintenance of highways, routine maintenance, periodic maintenance, special repairs. Strengthening of existing pavements, evaluation, overlay design. Highway drainage, surface and sub-surface drainage.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Plan Highway Networks
2. Design Highway geometries
3. Design intersection and traffic management plans
4. Design flexible and rigid pavements
5. Understand the principles of construction and maintenance of Highway Pavements

Text Books:

3. Khanna, S.K. and C.E.G. Justo Highway Engineering, Nem Chand and Bros, Roorkee, India, 2018.
4. Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India, 1997.
5. Kadiyali L.R. and Dr.N.B.Lal Principles and practice of Highway Engineering, Khanna Publishers, New Delhi, 2005.

Reference Books:

1. Highway Engineering by Srinivasa Kumar R, Universities Press, Hyderabad, 2020.
2. Principles of Transportation Engineering by Partha Chakroborthy and Animesh Das, PHI Learning Private Ltd, 2017.

Online Resources:

1. https://nptel.ac.in/courses/105101087
2. https://nptel.ac.in/courses/105105107

DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES SEMESTER –V			
Subject Code	**21CECET5030**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Familiarize with different types of design
2. Equip with concepts of design of flexural
3. Understand Concepts of shear, bond and torsion.
4. Familiarize with different types of compressions members and Design
5. Equip student with concepts of design of slabs and different types of footings and their design

Unit -1 Introduction	**Hours**
a) Working stress method: Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance for balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced beams. b) Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.	**10**
Unit -2 Design for Flexure	
Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T and L) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel Minimum Tension Reinforcement-Maximum Flexural Steel- Design of Flanged Sections (T&L)- Effective width of flange –Behaviour- Analysis and Design.	**10**
Unit – 3 Design for Shear, Torsion and Bond	
Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing. Limit state design for serviceability: Deflection, cracking and code provision, Design of formwork for beams and slabs.	**10**
Unit – 4 Slabs	
Classification of slabs, design of one - way slabs, one-way continuous slab using IS Coefficients (Conventional) –Design of two - way slabs-simply supported and various edge conditions using IS Coefficients, design of waist slab staircase	**10**
Unit – 5 Design of Compression members & Footings	

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions. **Footings:** Different types of footings – Design of isolated footings – pedestal, square, rectangular and circular footings subjected to axial loads, uni-axial and bi-axial bending moments.	**10**

NOTE: All the designs to be taught in Limit State Method Following reinforcement detailing should be prepared by the students.

1. Reinforcement detailing of T-beams, L-beams and continuous beams.
2. Reinforcement detailing of columns and isolated footings.
3. Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN: The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Course outcomes:

Upon successful completion of the course student will be able to

1. Work on different types of design philosophies
2. Carryout analysis and design of flexural members and detailing
3. Design structures subjected to shear, bond and torsion
4. Design reinforced concrete slabs
5. Design different type of compression members and different type of footings

Text Books:

1. Reinforced Concrete Structures, S. Unnikrishna Pillai & Devdas Menon, Tata Mc.Graw Hill, New Delhi, 2006.
2. Design of Reinforced concrete Structures, N. Subrahmanyian Oxfored publications, 2016.

Reference Books:

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. Lakshmi Publications, 2015.
2. Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, New Age Publications, 2018.

Code Books:

1. IS 456: 2000 – plain and reinforced concrete – code of practice (fourth revision)
2. SP 16: Design Aids for Reinforced Concrete to IS 456:1978

SOIL MECHANICS LAB SEMESTER - V			
Subject code	**21CECEL5060**	Internal Marks	15
Number of Hours/Week	03	Exam Marks	35
Total Number of Lecture hours	36	Exam Hours	03
Credits -1.5			

Course objectives:

The objectives of this course are:

1. To impart knowledge of determination of index properties required for classification of soils
2. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
3. To teach how to determine shear parameters of soil through different laboratory tests

1. Determination of Moisture content 2. Specific Gravity of soil particles. 3. Sieve Analysis. 4. Atterberg's Limits. 5. Proctor's Compaction Test. 6. Determination of Field Density. 7. Permeability of soil - Constant and Variable head tests 8. CBR Test 9. Unconfined Compression Test. 10. Vane Shear test 11. Direct Shear test 12. Triaxial Compression test (UU Test) 13. Differential free swell (DFS) 14. Consolidation test (to be demonstrated)	**Hours 36**

Equipment Requirements:

1. Casagrande's liquid limit apparatus.

2. Apparatus for plastic and shrinkage limits

3. Field density apparatus for a) Core cutter method b) Sand replacement method

4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.

6. Permeability apparatus for a) Constant head test b) Variable head test

7. Universal auto compactor for I.S light and heavy compaction tests.

8. Shaking table.

9. CBR Apparatus

10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity

11. One dimensional consolation test apparatus with all accessories.

12. Triaxial cell with provision for accommodating 38 mm dia specimens.

13. Box shear test apparatus

14. Laboratory vane shears apparatus.

15. Hot air ovens (range of temperature 500 - 1500C)

Course outcomes:

After studying this course, students will be able to:

1. Determine index properties of soil and classify them.

2. Determine permeability of soils.

3. Determine Compaction, Consolidation and shear strength characteristics

TEXT BOOKS:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2016.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers, 2018.
3. 'Principles of Foundation Engineering by Das, B.M., - (2011) –6th edition (Indian edition) Cengage learning
4. Soil mechanics & foundation engineering by Arora, STANDARD PUBLISHER DIST, 2020.

5. IS 1080, 1985 “Code of Practice for Design and Construction of Shallow Foundations In Soils”
6. IS 2720-1, 1983 “Methods of test for soils”

TRANSPORTATION ENGINEERING LAB SEMESTER – V			
Subject Code	**21CECEL5070**	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVE:

This course will enable students to:

1 Impart basic knowledge to carry out quality control lab tests for roads in highway engineering practice.
2 Conduct quality control in road construction as per standards and introduce the concepts of design mix
3 Conduct traffic studies and present the data for transportation engineering applications

LIST OF EXPERIMENTS:	
A) Tests on road aggregates 1. Aggregate crushing value test 2. Los Angeles abrasion test 3. Aggregate impact value test 4. Aggregate shape test (flakiness & elongation) 5. Water absorption & Specific gravity of aggregates 6. Job mix formula by Rothfuch Method. **B) Tests on bitumen** 7. Penetration Test 8. Ductility Test 9. Elastic Recovery Test 10. Softening point Test 11. Specific gravity Test 12. Viscosity Test 13. Flash and fire point Test **C) Traffic Studies** 14. Classified Traffic volume study at mid blocks 15. Spot Speed Study 16. Origin & Destination studies **D) Miscellaneous Tests (demonstration only)** 17.Bitumen extraction test 18.Design of Bitumen mixture by Marshall stability test	36 Hours

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Perform experiments on aggregates and bitumen on their suitability for road construction
2. Understand basic traffic studies for transportation planning and design.
3. Conduct tests on job mix formula and Marshall stability
4. Practice working as a team member and lead a team
5. Demonstrate professional behaviour in conducting the experiments

INDIAN STANDARD CODES:

1. Geometric Aspects: IRC:38, 69, 73, 86, SP-23
2. IRC:37: 2018: Guidelines for the design of flexible pavements
3. IRC 58 :2015: Guidelines for the design of plain jointed rigid pavements
4. Pavements: IRC: 15, 44
5. SP-42, SP-88, MORT&H Specifications.
6. IRC MORT&H- Specifications for road and bridge works, 2013 (Fifth Revision)
7. IRC:86-1983 (geometric design standards)
8. IRC 38 -1988 (Horizontal curves)
9. IRC: SP:23-1983 (vertical curves)
10. IRC 35 -2015 (Road markings)
11. IRC 67 -2012 (Road signs)
12. IRC 53 - 2012 (Accident forms)
13. IRC:82-2015 (Maintenance of BT roads)
14. IRC:93-1985 (traffic signals)
15. IRC:106-1990 (capacity)
16. IRC: SP:41-1994 (At-grade intersection)

SOFT SKILLS & APTITUDE BUILDER - 1			
Subject Code	**21CEAHS5080**	IA Marks	15
Number of Practice Hours/Week	4	Exam Marks	35
Total Number of Practice Hours	64	Exam Hours	3
Credits - 2			
Section A **Soft Skills**			
Unit – 1: Intrapersonal Communication			**Hours**
Introduction to Soft Skills and its Significance **Personal Effectiveness**: Who am I and What am I; My Strengths and Weaknesses; SWOT Analysis; SMART Goal Setting; Being Proactive **Principles of Personal Vision**: Beginning with the End in Mind; Time Management: Understanding Priorities; Put First-Things-First **Activity**: Psychometric Tests and SWOT Analysis, SMART Goal Setting			**11**
Unit 2: Interpersonal Communication			
Principles of Creative Cooperation and Organization Skills: Think Win-Win; Seek First to Understand then to be Understood; Synergize; Life-Long Learning **Emotional Intelligence**: Self-Awareness, Self-Regulation, Empathy, Assertiveness, Adoptability, Managing Emotions **Activity**: Resolving a Conflict with your Friend/Colleague/Family Member; Group Discussions & Debates			**11**
Unit – 3: 21st Century Skills			
What are 21st Century Skills? Learning Skills- Digital Literacy- Life Skills **Critical Thinking**: Active Listening, Observation, Introspection, Analytical Thinking, Open Mindedness **Problem Solving**: Understanding the Complexity of the Problem, Defining the Problem, Cause and Effect Analysis, Exploring Possible Solutions, Planning Actions, Analysing Results of your Actions, Getting Feedback, Redefining the Problem, The Problem Solving Cycle **Decision Making**: Managing Conflict, Conflict Resolution, Methods of Decision Making, Effective Decision Making in Teams – Methods & Styles **Activity**: Case Study			**10**
Section B **Aptitude Builder**			
Unit – 4: Ratios & Percentages			
Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios, Compound Ratio, Problems on Proportion, Mean Proportional and Continued Proportion. **Partnership:** Introduction, Relation between Capitals, Period of Investments and Shares **Number System:** Classification of Numbers, Divisibility Rules, Finding the Units Digit, Finding Remainders in Divisions Involving Higher Powers, LCM and HCF Models **Percentages:** Introduction, converting a Percentage into Decimals, Converting a Decimal into Percentage, Percentage Equivalent of Fractions, Problems on Percentages			**16**

Profit And Loss: Problems on Profit and Loss Percentage, Relation between Cost Price and Selling Price, Discount and Marked Price, Two Different Articles Sold at Same Cost Price, Two Different Articles Sold at Same Selling Price Gain% / Loss% on Selling Price **Problems on Ages:** Introduction, Problems based on Ages **Averages:** Definition of Average, Rules of Average, Problems on Average , Problems on Weighted Average, Finding Average using Assumed Mean Method **Alligation and Mixture:** Problems on Mixtures, Alligation Rule, Problems on Alligation	
Unit – 5: Mental Ability	
Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters **Number and Letter Analogies:** Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy **Odd Man Out:** Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out **Coding and Decoding:** Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model **Blood relations:** Defining the Various Relations among the Members of a Family, Solving Blood Relation Puzzles, Solving the Problems on Blood Relations using Symbols and Notations **Direction Sense:** Solving Problems by Drawing the Paths, Finding the Net Distance Travelled, Finding the Direction, Problems on Clocks, Problems on Shadows	**16**

Section-A: Text (T) / Reference (R) Books:	
For Units 1, 2, & 3	
T1	English and Soft Skills, Dr. S. P. Dhanvel, Orient Blackswan, 2011
R1	Seven Habits of Highly Effective People, Stephen R Covey
R2	Emotional Intelligence, Daniel Goleman, Bantom Book, 2006
R3	21st Century Skills: Learning for Life in our Times, Bernie Trilling, Charles Fadel; John Wiley & Sons
For Units 4&5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A Modern Approach to Logical Reasoning'
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's Verbal Reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO1	re-engineer attitude and understand its influence on behaviour
CO 2	develop interpersonal skills and be an effective goal oriented team player
CO 3	develop holistic personality with a mature outlook to function effectively in different circumstances
Section B: Aptitude Builder	
CO 4	solve the real-time problems for performing job functions easily
CO 5	analyse the problems logically and critically

DISASTER MANAGEMENT SEMESTER – V			
Subject Code	**21CECEN5090**	Internal Marks	30
Number of Lecture Hours/Week	2	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – NA			

Course Objectives:

This course will enable students to:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management. Describe public awareness and economic incentive possibilities

Unit -1 Natural Hazards and Disaster Management	
Introduction of DM – Inter Disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.	**Hours – 10**
Unit -2 Man made Disaster and their Management along with Case Study	
Fire hazards – transport hazard dynamics– solid waste management – post disaster – bio terrorism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.	**Hours – 10**
Unit – 3 Risk and Vulnerability	
Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses	**Hours – 10**
Unit – 4 Role of Technology in Disaster Managements:	
Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities- electrical substations- roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.	**Hours – 10**
Unit-5 Education and Community Preparedness:	
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster	**Hours –10**

recovery -Community based disaster management and social capital- Designing resilience- building community capacity for action.	

Course outcomes:

On completion of this course, students are able to

1. Affirm the usefulness of integrating management principles in disaster mitigation work
2. Distinguish between the different approaches needed to manage pre- during and post-disaster periods
3. Explain the process of risk management
4. Relate to risk transfer
5. Prepare community for risk reduction

Text Books:

1. Disaster Management – Global Challenges and Local Solutions by Rajib shah & R Krishnamurthy (2009), Universities press.
2. Disaster Science & Management' by Tushar Bhattacharya, 2012 Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication

Reference Books:

1. Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Online resources:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

Professional Elective -I

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE1	21CECEP504a	Advanced Concrete Technology	3	0	0	3
2		21CECEP504b	Open Channel flow	3	0	0	3
3		21CECEP504c	Advanced Structural Analysis	3	0	0	3
4		21CECEP504d	Remote Sensing and GIS	3	0	0	3

ADVANCED CONCRETE TECHNOLOGY SEMESTER -V			
Subject Code	**21CECEP504a**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Identify the aggregate and cement properties
2. Understand the behavior of fresh and hardened concrete.
3. Make aware the recent developments in concrete technology
4. Understand factors affecting the strength, workability and durability of concrete
5. Impart the methods of proportioning of concrete mixtures.

Unit -1	**Hours**
Aggregates: Geology aspects, Review of types; sampling and testing; effects on properties of concrete, production of artificial aggregates. Introduction to ASR and AAR Special Cements: Review of types of cements, chemical composition; properties and tests, chemical and physical process of hydration,	**10**
Unit -2	
Mineral Admixtures: Chemical Admixtures, Flyash, ground granulated blast furnace slag, metakaolin, rice-husk ash and silica fume; chemical composition; physical characteristics; effects on properties of concrete; advantages and disadvantages; proportioning of concrete mixtures: Factors considered in the design of mix; BIS Method, ACI method, Durability aspects.	**10**
Unit – 3	
Durability of concrete: Durability concept; factors affecting, reinforcement corrosion; fire resistance; frost damage; sulphate attack; alkali silica reaction; concrete in sea water, statistical quality control, acceptance criteria as per BIS code	**10**
Unit – 4	
Non-destructive testing of concrete: Surface Hardness, Ultrasonic, Penetration resistance, Pull-out test, chemical testing for chloride and carbonation- core cutting - measuring reinforcement cover. Basics on Thermal studies.	**10**
Unit – 5	
Special concretes: Special processes and technology for particular types of structure - Roller compacted concrete – Ready mix concrete, Sprayed concrete; underwater concrete, mass concrete, self-compacting concrete, high-performance concrete, Fibre-reinforced concrete; slip form construction, Prefabrication technology, Viscosity and air entrained agents.	**10**

Course outcomes:

On successful completion of this course, students will be able to

1.Understand the testing of concrete materials as per IS code

2. Know the procedure to determine the properties of fresh and hardened of concrete

3. Design the concrete mix using ACI and IS code methods
4. Select and Design special concretes depending on their specific applications
5. Acquaint with non-destructive testing of concrete

Text Books:

1. Neville A.M.,"Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 2012
2. Job Thomas., " Concrete Technology", Cengage learning, 2015.
3. R. Santhakumar „ Concrete Technology", Oxford Universities Press, 2006
4. Shetty M. S., Concrete Technology", S. Chand & Co., 2006
5. All relavent IS Codes in each Material.

Reference Books:

1. Mehta and Monteiro, "Concrete-Micro structure, Properties and Materials", McGraw Hill Professional, 2020.
2. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2010
3. Lea, "Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e, 2017

Bungey, Millard, Grantham – Testing of Concrete in Structures- Taylor and Francis, 2006

Code Books:

1. IS:10262-2019 Guidelines for concrete mix proportion
2. IS 456: 2000 – Plain and Reinforced concrete – code of practice (fourth revision)

OPEN CHANNEL FLOW SEMESTER -V			
Subject Code	**21CECEP504b**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students

1. To comprehend types of open channel and their behaviours.
2. To identify types of channels and its requirement.
3. To apply the basic principles of flow to design different types of channels.
4. Understand uniform flow in mobile boundary channels.
5. To understand the concept of hydraulic jump and its applications.

Unit -1	**Hours**
Basic Flow Concepts: Types of channels, classification of flows, basic equations, velocity distribution, velocity coefficients, pressure distribution.	**10**
Unit -2	
Energy and momentum principles: Specific energy, critical flow, section factor for critical flow computation, first hydraulic exponent, computation of critical flow, specific force, specific force, channel transitions	**10**
Unit – 3	
Uniform flow in rigid boundary channels: Shear stress distribution, velocity distribution in turbulent flow, Chezy's equation, Manning's equation, conveyance of a channel, section factor for uniform flow computation, second hydraulic exponent, computation of uniform flow.	**10**
Unit – 4	
Uniform flow in mobile boundary channels: Incipient motion condition, shield's analysis, regimes of flow, prediction of regimes, flow resistance.	**08**
Unit – 5	
Gradually varied flow: Differential equation of GVF, classification and analysis of flow profiles, computation of GVF. Hydraulic jump: Types of jump, general equation for jump in prismatic channels, jump in horizontal and slopping rectangular channels, location of hydraulic jump	**12**

Course outcomes:

On completion of this course, students are able to

1. Explain types of flow in open channel, velocity and pressure distribution

2 Explain specific energy, compute uniform flow, critical flow, section factor and conveyance of channel and its transitions.

3 Analyze and design of artificial channels with rigid and mobile boundary

4 Classify various flow profiles and compute gradually varied flow profiles in various types of slopes in channel

5 Comprehend hydraulic jump, its types and compute initial and sequent depth in case of various channels

Text Books:

1. V.T Chow, Open Channel Hydraulics, Mc Graw Hill, 2009.
2. K. Subramanya, Flow in Open Channels, Tata Mc. Graw Hill, 2019
3. A. Osman Akan, Seshadri Iyer, Open Channel Hydraulics, Elsevier, 2021.
4. K.G. Rangaraju , Flow through Open Channels, Tata Mc. Graw Hill, 1993.

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Reference Books:

1.. M.H Chaudhury, Open Channel Flow, Prentice Hall of India, 2008 and later ed..
2. Rajesh Srivastava, Flow through open channels, Oxford higher education, 2007.
3. NPTEL Web Resources on Open Channel Flow/Hydraulics

ADVANCED STRUCTURAL ANALYSIS SEMESTER –V			
Subject Code	**21CECEP504c**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Familiarize Students with Different types of Structures
2. Equip student with concepts of Arches
3. Understand Concepts of lateral Load analysis
4. Familiarize Cables and Suspension Bridges
5. Develop Slope deflection equation.
6. Understand Analysis methods Moment Distribution, and Kanis Method

Unit -1	**Hours**
Three Hinged Arches: Elastic theory of arches – Eddy' s theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels. Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches.	**10**
Unit -2	
Lateral Load Analysis Using Approximate Methods: application to building frames. (i) Portal Method (ii) Cantilever Method.	**10**
Unit – 3	
Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.	**10**
Unit – 4	
Moment Distribution Method: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports – Portal frames – including Sway-Substitute frame analysis by two cycles. Kani' s Method: Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway.	**10**
Unit – 5	
Slope Deflection Equations Derivation, application to continuous beams with and without settlement of supports – Shear Force and Bending moment.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Differentiate Determinate and Indeterminate Structures.
2. Carryout lateral Load analysis of structures.

3. Analyze Cable and Suspension Bridge structures.
4. Analyze structures using Moment Distribution and Kani' s Method.
5. Analyze structures using Slope Deflection Method.

Text Books:

1. Structural Analysis, R.C. Hibbeler, Pearson Education, India
2. Theory of Structures – II, B. C. Punmia, Jain & Jain, Laxmi Publications, India.
3. Structural Analysis, C.S. Reddy, Tata Mc-Graw hill, New Delhi.

Reference Books:

1. Intermediate Structural Analysis, C. K. Wang, Tata McGraw Hill, India
2. Theory of structures, Ramamuratam, Dhanpatrai Publications.
3. Analysis of structures, Vazrani&Ratwani – Khanna Publications.

REMOTE SENSING AND GIS SEMESTER -V			
Subject Code	**21CECEP504d**	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

This course will enable students to:

1. Introduce the basic principles of Remote Sensing and GIS techniques and learn various types of sensors and platforms
2. Learn visual image interpretation & processing of digital image
3. Understand the concept of GIS and Understand different types of spatial data
4. Understand the principles of spatial analysis
5. Appreciate application of RS and GIS to Civil engineering
6. Appreciate application of RS and GIS to Water management

Unit -1	**Hours**
Introduction to Remote Sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surface characteristics of remote sensing systems. Sensors and platforms: Introduction, types of sensors, airborne remote sensing, space-borne remote sensing, image data characteristics, Indian Satellites, and other purpose-driven satellites.	**10**
Unit -2	
Image analysis: Introduction, elements of visual interpretations, digital image processing- image preprocessing, image enhancement, image classification, supervised classification unsupervised classification.	**10**
Unit – 3	
Geographic Information System: Introduction; GIS definition and terminology; GIS categories; Components of GIS; Fundamental operations of GIS; A theoretical framework for GIS.Types of Data Representations: Data input and output; Data editing; Types of data entry – Keyboard entry, Coordinate geometry procedure, Manual digitizing and Scanning; Types of GIS – Raster GIS and Vector GIS; Advantages and Disadvantages of Raster and Vector GIS.	**10**
Unit – 4	
Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing.	**10**
Unit – 5	
RS and GIS applications General: Land cover and land use, agriculture, forestry, urban applications. Application to Hydrology and Water Resources: Flood zoning and mapping, groundwater prospects, and potential recharge zones.	**10**

Course Outcomes: after completion of this course students will able to.

1. Understand the Remote sensing processes and be familiar with ground, air, and satellite-based sensor platforms

2. Understanding the Image Analysis and processing
3. Understanding GIS and its components, Raster and Vector formats of data and their usage in GIS
4. Create spatial data inputs and analysis
5. Apply RS and GIS concepts in Civil Engineering applications

TEXT BOOKS

1. Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image Interpretation', Wiley India Pvt. Ltd., New Delhi
3. Schowenger, R. A (2006) 'Remote Sensing' Elsevier publishers.
4. Fundamentals of Remote Sensing' by George Joseph, Universities Press, 2013.

REFERENCES

1. Remote Sensing and its Applications by Narayan LRA, Universities Press, 2012.
2. Concepts and Techniques of Geographical Information System' by Chor Pang Lo and A K W Yeung, Prentice Hall (India), 2006
3. Introduction to Geographic Information Systems' by Kand Tsung Chang, McGraw Hill Higher Education, 2009.
4. Basics of Remote sensing & GIS' by Kumar S, Laxmi Publications, New Delhi, 2005.

Online Resources:

https://archive.nptel.ac.in/courses/105/103/105103193/
https://onlinecourses.nptel.ac.in/noc23_ce52/preview
https://onlinecourses.nptel.ac.in/noc22_ce78/announcements?force=true

B.Tech. (Civil Engineering)
Semester VI (Third year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECET6010	Hydrology and Water Resources Engineering	3	0	0	3
2	21CECET6020	Design and Drawing of Steel Structures	3	0	0	3
3	21CECET6030	Environmental Engineering	3	0	0	3
4	21CECEP604x	Professional Elective - II	3	0	0	3
5	21CExxO605x	Open Elective course - II	2	0	2	3
6	21CECEL6060	Environmental Engineering Lab	0	0	3	1.5
7	21CECEL6070	RS & GIS LAB	0	0	3	1.5
8	21CECEL6080	Irrigation Design and Drawing Lab	0	0	3	1.5
9	21CEAHS6090	Soft Skills & Aptitude Builder - 2	1	0	2	2
10	21CMBIT6100	Biology for Engineers	2	0	0	0
				Total Credits		21.5
		Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	4	0	0	4
Industrial/Research Internship (Mandatory) 2 months during summer vacation						

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE2	21CECEP604a	Foundation Engineering	3	0	0	3
2		21CECEP604b	Offshore Structures	3	0	0	3
3		21CECEP604c	Pavement Design	3	0	0	3
4		21CECEP604d	Urban Hydrology	3	0	0	3

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

HYDROLOGY AND WATER RESOURCES ENGINEERING SEMESTER – VI			
Subject Code	**21CECET6010**	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Understand the concept of the hydrological cycle and Runoff
2. Learn about hydrograph analysis and measurement of flood
3. Understand the measurement of groundwater & irrigation system.
4. Learn about canal structures and diversion headworks.
5. Learn about different types of dams and reservoirs and its site selection.

Unit -1: Introduction	
Introduction to Hydrology and Hydrological cycle. Precipitation, Evaporation, Transpiration, Evapotranspiration, Infiltration. Rain gauge network, Depth Area curves, Probable Maximum Precipitation. **Runoff:** Components of Runoff, Factors affecting runoff, SCS-CN method of estimating runoff, Flow duration curves.	**Hours – 10**
Unit -2: Hydrograph analysis & flood routing	
Hydrograph analysis: Hydrograph definition, Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. **Floods and flood routing:** Causes and effects, Standard Project Flood (SPF) and Probable Maximum; Flood (MPF), flood control methods and management. Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.	**Hours – 10**
Unit – 3: Water withdrawals and uses	
Ground Water: forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady-state flow in wells, equilibrium equations for confined and unconfined aquifers. **Irrigation:** Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Methods of applying water to the fields: surface, sub-surface, sprinkler, and trickle/drip irrigation.	**Hours – 10**
Unit – 4: Distribution Systems	
Canal systems, alignment of canals, canal losses, Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Waterlogging: causes, effects and remedial measures.	**Hours – 10**
Unit – 5: Dams	
Dams: Introduction to Dam Engineering, types of dams, selection of the type of Dam, selection of a site for a dam. Gravity dams, Causes, and failures. Forces acting	**Hours – 10**

on a gravity dam. elementary and practical profile, Types of Earth dams, and causes of failures.	

Course Outcomes: after completion of this course students will able to.

1. Remember the hydrological cycle and its relevance to civil engineering. And understand the theory for physical process and interaction.
2. Applications of the hydrologic cycle, Unit hydrograph and understanding floods, and analysis of design flood, flood routing
3. Applications of groundwater movement and well hydraulics and understanding the irrigation water requirements of various crops and methods of applying water to the fields
4. Understanding the canal structures and their design
5. Analysis of dams, reservoirs and selection of its site.

TEXT BOOKS

1. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P) Ltd, 2021.
2. Engineering Hydrology, by K Subramanya, McGraw Hill, 2020

REFERENCES

1. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers, 2018.
2. Applied hydrology, Chow V. T., D. R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2017), New Delhi.

Online Resources:

https://archive.nptel.ac.in/courses/105/105/105105110/
https://archive.nptel.ac.in/courses/105/103/105103213/
https://archive.nptel.ac.in/courses/105/105/105105214/
https://onlinecourses.nptel.ac.in/noc23_ce44/preview

DESIGN AND DRAWING OF STEEL STRUCTURES SEMESTER –VI			
Subject Code	**21CECET6020**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Familiarize Students with different types of Connections and relevant IS codes
2. Equip student with concepts of design of flexural members
3. Understand Design Concepts of tension and compression members in trusses
4. Familiarize students with different types of Columns and column bases and their Design
5. Familiarize students with Plate girder and Gantry Girder and their Design

Unit -1	Hours
Connections: Introduction: (a) Riveted connections – Definition, rivet strength and capacity- Codal Provisions, (b) Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.	10
All units i.e., from unit II to unit-VI to be taught in Limit State Design and in Welded connections only	
Unit -2	
Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.	10
Unit – 3	
Tension Members and compression members: General Design of members subjected to direct tension and bending –effective length of columns. Slenderness ratio – permissible stresses.	10
Unit – 4	
Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns. Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected moment.	10
Unit – 5	
Design of Plate Girder: Design consideration – I S Code Recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections. Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders	10
Note: Welding connections should be used in Units II – V. The students should prepare the following drawings. 1 Detailing of welded joints. Plate 2 Detailing of simple and Compound beams including curtailment of flange plates 3 Detailing of compression and tension member	

4 Detailing of Column including lacing, battens, Column bases – slab base and gusseted base 5 Detailing of Plate girder including curtailment, splicing and stiffeners. **FINAL EXAMINATION PATTERN:** The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.	

Course outcomes:

Upon successful completion of the course student will be able to

1. Work with relevant IS codes
2. Carryout analysis and design of flexural members and detailing
3. Design compression members of different types with connection detailing
4. Design Plate Girder and Gantry Girder with connection detailing
5. Produce the drawings pertaining to different components of steel structures

Text Books:

1. Steel Structures Design and Practice, N. Subramanian, Oxford University Press, Edition 3 2011 .
2. Design of steel structures, S. K. Duggal, Tata McGraw Hill, New Delhi, Edition 3, 2008
3. Design of Steel Structures S. S. Bhavikatti, I. K International Publishing House Pvt. Ltd., Edition 5, 2018

Reference Books:

1. Structural Design in Steel, SarwarAlamRaz, New Age International Publishers, New Delhi , Edition 3, 2019.

IS Codes:

1. IS: 800 – 2007 ,Indian Standard Code for General Construction in Steel, 3rd revision, Bureau of Indian standards
2. IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.
3. Steel Tables. These codes and steel tables are permitted to use in the examinations.

Online Resources

1. Web link: https://nptel.ac.in/courses/105/105/105105162/

ENVIRONMENTAL ENGINEERING SEMESTER – VI			
Subject Code	21CECET6030	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of water quality requirement for domestic usage and other usage
3. Impart understanding of importance of protection of water source quality
4. Selection of valves and fixture in water distribution systems for water supply system.
5. Impart knowledge on design of water distribution network

Unit -1 Introduction:	
Water: - Water Supply systems, Need for planned water supply schemes, Sources of Water, Water demand and Potable, industrial and agricultural water requirements. Role of Environmental Engineer. Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system.	**Hours – 10**
Unit -2 Water Demand, Quantity Estimation and colletion:	
Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it- Types of water demands and its variations- factors affecting water demand, Design Period, Factors affecting the Design period, Population Forecasting. Collection of water: Intake methods	**Hours – 10**
Unit – 3 Qualitative analysis and treatment of water:	
Qualitative analysis: Drinking water standards; Physical, chemical, and bacteriological analysis of water. **Treatment of Water:** Flowchart of water treatment plant, Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration. Disinfection: Theory of disinfection- Chlorination and other Disinfection methods, Softening of Water, Removal of color and odors.	**Hours – 10**
Unit – 4 Sewage	
Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, recycling of sewage – quality requirements for various purposes.	**Hours – 10**
Unit – 5 Building Plumbing and Distribution of Water:	

Plumbing Systems of Drainage – Sanitary Fittings and other Accessories – Single Stack System – One Pipe and Two Pipe Systems, various kinds of fixtures and valves used. **Distribution of Water:** Requirements- Methods of Distribution system, Layouts of Distribution networks. Analysis of Distribution networks: Hardy Cross and equivalent pipe methods.	**Hours –10**

Course outcomes:

On successful completion of this course, students are able

1. Identify the water source and select proper intake structure
2. Estimate the demand of water.
3. Selection of suitable treatment for raw water treatments
4. Select the appropriate appurtenances in the water supply
5. Analyze the suitability of water distribution methods in various regions.

Text Books:

1. The elements of environmental Engineering Elements K. N. Duggal, S. Chand & Company Ltd., New Delhi 2012.
2. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna Paramount Publications, Visakhapatnam in 2018.
3. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
4. WHO Drinking water specifications. https://cpcb.nic.in/who-guidelines-for-drinking-water-quality/
5. Water Quality Standards Updated On : 23 Oct 2019. 1. Water Quality Criteria ...***BIS-Drinking Water Specifications (IS: 10500-2012***). https://cpcb.nic.in/wqm/BIS_Drinking_Water_Specification.pdf

Reference Books:

1. Rural Municipal and Industrial water management, K.V.S.G. Murali Krishna, Environmental Protection Society, Kakinada 2021.
2. Environmental Engineering, Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003

Online resources:

https://nptel.ac.in/courses/103107084

ENVIRONMENTAL ENGINEERING LAB SEMESTER – VI			
Subject / Lab Code	21CECEL6060	Internal Marks	15
Number of Lecture Hours/Week	3	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives: This course enable the students to:

1. Know the important characteristics of water and wastewater in the laboratory
2. Know the physical parameters of water sample
3. Understand of chemical parameters of water sample
4. Understand of biological parameters of water sample
5. Understand of the strength of the sewage in terms of BOD and COD

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil. 2. Determination and estimation of Total Hardness–Calcium & Magnesium. 3. Determination of alkalinity/Acidity 4. Determination of chlorides in water and soil 5. Determination and estimation of total solids 6. Determination of Iron. 7. Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method and B.O.D. 8. Determination of N, P, K values in waste water 9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste. 10. Determination of C.O.D. 11. Determination of Optimum coagulant dose. 12. Determination of Chlorine demand.	36 Hours

Course outcomes:

On successful completion of this lab course, students will be able to

1. Estimation of some important characteristics of water and wastewater in the laboratory
2. Estimation the physical parameters of water sample
3. Estimation of chemical parameters of water sample
4. Estimation of biological parameters of water sample
5. Estimation of the strength of the sewage in terms of BOD and COD
6. Conclude and decide whether the water is potable or not

Text Books:

1. Environmental Engineering laboratory Practice by B. Narayanaswamy, ISBN 978-93-85977-99-2, Shanlax Publications, 2016.
2. WHO Drinking water specifications. https://cpcb.nic.in/who-guidelines-for-drinking-water-quality/

3. Water Quality Standards Updated On : 23 Oct 2019. 1. Water Quality Criteria ...*BIS-Drinking Water Specifications (IS: 10500-2012*). https://cpcb.nic.in/wqm/BIS_Drinking_Water_Specification.pdf

Hardware/Software Requirements:

1. pH meter
2. Turbidity meter
3. Conductivity meter
4. Hot air oven
5. Muffle furnace
6. Dissolved Oxygen meter
7. U–V visible spectrophotometer
8. COD Reflux Apparatus
9. Jar Test Apparatus
10. BOD incubator
11. Autoclave
12. Laminar flow chamber
    Hazen's Apparatus

Online resources:

1. https://ee1-nitk.vlabs.ac.in/
2. https://ee2-nitk.vlabs.ac.in/

REMOTE SENSING & GIS LAB SEMESTER - VI			
Subject code	**21CECEL6070**	Internal Marks	15
Number of Hours/Week	03	Exam Marks	35
Total Number of Lecture hours	36	Exam Hours	3
Credits -1.5			

Course Objectives:

The course is designed to

1. Understand the process Geo-referencing, Preparation of Base map from of Toposheet
2. Digitization, creation of thematic maps from toposheets.
3. Developing Digital Elevation model
4. To convert raster map to vector layer and vector layer to raster by using Arc - GIS Software
5. Interpretation and Estimation of features of Land Use/land cover details from satellite imagery.
6. Learn to apply GIS software to simple problems in water resources, transportation engineering and Agriculture

LIST OF EXPERIMENTS

1. Familiarization with GIS Software, Data Input
2. Geo Referencing of Toposheet
3. Digitization of Toposheet
4. Creation of Thematic Maps
5. Base Map Preparation
6. Data Conversion – Vector to Raster, Raster to Vector
7. Adding Attribute Data – Querying on Attribute Data
8. Vector Analysis
9. Raster Analysis
10. Map Composition
11. Developing Digital Elevation Model

12. Simple Applications of GIS in Water Resources Engineering & Transportation Engineering

Course Outcomes:

At the end of the course the student will be able to

1. Work comfortably on GIS software
2. Digitize and create thematic map and extract important features
3. Develop digital elevation model
4. Raster to vector conversion: point, line, polygon vector layers
5. Interpretation and Estimation of features from satellite imagery.
6. Analyze and Modelling using GIS software.

SOFTWARES:

1. Arc GIS 10.1

2. ERDAS Imagine 13

3. MapInfo 6.5

4. ILWIS or Any one or Equivalent.

Text Book

1. Remote Sensing and Image Interpretation, Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013), Wiley India Pvt. Ltd., New Delhi
2. Concepts and Techniques of Geographical Information System, Chor Pang Lo and A K W Yeung, Prentice Hall (India), 2016

IRRIGATION DESIGN AND DRAWING LAB SEMESTER-VI			
Subject Code	**21CECEL6080**	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVE:

The course is designed:

1. To understand the basic types of Irrigation, Irrigation standards and crop water assessment.
2. To study the different aspects of the design of Hydraulic Structures
3. To Provide knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators, canal falls and structures involved in the cross drainage works.

Falls: Types and location, design principles of Sarda type fall and straight glacis fall**.** **Regulators:** Head and cross regulators, design principles **Cross Drainage Works:** Types, selection, and design principles of the aqueduct, siphon aqueduct and super passage. **Diversion Head Works:** Types of diversion head works, weirs and barrages, layout of diversion head works, components	**12 Hours**
Design and drawing of 1. Surplus weir 2. Tank sluice with a tower head 3. Canal drop-Notch type 4. Canal regulator 5. Under the tunnel 6. Syphon aqueduct type III	**24 Hours**

Course outcomes: After studying this course, students will be able to

1. Design and draw the Surplus weir
2. Design and draw the Tank sluice with a tower head
3. Design and draw the Canal drop-Notch type
4. Design and draw the Canal regulator
5. Design and draw the Under the tunnel
6. Design and draw the Syphon aqueduct type III

Hardware/Software Requirements:

1. Mini drafter
2. Drawing Tools

Text Books:

1. Water Resources Engineering: Principles and Practice by Satya N Murthy, Challa, New Age Publishers, 2020.

Reference Book:

1. Irrigation engineering and Hydraulic structures by S. K. Garg, Standard Book House, Khanna Publishers, 38th revised edition 2023.
2. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P) Ltd, 2021

Codes:

1. IS 457: 1957, Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
2. IRC: SP:13-2004, Guidelines for design of small bridges and culverts.
3. IS 6531: 1994 Canal Head Regulators - Criteria for Design
4. CBIP- Publication No 179-1985, Manual on Barrages and weirs on Permeable foundations.
5. CBIP- Publication No 12-1981, Design of weirs on Permeable foundations.
6. IS 4997: 1968 Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron.
7. IS 12720: 2004 Criteria for Structural Design of Spillway Training Walls and Divide Walls
8. IS 13195: 1991 Preliminary design, operation and maintenance of protection works downstream of spillways - Guidelines.
9. IS 10210: 1993 Criteria for Design of Hydraulic Hoists for Gates

Soft Skills & Aptitude Builder – 2 Semester VI			
Subject Code	21CEAHS6090	**IA Marks**	15+15
Number of Lecture Hours/Week	2	**Exam Marks**	35+35
Total Number of Lecture Hours	32	**Exam Hours**	3
Credits - 2			
Section A, Soft Skills			
Unit – 1: Communicative Competence			**Hours**
Verbal Reasoning: Reading Comprehension-Text Completion- Sentence Equivalence Spotting Errors, Sequencing of Sentences, Parallelism in Structure E-Mail Etiquette, Reporting News Activity: Completing Exercises			**6**
Unit 2: Career and Employability Skills			
What is a Career: Career vs Job, Career Values & Grid, Skills vs Strengths, Spotting Skills/Reflection of Present Skills, Meeting the Expectation of your Employer, Matching your Skills with the Required Skills, Preparing Resume, Preparing for Interviews & Structuring Answers Activity: Resume Building, Interviews			**6**
Section B,Aptitude Builder			
Unit – 3: Time and Work			
Pipes and Cisterns: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours Method, Problems on Alternate Days, Problems on Pipes and Cisterns. **Time , Distance and Speed, Problems on Trains, Boats and Streams:** Relation between Speed, Distance and Time, Converting km/h into m/s and vice versa , Problems on Average Speed, Problems on Relative Speed, Problems on Circular Tracks, Problems on Races **Problems on Trains:** Two Trains Moving in Opposite Direction, Two Trains Moving in same Direction, A Train Crossing a Stationary Object of a Given Length like a Platform or Bridge, A Train Crossing a Stationary Object like a Pole or a Man **Boats and Streams:** Time Based, which can be considered as a Point Object Speed Based, Distance Based, Average Speed Based			**6**
Unit – 4: Logical and Analytical Reasoning			
Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, Complex Arrangement**.** **Clocks:** Finding the Angle When the Time is Given, Finding the Time When the Angle is Known, Relation between Angles, Minutes and Hours, Position of Hands of the Clock, Time Gained or Lost by the Clock, Mirror /Water Image-based Time. **Calendars:** Definition of a Leap Year, Finding the Number of Odd Days, Framing the Year Code for Centuries, Finding the Day of any Random Calendar Date **Syllogisms:** Finding the Conclusions using Venn Diagram Method, Finding the Conclusions using Syllogism Method **Simple Interest:** Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal			**7**

Compound Interest: Definition and Formula for Amount in Compound Interest, Difference between Simple Interest and Compound Interest for 2 Years on the Same Principle and Time Period.	
Unit – 5: Permutations, Probability, Areas and Volumes	
Definition of permutation, Problems on Permutations, Definition of Combinations, problems on Combinations **Probability:** Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards, Problems on Years **Mensuration - 2D:** Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas **Mensuration - 3D:** Problems on Volumes, Problems on Surface Areas	**7**
Text (T) / Reference (R) Books:	
For Units 1 & 2	
T1	Enhance Your Employability Skills, David Winter and Laura Brammar, University of London
T2	R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003
R2	How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill
For Units 3, 4, & 5	
T1	R S Agarwal, S Chand, 'Quantitative Aptitude'
T2	R S Agarwal, S.Chand , 'A modern approach to Logical reasoning'
R1	Quantitative Aptitude for CAT By Arun sharma
R2	GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO 1	learn and practice effective communication skills
CO 2	develop broad career plans, evaluate the employment market, and become industry ready
Section B: Aptitude Builder	
CO 3	develop accuracy on time and distance and units related solutions
CO 4	solve the real-time problems for performing job functions easily
CO 5	solve problems related to permutations and combinations, probability, areas and volumes

BIOLOGY FOR ENGINEERS SEMESTER – VI			
Subject Code	**21CMBIT6100**	Internal Marks	30
Number of Lecture Hours/Week	2	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 0			

Course Objectives:

This course will enable students to:

1. To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry
2. To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
3. To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
4. To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
5. To convey that without catalysis life would not have existed on earth
6. The molecular basis of coding and decoding genetic information is universal

Unit -1 Introduction	
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry	**Hours – 12**
Unit -2 Classification	
Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultra structure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophy, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus	**Hours – 10**
Unit – 3 Genetics & Bio molecules	
Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	**Hours – 10**

Molecules of life: In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	
Unit – 4 Enzymes & Information Transfer Purpose	
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. Information Transfer Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	**Hours – 10**
Unit – 5 Microbiology & Metabolism	
Macromolecular analysis Purpose: How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge **Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	**Hours – 8**

Course outcomes:

On successful completion of this course, students are able

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.

Text Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd, 2020
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons, 2006

Reference Books:

1. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company, 2017

2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

Online resources:

1. https://onlinecourses.nptel.ac.in/noc19_ge31/preview

Professional Elective – II

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE2	21CECEP604a	Foundation Engineering	3	0	0	3
2		21CECEP604b	Offshore Structures	3	0	0	3
3		21CECEP604c	Pavement Design	3	0	0	3
4		21CECEP604d	Urban Hydrology	3	0	0	3

FOUNDATION ENGINEERING SEMESTER-VI			
Subject Code	**21CECEP604a**	Internal Marks	30
No. of Lecture Hours/Week	3	Exam. Marks	70
Total Number of Lecture Hours	50	Exam. Hours	03
Credits-03			

Objectives: This course will enable the student to:

1. Introduce concepts of stability of slopes useful for design of earthen embankments and dams.
2. Introduce earth pressure theories for the design of retaining walls.
3. Understand the bearing capacity of shallow foundations
4. Understand the capacity of pile foundations
5. Introduce the types of well foundations and methods of soil exploration

Unit-1	
Stability of Slopes: Introduction to the stability of slopes, Infinite slopes and translational slides, Definitions of a factor of safety, finite slopes-forms of slip surface, Limit equilibrium method and critical stages in stability, Total stress and effective stress methods of analysis, $\phi_u = 0$ Analysis (Total stress analysis),c-ϕ analysis-Method of slices, Location of the most critical circle, stability of earth dam slopes, friction circle method, Taylor's stability number.	10 Hours
Unit-2	
Earth pressure and retaining walls: Introduction to earth pressure and retaining walls, Effect of wall movement on Earth Pressure, Earth Pressure at rest, Rankine's theory of Earth pressure; Coulomb's theory of earth pressure, Culmann's graphical method for active earth pressure, Design considerations for retaining walls, Types of retaining walls, selection of backfill and placement condition, drainage in retaining walls	10 Hours
Unit-3	
Shallow Foundations: Concept of Foundation, Types of Foundations and their applicability, General requirements of foundations, Location and Depth of foundation. **Bearing Capacity of Shallow Foundation:** Terminology relating to bearing capacity, Bearing Capacity of Shallow Foundations - Terzaghi's Bearing Capacity theory, Skempton's Bearing Capacity theory for Clay soils; IS-Code Recommendations for Bearing Capacity; Influence of water table on bearing capacity. **Settlement of shallow foundations:** Types of foundation settlements and their determination, Settlements of foundations on granular soils, Allowable settlements, Methods to reduce differential settlements, Allowable Bearing Pressure based on SPT Number- Teng's correlation and IS recommendation.	10 Hours
Unit-4	
Pile Foundations: Uses of Piles, Types of Piles, Pile load carrying capacity in compression - Static Pile Load formula, Dynamic Pile formulae, static pile load test, Group action of Piles - load carrying capacity and settlement, Negative skin friction.	10 Hours
Unit-5	

Well Foundations: Types of wells, Components of well foundation, Shapes of wells, Depth of a well foundation, Forces acting on well foundation, Construction and Sinking of wells. **Soil Exploration:** Need, Methods of exploration, Methods of Boring, Soil Samples, Soil samplers and Sampling; Number and disposition of trial pits and borings, Depth of exploration, Plate load test, Penetration tests, Bore logs, Site investigation report.	10 Hours

Course Outcomes: On successful completion of this course the students will able to:

1.Check the stability of various slopes.
2. Calculate earth pressures to design retaining walls
3. Determine the bearing capacity of shallow foundations.
4. Determine the capacity of pile foundations.
5. Select a suitable method of soil exploration.

TEXT BOOKS:

1. Basic and Applied Soil Mechanics, Gopal Ranjan & A.S.R. Rao, New Age International Pvt. Ltd, (2004).
2. Principles of Foundation Engineering, Das, B.M., (2011), 6th edition Cengage learning

REFERENCE BOOKS:

1. Foundation Analysis & Design by Bowles, J.E., McGraw- Hill, 7th edition, 1995.

2. Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill,2010.

3. Principles of Foundation Engineering by B.M. Das., PWS Publishing Company, 4th edition, 1999.

4. Foundation Engineering by Varghese, P.C., Printice Hall of India, New Delhi, Eastern Economy Edition, 2000.

5. Soil Mechanics and Foundation Engineering by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt., Ltd., New Delhi, 17th edition, 2017.

6. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors, Pvt., Ltd., New Delhi, 7th edition, 2019.

Online resources:

https://elearn.nptel.ac.in/shop/nptel/geotechnical-engineering-ii-foundation-engineering

OFFSHORE STRUCTURES SEMESTER - VI			
Subject Code	**21CECEP604b**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Understand underwater construction practice
2. Study Marine Hydrodynamics
3. Analyze marine engine systems on board the ships such as pumps, and pumping systems
4. Understand structure and properties of materials, their possible corrosion responses, and then show you how to apply these knowledge specific applications.
5. Analyze various loads which the offshore structure is subjected, types of offshore structures and various equipment's on the offshore structure loading mechanisms, mooring hardware components etc.

Unit -1	
Offshore Engineering: Introduction to offshore structures, codes of practice, offshore project management, deep water, offshore site investigations, geophysical methods; offshore sediment.	**Hours – 10**
Unit -2	
Loads on offshore structures Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; DesignWave heights and Spectral Hydrodynamic Application floating and submerged bodies, Hydrodynamic damping.	**Hours – 10**
Unit – 3	
Marine Hydrodynamics: Fluid pressure and centre of pressure – estimation of weight and centre of gravity – conditions of equilibrium – definition of meta-centre – hydrostatic particulars – stability at small angles of inclinations – problems of heel and trim-free surface effect.	**Hours – 10**
Unit – 4	
Blast Mitigation-Blast walls; Collision of Boats and energy absorption; Platform survival capacity and Plastic design methods.	**Hours – 10**
Unit – 5	
Soil mechanics of seabed: Geotechnical studies of sea floor sediments – Stability – Bearing capacity features of foundation of gravity structures –Bearing capacity and settlement under dynamic loads – Immediate and long-term behavior liquefaction under cyclic loads.	**Hours – 10**

Course outcomes:

On successful completion of this course, students will be able to

1. Understand offshore construction
2. Understand offshore structures and various equipment's.
3. Analyze offshore structure loading mechanisms.
4. Design mooring hardware components.
5. Appraise Marine Hydrodynamics.

Text Books:

1. BC Grewick, Jr. Construction of marine and offshore structure, CRC Press, 2007.
2. RD Blevins, Flow induced vibrations, Van Nostrand Reinhold, 1990.
3. N Barltrop, Floating structures: A Guide for design and analysis, OPL, 1998.

Reference Books:

1. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
2. HO Bordeaux, Buoy engineering, John Wiley, 1975.

PAVEMENT DESIGN SEMESTER - VI			
Subject Code	**21CECEP604c**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Know various components and their functions in a Pavement.
2. Know the construction and maintenance of a parameter tests.
3. Know the construction and maintenance of Flexible Airport Pavements.
4. Acquire strong base in planning principles of airport geometrics and pavements
5. Acquire strong base in design principles of airport geometrics and pavements

Unit -1 Material Characterization	**Hours**
Characterization of test types, Plate- Load Tests, Triaxial Compression Test, CBR Test, Stabilimeter and Cohesion meter. Tests for Bituminous Mixtures: Modulus of Rupture, Indirect Tensile Test, Layered input Parameter Tests, Resilient Modulus Test, Complex (Dynamic) Modulus Test, Diametrical Resilient Modulus, Asphalt Mix Stiffness (Shell Nomograph), Creep Test, Wave Propagation Techniques, CBR-Modulus correlation, Typical Modulus Values, Poisson's Ratio. Fatigue Testing and Permanent Deformation	**10**
Unit -2 Design of Flexible Pavements	
Design of Flexible Airport Pavements: Corps of Engineers (CBR) Method, FAA, CDOT, The Asphalt Institute Method.	**10**
Unit – 3 Design of Flexible Highway Pavements	
Differences between Airport and Highway Pavements, Differences in Design Methods, AASHO Flexible Pavement Design, Multi-Layer Elastic Analysis, The asphalt Institute Design.	**10**
Unit – 4 Design of Rigid Pavements	
Design of Rigid Airport Pavements: Determination of Modulus of Subgrade Reaction, Modulus of Rupture, Factor of Safety, Design Charts, PCA, Corps of Engineers Method, FAA. Base courses, compaction requirements, Joints and Reinforcement Requirements, Joints at Intersections, Design of Steel Reinforcement, Continuously Reinforced concrete pavements, Use of eel Section and Junction of Flexible and Rigid Pavements	**10**
Unit – 5 Design of Rigid Highway Pavements	
Development of Design, Test Roads, Definition of Pavement types, Design Factors, Load Stresses, Thickness Design, Jointing and Reinforcement Requirements, Joints, Load-transfer Devices, Continuously Reinforced Concrete Pavements, Approach slabs, Subgrade and Sub bases, Slip-Form Construction	**10**

Course outcomes:

On successful completion of this course, students will be able to

1. Design of Flexible Pavements.
2. Design of Flexible Highway Pavements.
3. Design the flexible and rigid runways.
4. Design of Rigid Highway Pavements.
5. Understand & Evaluate airport & aircraft characteristics.

Text Books:

1. Principles of pavement design – Yoder & wit zorac – Jhon willey & Sons. Jan 8, 1991

Reference Books:

1. Pavement Analysis and Design – Yang H. Huang, Pearson. Aug 8, 2003
2. Relevant codes and handouts of abroad practices.

Urban Hydrology SEMESTER –VI			
Subject Code	**21CECEP604d**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

1. Appreciate the impact of urbanization on catchment hydrology
2. Understand the importance of short-duration rainfall-runoff data for urban hydrology studies.
3. Learn the techniques for peak flow estimation for stormwater drainage system design.
4. Understand the concepts in the design of various components of urban drainage systems.
5. Learn some of the best management practices in urban drainage.

Unit -1	
Introduction: Urbanization and its effect on water cycle – urban hydrologic cycle – trends in urbanization – Effect of urbanization on hydrology	**Hours – 10**
Unit -2	
Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems	**Hours – 10**
Unit – 3	
Approaches to urban drainage: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems	**Hours – 10**
Unit – 4	
Elements of drainage systems: Open channel, underground drains, appurtenances, pumping, and source control.	**Hours – 10**
Unit – 5	
Analysis and Management: Storm water drainage structures, design of Storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.	**Hours – 10**

Course Outcomes:

1.Understanding the impact of urbanization on catchment hydrology
2. Develop intensity duration frequency curves for urban drainage systems.
3. Develop design storms to size the various components of drainage systems.
4. Prepare master drainage plan for an urbanized area.
5. Apply best management practices to manage urban flooding.

TEXTBOOKS:

1. ‘Manual on Drainage in Urbanised area ’by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 - 2 volumes), UNESCO,
2. ‘Urban Hydrology’ by Hall M J (1984), Elsevier Applied Science Publisher.
3. ‘Hydrology – Quantity and Quality Analysis’ by Wanielista M P and Eaglin (1997), Wiley and Sons.

REFERENCES:

1. ‘Storm water Detention for Drainage’ by Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
2. ‘Urban water cycle processes and interactions’ by Marsalek et al (2006), Publication No. 78, UNESCO, Paris (http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)
3. ‘Frontiers in Urban Water Management – Deadlock or Hope’ by Maksimovic C and J A Tejada-Guibert (2001), IWA Publishing

B.Tech. (Civil Engineering)
Semester VII (Fourth year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECEP701x	Professional Elective - III	3	0	0	3
2	21CECEP702x	Professional Elective - IV	3	0	0	3
3	21CECEP703x	Professional Elective - V	3	0	0	3
4	21CExxO704x	Open Elective courses - III	2	0	2	3
5	21CExxO705x	Open Elective courses - IV	2	0	2	3
6	21CEMST7060	Management Science	3	0	0	3
7	21CECES7070	Software Applications in Civil Engineering Lab (SOC)	1	0	2	2
Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)			0	0	6	3
		Total Credits				23
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE3	21CECEP701a	Prestressed Concrete	3	0	0	3
2		21CECEP701b	Ground Water Development & Management	3	0	0	3
3		21CECEP701c	Soil Dynamics and Machine Foundation	3	0	0	3
4		21CECEP701d	Air and Noise Pollution and Control	3	0	0	3
1	PE4	21CECEP702a	Solid Waste & Hazardous Waste Management	3	0	0	3
2		21CECEP702b	Ground Improvement Techniques	3	0	0	3
3		21CECEP702c	Hydraulic Structures	3	0	0	3
4		21CECEP702d	Bridge Engineering	3	0	0	3
1	PE5	21CECEP703a	Construction, Specifications and Project Management	3	0	0	3
2		21CECEP703b	Railway, Airport Docks and Harbors	3	0	0	3
3		21CECEP703c	Repair and rehabilitation of structures	3	0	0	3
4		21CECEP703d	Earth and rock fill dams	3	0	0	3

Open Electives:

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

SOFTWARE APPLICATIONS IN CIVIL ENGINEERING LAB SEMESTER – VII			
Subject Code	21CECES7070	Internal Marks	15
Number of Lecture Hours/Week	2	External Marks	35
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 02			

COURSE OBJECTIVE:

This course will enable students to:

1. To teach the students to understand the details of STAAD Pro software package.
2. To enable the students to prepare input data for RCC & Steel structures
3. To enable the students to design different components of structures.
4. To teach the students to understand the modeling of HEC-HMS packages.
5. To enable the students to know about Project management.

LIST OF EXPERIMENTS:	
1. Design Of Simply Supported RCC Beam 2. Design Of Cantilever RCC Beam 3. Design Of Continuous RCC Beam 4. Design Of Simply Supported Steel Beam 5. Design Of Continuous Steel Beam 6. Design Of RCC Column with Different End Conditions 7. Design Of Steel Column with Different End Conditions 8. Design Of Steel Trusses 9. Design Of RCC Portal Frames 10. Design Of Steel Portal Frames 11. Introduction to Hydrological modelling by using HEC-HMS 12. Introduction to Primavera.	36 Hours

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Understand the details of STAAD Pro software package.
2. To prepare input data of STAAD Pro
3. Run STAAD Pro for Analysis and design of structures.
4. To understand about hydrological modeling
5. To Run Primavera for project management

Hardware/Software Requirements:

1. STAAD PRO V8i
2. PRIMAVERA
3. HEC-HMS

Textbooks:

1. STAAD Pro V8i for Beginners 1st Edition, Kindle Edition by Sarma (3 April 2017).
2. Analysis of Structural Elements by STAAD Pro for beginners [with RCC design]: 2nd Edition Kindle Edition by Raghunandan M H (14 April 2018).

3. Planning and Managing Projects with PRIMAVERA (P6) Project Planner by P. Vinayagam (Author), A. Vimala (Author)
4. GIS based HEC-HMS and HEC-RAS modeling: A study of Woldiya watershed in Ethiopia Paperback – October 7, 2011 by Paresh Chandra Deka (Author), Nigussie Bekele (Author), Belay Zegeye Abete (Author).

Professional Elective-III

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE3	21CECEP701a	Prestressed Concrete	3	0	0	3
2		21CECEP701b	Ground Water Development & Management	3	0	0	3
3		21CECEP701c	Soil Dynamics and Machine Foundation	3	0	0	3
4		21CECEP701d	Air and Noise Pollution and Control	3	0	0	3

PRESTRESSED CONCRETE SEMESTER -VII			
Subject Code	**21CECEP701a**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 3			

Course Objectives:

This course will enable students to:

1. Explain the basic concept and necessity of prestressed concrete and materials used.
2. Learn the analysis of prestress and load balancing concept and losses of prestress
3. Study the flexural and shear design of prestressed concrete beam sections
4. Know the concepts of deflections and end blocks of prestressed concrete sections.
5. Discuss about composite sections and the design considerations.

Unit-1	
Introduction: Historic development – General principles of prestressing Pre-tensioning and post tensioning – Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel their characteristics. I.S.Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System. **Analysis of PSC:** Basic Assumptions in Analysis of prestress and design, Analysis of prestress (force & stress concepts), Resultant Stresses at a section- pressure line-Concepts of load balancing- Stresses in Tendons, Cracking moment.	**Hours – 10**
Unit -2	
Losses of prestress: Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses. Analysis of sections for flexure; Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons.	**Hours – 10**
Unit – 3	
Design of sections for flexure and shear: Allowable stress, Design criteria as per I.S. Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses – design for shear in beams – Kern – lines, cable profile-PT slabs.	**Hours – 10**
Unit – 4	
Deflections: Necessity of deflection estimation, limitations of deflections. Deflections of pre- stressed concrete beams with uniformly distributed and point loads. **Analysis of end blocks**: Types of end blocks and Importance of end block, Analysis and design of end block by Guyon method and IS method -Approximate design of End block-for not more than two cables- Anchorage zone stresses- Anchorage zone reinforcement – Transfer of prestress in pretensioned members.	**Hours – 10**
Unit – 5	
Composite section: Introduction – Analysis of stress – Differential shrinkage – General designs considerations – Shear connectors.	**Hours – 10**

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the concept of prestressing and determine the losses of prestress.
2. **Analyze** the prestressed concrete beam and suggest the cable profile for beam.
3. **Evaluate** the prestressed concrete beam for flexure and shear.
4. **Apply** skills to satisfy the serviceability and strength provisions of the Indian Standards (IS: 1343- 2012).
5. **Examine** the principles of design of composite sections and their advantages.

TEXT BOOKS

1."Prestressed Concrete" by Krishna Raju,6th Edition Tata McGraw Hill Education (28 April 2018).

2. "Prestressed Conc rete" by N. Rajagopalan, 2nd Edition, Narosa publications. (1 January 2010).

REFERENCES

1"Prestressed Concrete" by Ramamrutham, 5th Edition, Dhanpatrai Publications (2013).

2. "Design of Prestressed concrete structures (Third Edition)" by T.Y. Lin & Ned H.Burns. (7 September 2010).

3. Prestressed Concrete: A Fundamental Approach by Dr. Edward G. Nawy P.E. (Author)

IS Codes:

IS:1343 (2012) - Code for Practice for Prestressed Concrete..

Online Resources

1. https:// nptel.ac.in/courses/105/106/105106118/
2. https:// nptel.ac.in/courses/105/106/105106117/

GROUNDWATER DEVELOPMENT AND MANAGEMENT SEMESTER- VII			
Subject Code	**21CECEP701b**	Internal Marks	30
No. of Lecture Hours/Week	03	Exam. Marks	70
Total Number of Lecture Hours	50	Exam. Hours	03
Credits-03			

Course Learning Objectives

This course will enable students to:

1. Recognize groundwater as an important natural resource.
2. Understand flow towards wells in confined and unconfined aquifers.
3. Understand the principles involved in the design and construction of wells.
4. Create awareness on improving the groundwater potential using various recharge techniques.
5. Know the importance of saline water intrusion in coastal aquifers and its control measures.
6. Understand groundwater modelling.

Unit-1	
Introduction: Groundwater in the hydrologic cycle, origin of groundwater, groundwater occurrence, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, aquifer parameters, porosity, Specific yield and Specific retention, Permeability, Darcy's law, storage coefficient, Transmissivity, the differential equation governing groundwater flow in the three-dimensional derivation. **Well Hydraulics** Steady groundwater flow towards a well in confined and unconfined aquifers – Dupit's and Theism's equations, Assumptions, Formation constants, and the yield of an open well.	**10 Hours**
Unit-2	
Well Design Water wells, Open well, Advantages and disadvantages of open wells, Tube well, Advantages and disadvantages of tube wells, Types of wells, Screen well, Cavity well, Water well design-well diameter, well depth, Design of well screen-screen length, slot size, screen diameter and screen selection, screen material, Design of gravel pack, design criteria, Design of collector wells, Infiltration gallery, Yield of infiltration gallery.	**10 Hours**
Unit-3	
Well Construction and Development Drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open-hole, bail-down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.	**10 Hours**
Unit-4	
Artificial Recharge Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge, recharge through open channels and reservoirs. Saline Water Intrusion Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of the interface, control of saline water intrusion.	**10 Hours**

Unit-5	
Ground Water Modeling and Management Introduction to Ground Water Modeling, Basic Principles of Ground Water Modeling, Types of Ground Water Models-Conceptual, Physical, Analogue, and Mathematical Models, Modeling process, Concepts of groundwater management.	**10 Hours**
Course outcomes: On successful completion of this course, students will be able to 1. Estimate aquifer parameters and yield of wells and Analyse radial flow towards wells in confined and unconfined aquifers. 2. Understanding well-design specifications 3. Understand well construction practices. 4. Determine the process of artificial recharge for increasing groundwater potential and understanding saline water intrusion in coastal aquifers and its control measures 5. Understanding groundwater models and applying appropriate measures for groundwater management.	
Text. Books 1. 'Groundwater' by Raghunath H M, New Age International Publishers, 2021. 2. 'Groundwater Hydrology 'by Todd D.K., Wiley India Pvt Ltd., 2021.	
REFERENCES: 1.'Groundwater Assessment and Management by Karanth K R, Tata McGraw Hill Publishing Co., 2017. 2.'Groundwater Hydrology by V. C. Agarwal, PHI Learning, 2010.	
Online: 1. https://archive.nptel.ac.in/courses/105/101/105101214/ 2. https://onlinecourses.nptel.ac.in/noc22_ce92/preview 3. https://archive.nptel.ac.in/courses/105/105/105105042/	

SOIL DYNAMICS AND MACHINE FOUNDATION SEMESTER – VII			
Subject code	**21CECEP701c**	Internal Marks	30
Number of Hours/Week	3	External Marks	70
Total Number of Lecture hours	50	Exam Hours	03
Credits -03			

Course Objectives:

This course will enable students to:

1. Understand the fundamental behavior of geotechnical structures under dynamic loading.
2. Understand the theories of vibration analysis.
3. Conduct various laboratory and filed tests to determine the dynamic soil prosperities.
4. Interpret the various dynamic soil prosperities.
5. Understand the Design the machine foundations.

UNIT-1 **Introduction**: Types of motion- SHM- Fundamental definitions- SDOF systems- Free and forced vibration with and without damping- Types of damping-Equivalent stiffness of springs in series and parallel- Principles of vibration measuring devices- Introduction to two and multi degree freedom systems	**Hours 10**
UNIT-2 Theories of Vibration Analysis- EHS Theory and lumped parameter model- Different modes of vibration- Natural frequency of foundation soil system – Barkan and IS methods – Pressure bulb concept.	**Hours 10**
UNIT-3 Dynamic properties of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes- Reisner Theory – Limitations of Reisner theory – Sung's solutions -Pauw's Analogy – Heigh's Theory.	**Hours 10**
UNIT-4 Stress waves in bounded elastic medium- Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests.	**Hours 10**
UNIT-5 Machine Foundations: Classification based on the type of dynamic force and structural form, design data, design criteria, foundations for reciprocating, impact and high speed machined like turbo generators- IS code provisions for the design of the same	**Hours 10**

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand the fundamental behavior of geotechnical structures under dynamic loading
2. Know the theories of vibration analysis
3. Conduct various laboratory and filed tests to determine the dynamic soil prosperities
4. Interpret the various dynamic soil prosperities
5. Design the machine foundations

TEXT BOOKS:

1. Vibrations of Soils and Foundations – Richart Hall and Woods
2. Vibration Analysis and Foundation Dynamics, NSV Kameswara Rao, Wheeler Publishing, New Delhi.

3. Fundamentals of Soil Dynamics- B M Das

REFERENCES:

1. Foundations of Machines- Analysis and Design- Prakash and Puri
2. Analysis and design of Foundations for Vibrations- P J Moore
3. Dynamics of bases and Foundations- D D Barkar

AIR, NOISE POLLUTION AND CONTROL SEMESTER – VII			
Subject Code	21CECEP701d	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Know the analysis of different air pollutants.
2. Know the Thermodynamics and kinetics of air pollution
3. Understand Air quality management and Emission standards
4. Understand the control of Air Pollution
5. Understand the Noise pollution, Noise standards and Control

Unit -1 Introduction	
Air pollution, samples and analysis of pollutants, Conversion of ppm in $\mu g/m^3$, Definition of terms related to air pollution and control, secondary air pollutants-indoor air pollutants-climatic change and its impact –carbon trade.	**Hours – 10**
Unit -2 Thermodynamics and kinetics of air pollution	
Thermodynamics and kinetics of air pollution: Application in the formation of gases like SO_X, NO_X, CO and HC-Air fuel ratio- Computation and control of products of combustion, automobile pollution, and flares.	**Hours – 10**
Unit – 3 Ambient Air Quality Management	
Ambient Air Quality Management: Monitoring of SPM, SO_2, NO_X and CO-Stack monitoring for flue gases-micro meteorological monitoring –weather station-Emission standards- Gaussian model and fume dispersion.	**Hours – 10**
Unit – 4 Air pollution control	
Air pollution control-Control OF NO_X & SO_X emissions-Control of particulates-control at sources, process changes, Equipment modification, design, operation of control equipment's, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators	**Hours – 10**
Unit – 5 Noise pollution and control	
Noise pollution and control: Noise standards, Measurement and control methods-Reducing and residential and industrial noise-ISO-14000 series	**Hours – 10**

Course outcomes:

On successful completion of this course, students are able

1. Judge the ambient air quality based on the analysis of air pollutants
2. Understand the thermodynamics and kinetics of the pollutants.
3. Understand the flume behavior in a prevailing Environmental condition
4. Apply particulate and gaseous control measures for an industry
5. Describe the noise pollution measures to be taken to control the noise pollution.

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, Laxmi Publications, New Delhi,2015
2. Air Pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Company, hard cover picture book 2017
3. National ambient air quality standards NAAQS 2019. https://cpcb.nic.in/upload/NAAQS_2019.pdf

Reference Books:

1. An Introduction to Air pollution, R. K. Trivedy and P.K. Goel, B.S. Publications, second edition 2017
2. Air Pollution by K L Doren, CBS Publications, ISBN 9788123929019, first edition 2015
3. Environmental Science and Engineering by Dr. Suresh, S. K. Dhameja, S K Kataria publications, 2013

Online resources:

1. https://archive.nptel.ac.in/courses/105/107/105107213/

Professional Electives -IV

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE4	21CECEP702a	Solid Waste & Hazardous Waste Management	3	0	0	3
2		21CECEP702b	Ground Improvement Techniques	3	0	0	3
3		21CECEP702c	Hydraulic Structures	3	0	0	3
4		21CECEP702d	Bridge Engineering	3	0	0	3

SOLID AND HAZARDOUS WASTE MANAGEMENT SEMESTER – VII			
Subject Code	**21CECEP702a**	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Impart the basic knowledge of solid waste management.
2. Know the various methods solid waste collection.
3. Knowledge about waste minimization.
4. Study the design and operation of solid waste disposal.
5. Understand the hazardous waste management techniques.

Unit -1 Introduction to Solid Waste Management	
Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste - Factors Influencing generation of solid waste - sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities, Terms related ISWM like WTE, ULB, TLV etc..	**Hours – 10**
Unit -2 Basic Elements in Solid Waste Management	
Basic Elements in Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Type and methods of waste collection systems, analysis of collection system - optimization of collection routes– alternative techniques for collection system.	**Hours – 10**
Unit – 3 Transfer, Transport and Transformation of Waste	
Transfer, Transport and Transformation of Waste: Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements. Unit operations used for separation and transformation: shredding - materials separation and recovery, source reduction and waste minimization. Warm composting, vermin composting	**Hours – 10**
Unit – 4 Disposal of Solid Waste	
Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation. Case studies.	**Hours – 10**
Unit – 5 Hazardous Waste Management	
Hazardous Waste Management: sources, collection, transport, treatment and disposal methods. Incineration, Biomedical waste management, e-waste management and nuclear waste management.	**Hours – 10**

Course outcomes:

On successful completion of this course, students will be able to

1. Understand the different solid waste management techniques.
2. Choose appropriate method of solid waste collection.
3. Suggest the solid waste minimization technique.
4. Design the solid waste management method.

5. Suggest the appropriate hazardous waste management technique.

Text Books:

1. Solid and Hazardous Waste Management PM Cherry, CBS Publishers and Distriburs. New Delhi, 2016
2. Solid Waste Engineering, William A Worrell, P Aarue Vesilind, Cengage Learning, New Delhi 2016.
3. Hazardous Waste Management, Charles A. Wentz, McGraw Hill Publication, 1995

Reference Books:

1. Integrated Solid Waste Management, George Techobanoglous, McGraw Hill Publication, 1993.
2. Solid Waste Engineering, Vesilind, P.A., Worrell, W., Reinhart, D., Cenage learning, New Delhi, 2004.

Online resources:

1. https://archive.nptel.ac.in/courses/105/106/105106056/

GROUND IMPROVEMENT TECHNIQUES SEMESTER -VII			
Subject code	21CECCEP702b	Internal Marks	30
Number of Hours/Week	3	Exam Marks	70
Total Number of Lecture hours	50	Exam Hours	3
Credits -03			

Course Objectives:

The objectives of this course are:

1. Study modification of granular and cohesive soils
2. Study modification of soils by by Dewatering, and Grouting.
3. Study ground modification by various stabilization and grouting methods
4. Know how geosynthetics can be used to improve the engineering performance of soils.
5. Understand how the reinforced earth technology and can obviate the problems posed by the conventional retaining walls.

UNIT- I **In situ densification methods:** In-situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth; in situ densification of cohesive soils – pre loading, sand drains, pre-fabricated vertical drains, vertical and radial consolidation, stone columns, lime column.	**Hours 10**
UNIT -II **Dewatering:** Sumps and interceptor ditches, single and multi-stage well points, vacuum well points, horizontal wells, criteria for choice of filler material around drains, electro osmosis.	**Hours 10**
UNIT- III **Stabilization of soils:** Methods of soil stabilization – mechanical, cement, lime, bitumen; Grouting – objectives of grouting, grouts and their applications, methods of grouting, stage of grouting.	**Hours 10**
UNIT- IV **Geosynthetics:** Types of geosynthetics**,** functions of geotextiles, Use of geosynthetics for filtration and drainage, Use of geosynthetics in roads, geosynthetics in landfills.	**Hours 10**
UNIT- V **Reinforced earth:** Mechanism of reinforced soil, components of reinforced earth, design principles of reinforced earth walls, Retaining walls with metallic strip,	**Hours 10**

geotextile and geogrid reinforcements, Geosynthetics for reinforced embankments, geotextiles for in situ slope stabilization.	

Course Outcomes:

At the end of the course the student will be able to:

1. Suggest a suitable method for In-situ densification of cohesive and cohesionlesss soils
2. Study the importance and need for dewatering methods.
3. Suggest ground modification by various stabilization methods
4. Understand how geosynthetics can be used to improve the engineering performance of soils.
5. Understand how the reinforced earth technology can obviate the problems posed by the conventional retaining walls.

TEXT BOOKS:

1. Engineering Principles of ground modification by MR Hausmann, McGraw-Hill, 1st edition, January, 1990.
2. Designing with Geosynthatics by Robert M. Koerner, 6th Edition, Prentice Hall, 2016.
3. Ground Improvement Techniques by Nihar Ranjan Patra, Vikas Publishing House Pvt Ltd, 2012.

REFERENCES:

1. 'An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press,2006
2. Ground improvement Techniques, P.Purushothama Raju, Laxmi Publications, 2nd Edition, January, 2016

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/105/105/105105210/

HYDRAULIC STRUCTURES SEMESTER –VII			
Subject Code	21CECEP703c	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable Students to:

1. Demonstrate and understanding of advanced fluid mechanics principles and get a knowledge of various types of dam.
2. Understand the different elements of a dam and the Implementation of geotechnical engineering principles.
3. Analyze seepage through dams
4. Be able to integrate relevant concepts and methodologies in the area of hydraulics, hydrology and geotechnical engineering.
5. Understand dam outlet works

Unit -1	**Hours**
Elements of dam engineering: Introductory perspectives, Embankment types and Characteristics- Concrete dams and characteristics- Spillways and ancillary works – site assessment and selection of a type of dam, galleries.	**10**
Unit -2	
Embankment dam engineering: Nature and classification of soil-engineering characteristics of soil, principles of design – Material and construction. **Seepage through Dams:** Internal seepage – Stability and stresses, Settlement and deformation in rock fill embankments	**10**
Unit – 3	
Concrete dam engineering: Loading -Concepts and criteria, Gravity dam analysis design features and stability elementary profile of gravity dam-Concrete for dams – roller compacted concrete gravity dams	**10**
Unit – 4	
Dam outlet works: Spillways – Ogee spillway - cavitations on spillway – design feature- design principles and design of spillways – Chute spillways – Energy dissipation – stilling basins – plunge pools	**10**
Unit – 5	
Drop Structures: Sarda fall – Glacis fall –Design principles- Cross regulator, head regulator and function.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Selection of hydraulic structural elements.
2. Explain the selection of type of dam, design and to construct and analyse seepage through dams
3. Explain relevant concept and methodologies in the area of hydraulics, hydrology and

geotechnical engineering.

4. Know dam outlet works
5. Design hydraulic structures

Text Books:

1. Arora, K.R., Irrigation, Water Power and Water Resources Engineering, Standard Publishers, Distributors, Delhi, 2019.
2. Modi, P.N., Introduction to Water Resources and Waterpower Engineering, Standard Publication, Delhi, 2019.

Reference Books:

1. Garg, S.K., Irrigation Engineering and Hydraulic Structures Khanna Publishers, 2023.
2. Irrigation Engineering and Hydraulic Structures by Dr. S.K. Sharma, S Chand Publishing, 2017.

Codes:

1. IS 457: 1957, Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
2. IRC: SP:13-2004, Guidelines for design of small bridges and culverts.
3. IS 6531: 1994 Canal Head Regulators - Criteria for Design
4. CBIP- Publication No 179-1985, Manual on Barrages and weirs on Permeable foundations.
5. CBIP- Publication No 12-1981, Design of weirs on Permeable foundations.
6. IS 4997: 1968 Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron.
7. IS 12720: 2004 Criteria for Structural Design of Spillway Training Walls and Divide Walls
8. IS 13195: 1991 Preliminary design, operation and maintenance of protection works downstream of spillways - Guidelines.
9. IS 10210: 1993 Criteria for Design of Hydraulic Hoists for Gates

Online Resources

https://www.vssut.ac.in/lecture_notes/lecture1424715569.pdf
https://archive.nptel.ac.in/courses/105/105/105105110/

Bridge Engineering SEMESTER –VII			
Subject Code	**21CECEP702d**	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Learn General features of various Types of Bridges, selection of Bridge Site, Planning, Basics of selecting Bridge Super structure and loads to be considered in Design of Highway Bridges.
2. Learn about how to Decide no. of Lanes and clearances and Design of Slab culverts
3. Study the Design of Deck slab T-beam Bridges and learn the basics of long span bridges
4. Study the Design of Plate girders, Shear Connectors in Composite bridges and Elastomeric bearings
5. Study the Design of Abutments and Piers and bridge foundation

Unit -1	**Hours**
General features of Road bridges Investigations for Bridges: Components of bridges and various definitions, Classification and general features of different types of bridges, Planning of bridges, Collection of Data, Effective Linear water way, Economical span, Afflux, Freeboard, vertical clearance, kerbs, Choice of bridge type, Width of carriage way, Clearances. **Loads on Bridges**: : Different types of loads and their combinations considered for the design of Roadway bridges super structures	**10**
Unit -2	
General Design considerations: Traffic aspects of highway bridges, aesthetics, relative costs of bridge components **Analysis and Design of Culverts**: Effective width and Effective Length of dispersion of vehicular Loads, Analysis of solid slab, voided slab and skew slab culverts, Design principles of Box culverts, determination of design forces	**10**
Unit – 3	
Analysis and Design of Reinforced Concrete T Beam Bridges: Load distribution among longitudinal girders according to (i) Courbon's method, (ii) Guyon & Massonet method, and (iii) Hendry Jaegar method, Analysis of longitudinal girders and cross beams **Introduction to Long span bridges**; Introduction to Prestressed concrete, balanced concrete, cable stayed, steel truss bridges	**10**
Unit – 4	
Design of Steel Bridges: Fatigue strength of steel, design plate girders with lateral bracings, Design of composite bridges with various types of shear, Connectors **Design of bearings**: Types of bearings, design of elastomeric pad bearings	**10**
Unit – 5	

Design of Bridge Piers & Abutments: Design of Pier & Abutment Caps, Forces acting on Piers & Abutments, design aspects of piers & Abutments Bridge Foundations: Types of foundations, scour depth, Forces considered on Foundation	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Gain knowledge General features of various Types of Bridges, selection of Bridge Site, Planning, Basics of selecting Bridge Super structure and loads to be considered in Design of Highway Bridges.
2. Decide no. of Lanes and clearances and Design of Slab culverts
3. Design the Deck slab T-beam Bridges and learn the basics of long span bridges
4. Design the Plate girders, Shear Connectors in Composite bridges and Elastomeric bearings
5. Design the Abutments and Piers and bridge foundation.

Text Books:

1. "Essentials of Bridge Engineering" by D.J.Victor, 6th Edition, Oxford & IBH Pub, N. Delhi,1 January 2019.
2. "Design of Bridges" by N. Krishna Raju, 5th Edition,Oxford & IBH, N. Delhi, 1 January 2019

Reference Books:

1. "Bridge Engineering "by S. Ponnuswamy,3rd Edition, McGraw Hill Education (20 May 2017).
2. ''Design of Bridge Structures" by T. R. Jagadish & M.A.Jairam,2nd Edition, Prentice Hall of India, N. Delhi. 1 January 2009

Is Codes:

1. SP 13:2004: Guidelines for Design of Small Bridges and Culverts, Special Publication, Indian Road Congress.
2. SP 20:2002: Rural Roads Manual, Special Publication, Indian Road Congress (Chapter 7) SP 64: 2005: Guidelines for the Analysis and Design of Cast-in-place Voided Slab Superstructures, Indian Road Congress.
3. IRC: 5-2015, "Standard Specifications and code of Practice for road bridges: section I-General features of Design", Indian Road Congress.
4. IRC: 6-2017, "Standard Specifications and code of Practice for road bridges: section II-Loads and Stresses", Indian Road Congress, 5th revision.
5. IRC: 112-2011, "Code of Practice for Concrete Road bridges, Indian Road Congress
6. IRC: 24-2010, "Standard Specifications and code of Practice for road bridges: section V-Steel Road Bridges", Indian Road Congress.
7. IRC: 22-2015, "Standard Specifications and code of Practice for Road Bridges: section VI-Composite Construction, Indian Road Congress.

Online sources

1. Bridge Engineering - Course (nptel.ac.in)

Professional Electives V

S.No	Professional Electives	Subject Code	Name of the subject	L	T	P	Cr
1	PE5	21CECEP703a	Contracts, Specifications and Project Management	3	0	0	3
2		21CECEP703b	Railway, Airport Docks and Harbors	3	0	0	3
3		21CECEP703c	Repair and rehabilitation of structures	3	0	0	3
4		21CECEP703d	Earth and rock fill dams	3	0	0	3

CONTRACTS, SPECIFICATIONS AND PROJECT MANAGEMENT SEMESTER – VII			
Subject code	21CECEP703a	Internal Marks	30
Number of Hours/Week	3	External Marks	70
Total Number of Lecture hours	50	Exam Hours	03
Credits -03			

Course Objectives:

This course will enable students to:

1. Estimate the total quantity and analyze rates of materials required for the Construction
2. Understand various functions of construction and safety equipment.
3. Understand the Basics of Contracts
4. Plan the construction activities with different techniques.
5. Understand the concept of project management.

UNIT-1 **Detailed Estimation of Buildings:** using individual wall method and centerline method, Valuation of buildings. Estimation of R.C.C elements, Detailed bar bending schedule, Estimation of cost of materials. **Rate Analysis** – Working out data for various items of work over head and contingent charges. – Standard Schedule of Rates – Rate analysis for different items of work.	**Hours 10**
UNIT-2 **Construction equipment**: Earthwork equipment– Trucks and handling equipment – rear dump trucks - types of compaction rollers- bulldozers –graders – scrapers– draglines - clamshell buckets. **Concreting equipment**: Aggregate crushers -screening of aggregate –concrete mixers – mixing and placing of concrete – consolidating and finishing. **Safety equipment for** RCC, earthwork.	**Hours 10**
UNIT-3 **Contracts:** Types of contracts as per Indian Contract Act 1872., Contract specifications, Contract documents, Conditions of contracts, E.P.C, L.S, International Contracts, FIDIC contract regulations specifications for different items of Building Construction. PPP Mode.	**Hours 10**
UNIT-4 **Techniques of planning - Work Break down Structure -**bar charts – milestone charts – Networks- basic terminology, Sequence of activities, activity on link and activity on node representation. Critical path method CPM. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computation.	**Hours 10**
UNIT-5 **Project Management**: Definition of Projects; Stages of project planning. Coordination –scheduling - monitoring –Cost analysis - updating – allocation of resources- resource leveling.	**Hours 10**

Course Outcomes:

On successful completion of this course, students will be able to:

1. Compute the total quantity and analyze rates of materials required for the Construction
2. Recognize various construction and safety equipment.
3. Describe the Basics of Contracts
4. Relate the construction activities with different techniques.

5. Memorize the concept of project management.

TEXT BOOKS:

1. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016
2. Construction Project Management by Chitkara, 2010.
3. Estimating and Costing by G.S. BirdieDhanpat Rai Publishing Company, 2014.
4. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.
5. Project Management by K.N.Jha, Pearson Education India, 2015.

REFERENCES:

1. A Textbook of Estimating and Costing by R.C.Kohli,S Chand, 2013
2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

Railway, Airport Docks and Harbors SEMESTER -VII			
Subject Code	21CECEP703b	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire design principles of airport geometrics and pavements.
5. To know the planning, construction and maintenance of Docks

Unit -1 Components of Railway Engineering	
Components of Railway Engineering: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.	**Hours – 08**
Unit -2 Geometric Design of Railway Track	
Geometric Design of Railway Track: Alignment – Engineering Surveys – Gradients – Grade Compensation – Cant and Negative, Super elevation – Cant Deficiency – Degree of Curve – safe speed on curves	**Hours – 08**
Unit – 3 Turnouts & Controllers	
Turnouts & Controllers: Track layouts – Switches – Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems – Mechanical signaling system – Electrical signaling system – System for Controlling Train Movement – Interlocking – Modern signaling Installations.	**Hours – 12**
Unit – 4 Airport Planning & Design	
Airport Planning & Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Design of Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.	**Hours – 12**
Unit – 5 Planning, Layout, Construction & Maintenance of Docks & Harbors	

Planning, Layout, Construction & Maintenance of Docks & Harbours: Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts, Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids.	**Hours – 10**

Course outcomes:

On completion of this course, students will be able to

1. Design geometrics in a railway track.
2. Provide good transportation network.
3. Analyzing various techniques for the effective movement of trains Analyse quality of pavement material.
4. Design airport geometrics and airfield pavements.
5. Plan, construct and maintain of Docks. Plan, construct and maintain of Harbors.

Text Books:

1.Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi.2007

2.Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.1999

3.Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.2012

Reference Books:

1.'Railway Engineering 'by Saxena & Arora - Dhanpat Rai, New Delhi.2005

2.'Airport Engineering' by Virendra Kumar, Dhanpat Rai Publishers, New Delhi. 2020

REPAIR AND REHABITATION OF STRUCTURES SEMESTER – VII			
Subject Code	**21CECEP703c**	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

1. Study the Deterioration and distress in structures
2. Study the Mechanisms of degradation in Reinforced concrete
3. Explain the field monitoring and non-destructive evaluation of concrete structures.
4. Discuss the alternative repair strategies for deteriorated concrete structures.
5. Study about the Strengthening of structures.
6. Study about the structural health monitoring

Unit -1	**Hours**
Maintenance and Repair Strategies. Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance. Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes, Mechanism, Effect, preventive measures Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measure	**10**
Unit -2	
Failure of buildings: Definition of building failure-types of failures- Causes of Failures- Faulty Design, Accidental over Loading, Poor quality of material and Poor Construction practices- Fire damage - Various aspects of Inspection, Methodology for investigation of failures-diagnostic testing methods and equipments-repair of cracks in concrete	**10**
Unit – 3	
Non-Destructive Testing- Non-destructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance and Pull out test, Core cutting- Corrosion: Methods for corrosion measurement	**10**
Unit – 4	
Materials for repair and rehabilitation -Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibers- wraps- Glass and Hours Carbon fiber wraps- Steel Plates-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects - Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content - Depth of carbonation	**10**
Unit – 5	

Repair Techniques: Grouting, Jacketing, Shotcreting, extermally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipments, Precautions and Processes Case studies: case studies related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures	**10**

Course Outcomes: Upon successful completion of the course student will be able to

1. Describe the defects and deterioration of structures
2. Apply the Mechanisms of degradation in Reinforced concrete structures.
3. Discuss about repair of structures and evaluate applications.
4. Describe the specific repairs in under water structures and the constraints.
5. Explain about the strengthening of structures.

TEXT BOOKS

1. Concrete Structures-Repair, Rehabilitation and Retrofitting, B.Bhattacharjee, CRS Publishers and Distributors, 2017.
2. Concrete Structures-Protection, Repair and Rehabilitation, R.Dodge Woodson, Elsevier, 2009.
3. Concrete Technology, Santhakumar A.R, Oxford University Press, New Delhi, 2007

REFERENCE BOOKS

1. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt of India Press, New Delhi, 2014.
2. "Defects and Deterioration in Buildings" by Barry Richardson, Consulting Scientist, Winchester, U K. Routledge (30 November 2000)
3. "Acoustic Emission and Related Non-destructive Evaluation Techniques in the Fracture Mechanics of Concrete: Fundamentals and Applications" by Masayasu Ohtsu (1 October 2020) Wood head Publishing.
4. "Non-Destructive Evaluation of Concrete Structures" by Bungey, Woodhead Publishing (4June 2010).

Online Resources

1. https://nptel.ac.in/courses/105/106/105106202/
2. https:// nptel.ac.in/courses/105/105/10510521/

EARTH AND ROCKFILL DAMS SEMESTER – VII			
Subject code	21CECEP703d	Internal Marks	30
Number of Hours/Week	03	External Marks	70
Total Number of Lecture hours	50	Exam Hours	03
Credits -03			

Course Objectives:

This course will enable students to:

1. Design earth and rock fill dams causes of failures
2. Know Prevention techniques for slope failures
3. Determine slope stability
4. Get familiar with slopes Stabilization
5. Design rock fill dams

UNIT-1 Earthen Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction, gradation and requirements, quality monitoring, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.	**Hours 10**
UNIT-2 Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design	**Hours 10**
UNIT-3 Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability.	**Hours 10**
UNIT-4 Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/shotcrete).	**Hours 10**
UNIT-5 Rock fill Dams: Requirements of compacted rock fill, Shear strength of rock fill, Rock fill mixtures, Rock fill embankments, Earth-core Rock fill dams, Stability, Upstream & Downstream slopes.	**Hours 10**

Course Outcomes:

On successful completion of this course, students will be able to:

1. Design earthen dams
2. Know Prevention techniques for slope failures
3. Get familiarity with slope stability calculations
4. Get familiar with slopes Stabilization
5. Design rock fill dams

TEXT BOOKS:

1. Christian, K. Earth & Rock fill Dams – Principles of Design and Construction, CRC Press, 1997.
Estimating and Costing by G.S. BirdieDhanpat Rai Publishing Company

2. Sowers, G.F. – Earth and Rock fill Dam Engineering, Asia Publishing House, 1962

REFERENCES:

1. Bharat Singh and Sharma, H. D. – Earth and Rock fill Dams, 1999
2. Abramson, L. W., Lee, T. S. and Sharma, S. – Slope Stability and Stabilisation methods – John Wiley & sons. (2002)
3. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.

B.Tech. (Civil Engineering)

Semester VIII (Fourth year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21CECER8010	Project work, seminar and internship in industry	0	0	24	12
					Total Credits	12

Open Electives offered by Civil Engineering Department

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	21xxCEOxxxx	Geo-Spatial Technologies	3	0	0	3
2	21xxCEOxxxx	Industrial Waste Water Treatment	3	0	0	3
3	21xxCEOxxxx	Smart Cities	3	0	0	3
4	21xxCEOxxxx	Building Materials	3	0	0	3
5	21xxCEOxxxx	Elements of Civil Engineering	3	0	0	3
6	21xxCEOxxxx	Watershed Management	3	0	0	3
7	21xxCEOxxxx	Air, Noise Pollution and Control	3	0	0	3
8	21xxCEOxxxx	Civil - Engineering societal global impact	3	0	0	3
9	21xxCEOxxxx	Environmental Pollution & Control	3	0	0	3
10	21xxCEOxxxx	Green Buildings	3	0	0	3

GEO-SPATIAL TECHNOLOGIES SEMESTER -			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

1. Understand the various spatial and non-spatial data types, and data base management techniques
2. Develop the concepts and professional skills in utility of geospatial techniques
3. Improve the working knowledge of geospatial techniques in field problems

Unit -1	**Hours**
Introduction – Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. **Projections and Coordinate Systems** – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.	**10**
Unit -2	
Data Acquisition: Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital Elevation Data. **Data Management:** Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.	**10**
Unit -3	
Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System. **GIS Analysis and Functions**: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.	**10**
Unit -4	
Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.	**10**
Unit -5	
Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High-Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management	**10**

Course outcomes:

Upon the completion of this course, the students will be able to:

1. Understand the geospatial technology relating to the data acquiring and processing that is

associated with geographic locations

2. Apply Geospatial techniques in the decision support systems useful for decision makers and community services.
3. Ability to solve the problems related to the natural resource management, environment, urban planning and Infrastructure development, etc.
4. Able to generate the thematic maps using Geospatial techniques
5. Apply the concept of Geospatial Techniques to the Civil Engineering problems

Text Books:

1. Demers, M.N, (2013). 'Fundamentals of Geographic Information Systems' Wiley India Pvt. Ltd,.
2. Burrough, P. A., and McDonnell R. A. (1998). Principles of Geographical Information Systems. Oxford University Press, New York.
3. Kang-tsung Chang. (2006). Introduction to Geographical Information Systems. Tata McGrawHill Publishing Company Ltd., Third Edition, New Delhi.
4. George Joseph, (2013). 'Fundamentals of Remote Sensing' Universities Press.

Reference Books:

1. Sabins F.F. Jr. (1978). Remote Sensing Principles and Interpretations. W.H. Freeman and Company, San Francisco.
2. Tor Bernhardsen. (2002). Geographical Information System. Wiley India (P) Ltd., Third Edition, New Delhi.
3. Hoffman-Wellenhof, B, et al. (1997). GPS Theory and Practice. Fourth Edition, Springer Wein, New York.
4. Lilysand T.M., and Kiefer R.W. (2002). Remote Sensing and Image Interpretation. John Wiley and Sons, Fourth Edition, New York.
5. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). An Introduction to Geographic Information Technology. I.K. International Publishing House (P) Ltd, New Delhi.

INDUSTRIAL WASTE WATER TREATMENT SEMESTER -			
Subject Code	21CExxOxxx	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

This course will enable students to:

1. Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation
2. Understand the industrial process, water utilization and waste water generation
3. Impart knowledge on selection of treatment methods for industrial wastewater
4. Acquire the knowledge on operational problems of common effluent treatment plants.
5. Gain knowledge on different techniques and approaches for minimizing the generation and application of Physico chemical and biological treatment methods for recovery, reuse and disposal of industrial wastewater.

Unit -1	**Hours**
Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastes- Difference between industrial & municipal waste waters - Effects of industrial effluents on sewers and Natural water Bodies.	**12**
Unit -2	
Pre & Primary Treatment - Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction.	**10**
Unit – 3	
Waste Treatment Methods - Nitrification and De-nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process - Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water.	**10**
Unit – 4	
Characteristics and Composition of waste water and Manufacturing Processes of Industries like Sugar, Characteristics and Composition of Industries like Food processing Industries, Steel, and Petroleum Refineries.	**10**
Unit – 5	
Characteristics and Composition of Industries like Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries – Joint Treatment of Raw Industries waste water and Domestic Sewage – Common Effluent Treatment Plants (CETP) – Location, Design, Operation and Maintenance Problems – Economical aspects.	**8**

Course outcomes:

On successful completion of this course, students are able

1. Define and reason about fundamental concepts of waste water treatment
2. Design and conduct experiments and the ability to analyse the data, interpret results and draw conclusions.
3. Design a component, system or process to meet desired needs and imposed constraints.
4. Identify, formulate and solve civil engineering problems
5. Use appropriate modern techniques skills and tools including computer applications, necessary for engineering practice.

Text Books:

1. Metcalf & Eddy, “Wastewater engineering Treatment disposal reuse”, Tata McGraw

Hill, 1991.
2. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, 2000.

Reference Books:

1. M.N. Rao and Dutta – Industrial Waste, 2020.
2. Mark J. Hammer, Mark J. Hammer, Jr., “Water & Wastewater Technology”, Prentice Hall of India, 2012.
3. N.L. Nemerrow –Theories and practices of Industrial Waste Engineering, 1963.
4. C.G. Gurnham –Principles of Industrial Waste Engineering, 1955.

Online resources:

1. http://nptel.ac.in/courses/105106119/36

SMART CITIES SEMESTER -			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

Enables the students to

1. Understand the concept of a smart city
2. Planning and Development of the smart city
3. Understanding the various Intelligent transport systems
4. Understanding the infrastructure management and Policy

Unit -1	**Hours**
Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructuresneed assessment	**10**
Unit -2	
Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.	**10**
Unit -3	
Intelligent transport systems Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	**10**
Unit -4	
Management of water resources and related infrastructure Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.	**10**
Unit -5	
Infrastructure Management system & Policy for Smart city Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city	**10**

Course outcomes:

Upon the completion of this course, the students will be able to:

1. Understand the concept of a smart city
2. Planning and Development of the city
3. Application of the various Intelligent transport systems to smart city
4. Learn about the managing of water resources and infrastructure
5. Improve the infrastructure, management and Policy making in smart cities

Text Books:

1. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li, 2012.
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions andCities) by Nicos Komninos, 2014.
3. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend, 2013.

Reference Books:

1. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
2. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997
3. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

BUILDING MATERIALS SEMESTER -			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

1. Initiating the student with the knowledge of basic building materials and their properties
2. Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
3. The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
4. Imparting the students with the techniques of formwork and scaffolding
5. The students should be exposed to classification of aggregates, moisture content of the aggregate.

Unit -1 Introduction	**Hours**
Stones, Bricks and Tiles Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials	**10**
Unit -2 Masonry	
Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium	**10**
Unit – 3 Lime and Cement Lime	
Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete.	**10**
Unit – 4 Building Components	
Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre-fabricated roofs	**10**
Unit-5 Finishings	
Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.	**10**

Course outcomes:

On completion of this course, students are able to

1. Identify different building materials and their importance in building construction.
2. Differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.

3. Importance of building components and finishings.
4. Classification of aggregates, sieve analysis and moisture content usually required in building construction.
5. Understand the role of different floors, paints, Damp Proofing, structural elements

TEXT BOOKS

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd, 2012.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd, 2013.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd, 2016.
4. Building Construction, B.C. Punmia, Laxmi Publications (p) ltd, 2016.

REFERENCES

1. Building Materials, S. K. Duggal, New Age International Publications, 2012.
2. Building Materials, P. C. Verghese, PHI learning (P) ltd, 2015.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction, P. C. Verghese, PHI Learning (P) Ltd, 2017.

ELEMENTS OF CIVIL ENGINEERING SEMESTER -			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

Enables the students to

1. To Understand the basic concepts in Civil Engineering.
2. To Understand the concepts of surveying, elevations and mapping.
3. To expose the students to the various construction materials and elements
4. To Understand the concepts of Building Planning & Building Construction and
5. To Understand the concepts of water resource development.

Unit -1	**Hours**
Scope of Civil Engineering: Introduction: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management. **Introduction to Surveying:** Surveying and levelling, Object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.	**10**
Unit -2	
Elevation measurements: Levelling, object and uses, terms used in levelling, levelling instruments, methods of levelling. Modern Tools of Surveying and Mapping: Introduction to Theodolite, Electronic Distance Measurement Instruments, Total Station, Global Positioning System, Remote Sensing and Geographic Information System.	**10**
Unit -3	
Construction Materials: Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass , Plastic, Conducting, Magnetic, and Miscellaneous Materials.	**10**
Unit -4	
Elements of Building Planning: Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings. **Building Construction:** Classification of buildings based upon occupancy and structure, Design Loads, Common building components	**10**
Unit -5	
Water Resources Development: Elementary Hydrology, Sources of water, Watershed Development, water requirements and its conservation, Hydraulic Structures of Storage, Water Conveyance System: Canals; Water Conduits.	**10**

Course outcomes:

Upon the completion of this course, the students will be able to:

1. Realize Civil Engineering concepts
2. Comprehend the concepts of the surveying, elevations and mapping.
3. Realize The construction materials and elements
4. Be Familiar with concepts of Building Planning and Construction
5. Realize the concepts of Water resource development

Text Books:

1. Surveying Vol. I & II, Dr. B. C. Punamia Laxmi Publication, Delhi, 2016.
2. Building Construction, Dr. B. C. Punamia Laxmi Publication, Delhi, 2016.
3. Engineering Material, Dr. S.C. Rangwal, Charotar Pub. House
4. Irrigation Engineering and Hydraulic Structures, Santoshkumar Garg, : Khanna Publishers Delhi

Reference Books:

1. Civil Engineering Material, Jakson and Dhir, ELBS Publishing London, 1997
2. Civil Engg. Drawing, S. C. Rangwal, Charotar Pub. House Anand

WATERSHED MANAGEMENT SEMESTER-			
Subject Code	21xxCEOxxxx	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives: This course will enable students

1. To introduce the concept of watershed management.
2. To understand the watershed characteristics.
3. To learn the principles of soil erosion and measures to control erosion
4. To appreciate various harvesting techniques
5. To learn land management practices for various land use /land cover.
6. To introduce the concept of watershed modelling.

Unit -1	**Hours**
Introduction: concept of watershed development-objectives of watershed development, need for watershed development, characteristics of watershed: size, shape, physiography, slope, climate, drainage. land use, vegetation, geology and soils, hierology and hydrogeology, socioeconomic characteristics.	**10**
Unit -2	
Principles of erosion: types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion, universal soil loss equation, measures to control erosion, contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock fill dams, brush wood dam, Gabion.	**10**
Unit – 3	
Water harvesting: techniques of rain water harvesting, rain water harvesting from roof top, surface flow harvesting, sub surface flow harvesting, stop dams , form ponds and dug out ponds, percolation tanks.	**10**
Unit – 4	
Land management: land use and land capability, classification and management of forest, agriculture, grass land and wild land, land grading operation, reclamation of saline and alkaline soils.	**08**
Unit – 5	
Watershed modelling: Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models, integrated and multidisciplinary approach for watershed management.	**12**

Course outcomes:

On completion of this course, students are able to

1. Calculate watershed parameters and analyze watershed characteristics to take appropriate management action.
2. Quantify soil erosion and design control measures.
3. Apply land grading techniques for proper land management.
4. Suggest suitable harvesting techniques for better watershed management.
5. Apply appropriate watershed models for watershed management.

Text Books:

1. Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2. 'Land and Water Management' by Murthy.VVN, Kalyani Publications, 2007.
3. 'Watershed Management' by Murthy J V S, New Age International Publishers, 2006.

Reference Books:

1. ‘Water Resource Engineering’by Wurbs R A and James R A, Prentice Hall Publishers, 2002.
2. ‘Watershed Hydrology’ by Black P E, Prentice Hall, 1996.

AIR, NOISE POLLUTION AND CONTROL SEMESTER –			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

This course will enable students to:

1. Know the analysis of different air pollutants.
2. Know the Thermodynamics and kinetics of air pollution
3. Understand Air quality management and Emission standards
4. Understand the control of Air Pollution
5. Understand the Noise pollution, Noise standards and Control

Unit -1	**Hours**
Air pollution: samples and analysis of pollutants, Conversion of ppm in µg/m^3, Definition of terms related to air pollution and control, secondary air pollutants-indoor air pollutants-climatic change and its impact –carbon trade.	**12**
Unit -2	
Thermodynamics and kinetics of air pollution: Application in the removal of gases like SO_X, NO_X, CO and HC-Air fuel ratio- Computation and control of products of combustion, automobile pollution, and flares.	**10**
Unit – 3	
Ambient Air Quality Management: Monitoring of SPM, SO_2, NO_X and CO-Stack monitoring for flue gases-micro meteorological monitoring –weather station-Emission standards- Gaussian model and fume dispersion.	**10**
Unit – 4	
Air pollution control: Control OF NO_X & SO_X emissions-Control of particulates-control at sources, process changes, Equipment modification, design ,operation of control equipments, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators	**10**
Unit – 5	
Noise pollution and control: Noise standards, Measurement and control methods-Reducing and residential and industrial noise-ISO-14000 series	**8**

Course outcomes:

On successful completion of this course, students are able

1. Judge the ambient air quality based on the analysis of air pollutants
2. Apply particulate and gaseous control measures for an industry
3. Understand the flume behavior in a prevailing Environmental condition
4. Describe the noise pollution measures to be taken to control the noise pollution.
5. Select the proper noise control measures

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, Laxmi Publications, New Delhi,2015
2. Air Pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Company.

Reference Books:

1. An Introduction to Air pollution, R. K. Trivedy and P.K. Goel, B.S. Publications.
2. Environmental Science and Engineering by S.K.Dhameja

Online resources:

1. https://archive.nptel.ac.in/courses/105/107/105107213/

CIVIL ENGINEERING - SOCIETAL & GLOBAL IMPACT SEMESTER -			
Subject Code	21xxCEOxxxx	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:

This course will enable students to:

1. Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
2. Awareness of the impact of Civil Engineering for the various specific fields of human endeavor
3. Need to think innovatively to ensure Sustainability

Unit -1	**Hours**
Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.	**10**
Unit -2	
Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy), Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;"	**10**
Unit – 3	
Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationary and non- stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	**10**
Unit – 4	
Built environment – Facilities management, Climate control; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures	**10**
Unit – 5	
Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects, Innovations and methodologies for ensuring Sustainability during Project development"	**10**

Course Outcomes: after completion of this course students will able to.

1. Understand the role of Civil Engineering in Modern World
2. Understand various constructional Infrastructure and their importance in present environment
3. Interpret modern transportation systems and their advantages

4. Effect of global Warming and mitigation measures
5. Understand the importance of Sustainability and Reduction of Green House Gas Emissions

TEXT BOOKS

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economic and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

REFERENCES

1. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
2. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
3. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
4. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014

ENVIRONMENTAL POLLUTION & CONTROL SEMESTER –			
Subject code	21xxCEOxxxx	Internal Marks	30
Number of Hours/Week	03	Exam Marks	70
Total Number of Lecture hours	50	Exam Hours	3

Credits -03

Course Objectives: This course will enable students to:

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution, and solid waste management.
2. Provide basic knowledge on waste water management.
3. Provide basic knowledge on solid waste management.
4. Introduces some basics of sanitation methods essential for protection of community health.
5. Differentiate the solid and hazardous waste based on characterization

Unit- I Air Pollution and Noise Pollution	**Hours**
Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. **Noise Pollution**: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.	**10**
UNIT–II Industrial Wastewater Management	
Industrial Wastewater Management: – Strategies for pollution control - Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants - Recirculation of industrial wastes – Effluent standard	**10**
UNIT–III Solid Waste Management	
Solid Waste Management: Solid waste characteristics – basics of on-site handling and collection separation and processing - Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.	**10**
UNIT–IV Environmental Sanitation	
Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low-cost waste disposal methods	**10**
UNIT-V Hazardous Waste Management	
Hazardous Waste Management: Characterization - Nuclear waste – Biomedical wastes – Electronic wastes - Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.	**10**

Course outcomes:

By the end of successful completion of this course, the students will be able to:

1. Identify the air pollutant control devices
2. Have knowledge on the NAAQ standards and air emission standards
3. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods.
4. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
5. Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.

TEXT BOOKS:

1. Air Pollution and Control, K V S G Murali Krishna, Laxmi Publications, New Delhi 2015.
2. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003.
3. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education, 1996.
4. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing, 2012.

REFERENCES:

1. Air Pollution and Control by M.N. Rao & H.N. Rao, 2017.
2. Solid Waste Management by K. Sasi Kumar, S.A. Gopi Krishna. PHI New Delhi, 2013.
3. Environmental Engineering by Gerard Kiley, Tata McGraw Hill.
4. Industrial Water Pollution Control by Nemerow Jr., McGraw Hill Publishing, 1999.
5. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard – Cengage Learning.
6. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
7. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

Online resources:

1. https://archive.nptel.ac.in/courses/123/105/123105001/

GREEN BUILDINGS			
Subject Code	21xxCEOxxxx	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits –03

Course Objectives:

Enable the students to

1. Know the green building and green energy building materials.
2. Familiarize with different rating agencies and features of green buildings.
3. Understand the term sustainability and sustainable development.
4. Learn sources of greenhouse gases and its impact on climate.
5. Understand and Plan land use confirming to zonal regulations

Unit -1	**Hours**
INTRODUCTION What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building	**10**
Unit -2	
GREEN BUILDING CONCEPTS AND PRACTICES Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,	**10**
Unit – 3	
SUSTAINABILITY Introduction, Human development index, Sustainable development and social ethics, definitions of sustainability, populations and consumptions	**10**
Unit – 4	
THE CARBON CYCLE AND ENERGY BALANCES Introduction, Climate science history, carbon sources and emissions, The carbon cycle, carbon flow pathways, and repositories, Global energy balance, Global energy balance and temperature model, Greenhouse gases and Effects, Climate change projections and impacts	**10**
Unit-5	
SUSTAINABILITY AND BUILT ENVIRONMENT Introduction, Land use and land cover change, Land use planning and its role in sustainable development-Zoning and land use planning, smart growth, Environmentally sensitive design- low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings	**10**

Course outcomes:

On completion of this course, students are able to:

1. Describe green buildings and green building materials.
2. Acquaint with different rating agencies and energy features of green buildings.
3. Understand the term sustainability and sustainable development.
4. Recognize sources of greenhouse gases emissions and its impact on climate.
5. Plan land use confirming to zonal regulations.

TEXT BOOKS

1. Standard for the Design of High-Performance Green Buildings by ASHRAE, 2014.
2. Engineering Applications in Sustainable Design and Development By Bradley A.Striebig, Adebayo A.Ogundipe and Maria Papadakis. First edition, 2016, CENGAGE Learning.

REFERENCES

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
3. IGBC - Smart Cities & Green Building Concept in India

Honors

S.No	Honors	Subject Code	Name of the subject	L	T	P	Cr
1	POOL I		Finite Element Methods	4	0	0	4
2			Earthquake Resistant Design of Structures	4	0	0	4
3			Advanced Structural Design	4	0	0	4
4			Bridge engineering	4	0	0	4
1	POOL 2		Rock Mechanics	4	0	0	4
2			Foundation Engineering	4	0	0	4
3			Advanced Foundation Engineering	4	0	0	4
4			Earth and Rock Fill Dams	4	0	0	4
1	POOL 3		Highway Engineering	4	0	0	4
2			Pavement Analysis design	4	0	0	4
3			Intelligent transport systems	4	0	0	4
4			Traffic Engineering and Management	4	0	0	4
1	POOL 4		Environmental Laws and Policy	4	0	0	4
2			Environmental Change and sustainable development	4	0	0	4
3			Physico-Chemical Processes for Water and Wastewater Treatment	4	0	0	4
4			Environmental Impact Assessment and Management	4	0	0	4

Honors
POOL-1

FINITE ELEMENT METHODS SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Describe about the various approximation methods
2. Explain about the stress and strain concept.
3. Study about the Finite element formulation of the truss element.
4. Explain about the Finite element formulation of the beam elements
5. Describe about the Finite element formulation for plane stress and plane strain problems and Study about the numerical techniques

Unit -1	**Hours**
Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh –Ritz method of functional approximation. Principles of Elasticity: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with Axi-symmetric loading.	**10**
Unit -2	
One Dimensional Bar Element: Displacement function &Shape functions for one dimensional element – Stiffness matrix for linear and quadratic bar element - one dimensional bar problem – temperature loading -solution of bars with varying C/s using FE formulation. One Dimensional Beam element: FE formulation of beam element- shape functions -Stiffness matrix for beam element load vector – analysis of continuous beam using FE formulation.	**10**
Unit – 3	
Plane truss: Bar element in 2-D assembly -solution of a Plane truss problem- Transformation matrix Two-Dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models – CST element, LST element- generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates.	**10**
Unit – 4	
Generation of element stiffness and nodal load matrices for 3-node triangular element and four node rectangular elements. Isoparametric formulation: Concepts of isoparametric elements for 2D analysis- 4 –noded and 8-noded iso-parametric quadrilateral elements – Simple problems with CST and LST elements	**10**
Unit – 5	

Axi-symmetric analysis: Basic Principles -Formulation of 3-node Iso-parametric plane strain element, Axisymmetric ring element. Solution techniques: Numerical Integration, Lagrangian and Serendipity elements. Static condensation, assembly of elements and solution techniques for static loads.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Develop constitutive relations in mechanics and formulate equilibrium equations in elasticity
2. Formulate structural mechanics problems by using energy principles and applying Rayleigh -Ritz method.
3. Solve simple structural mechanics problems of one dimension using Numerical technique of Finite element method.
4. Develop finite element formulation of two-dimensional problems and solve them for displacements at nodes.
5. Assemble Stiffness matrices, apply boundary conditions and solve for the displacements in Axi symmetric problem and Explain about the solution techniques.

Text Books:

1. "Finite Elements Methods in Engineering" by Tirupati.R. Chandrupatla and Ashok D. Belegundu ,4th Edition, Pearson Education Publications.
2. "Finite element analysis" by S.S. Bhavikatti, 3rd Edition New age international publishers (1 January 2015).

Reference Books:

1. "Concepts and Applications of Finite Element Analysis" by Robert D.Cook, David S. Malkus and Michael E.Plesha. Jhon Wiley & Sons 4 th Edition (1 January 2007).
2. "Finite Element analysis – Theory & Programming" by C.S.Krishna Moorthy,2nd Edition Tata Mc.Graw Hill Publishers,2007.
3. "Finite element analysis" by P.Seshu, Prentice Hall of India. (1 January 2003)

Online sources

1.Finite Element Method - Course (nptel.ac.in)

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Learn the principles of engineering seismology.
2. Understand the design considerations for regular and irregular shapes of building.
3. Design of earthquake resistant RC building as per IS 1893:2002.
4. Study the behaviour of masonry building under seismic loading.
5. Understand the concepts of Structural and Non-structural Elements and understand the concept of ductility.

Unit -1	**Hours**
Engineering Seismology Earthquake phenomenon- cause of earthquakes-Faults-Plate tectonics- Seismic Waves-Terms associated with earthquakes-Magnitude/Intensity of an earthquake scales-Energy Released-Earthquake measuring instruments-Seismo scope, Seismograph, accelero graph-strong ground motions- Seismic zones of India. Theory of Vibrations: Elements of a vibratory system- Degrees of Freedom-Continuous System-Lumped mass idealization-Oscillatory Motion-Simple Harmonic Motion-Free vibration of single degree of freedom (SDOF) for undamped, damped and critical damping system	**10**
Unit -2	
Conceptual design Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry elongated shapes-stiffness and strength-Horizontal and Vertical Members Twisting of buildings- flexible building systems-choice of construction material sunconfined concrete-confined concrete.	**10**
Unit – 3	
Introduction to earthquake resistant design Seismic design requirements-regular and irregular configurations of plan-basic assumptions-basic load combinations-permissible stresses-seismic methods of analysis. Reinforced Concrete Buildings Principles of earthquake resistant deign of RC members- Structural models for frame buildings as per IS 1893:2002, - Vertical irregularities- Plan configuration problems Determination of design lateral forces- Equivalent lateral force procedure- Lateral distribution of base shear.	**10**
Unit – 4	
Masonry Buildings Introduction- Elastic properties of masonry assemblage-Categories of masonry buildings- Behavior of unreinforced and reinforced masonry walls- Behavior of Box action and bands, Behavior of infill walls-Improving seismic behavior of masonry buildings- Load combinations and permissible stresses- Seismic design requirements Lateral load analysis of	**10**

masonry buildings	
Unit – 5	
Structural and Non-Structural Elements Sectional shape, variations in elevation-cantilever walls without openings – Failure mechanism of non-structures- Effects of nonstructural elements on structural system. Analysis of non-structural elements- Prevention of non-structural damage. Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Ductility-definition-ductility relationships-Impact of Ductility-Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility-Ductile detailing considerations of RC member as per IS 13920. Behavior of beams and columns during Earthquakes.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Know the principles of engineering seismology
2. Understand the behaviour of regular and irregular shaped buildings for lateral loads.
3. Design earthquake resistant buildings as per IS 1893:2002.
4. Understand the behaviour of masonry building under seismic loading.
5. Explain about the behaviour of structural and non-structural elements and Gain the knowledge of ductile detailing consideration of RC member as per IS 13920

Text Books:

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd

Reference Books

3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
4. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros.
5. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial college Press.

Online sources

1. https://nptel.ac.in/courses/105105104

ADVANCED STRUCTURAL DESIGN SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Explain the design steps and technical aspects in the design of cantilever and Counterfort retaining wall with horizontal backfill, shear wall.
2. Elucidate design of flat slabs (Interior panel only).
3. Explain design of RCC circular water tanks resting on the ground.
4. Explain the design of concrete bunkers of circular shape (excluding staging) and brief the difference between bunkers and silos.
5. Explain the design of steel gantry girders.

Unit -1	**Hours**
Design of retaining wall: Design of cantilever and counterfort retaining wall -stability check -with & without surcharge. Shear wall Design: Shear wall design -ductile detailing.	**10**
Unit -2	
Flat slabs: Introduction, Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat Slabs-Check for one way and two-way shears – IS Codal provisions. Design of flat slabs (Interior panel only) & shear walls-ductile detailing.	**10**
Unit – 3	
Water tank: Design principles and IS codal provisions for water tanks, Design principles of underground water tank & overhead circular water tank.	**10**
Unit – 4	
Bunkers & Silos: Design of concrete bunkers of circular shape – Introduction to silos.	**10**
Unit – 5	
Girders: Design specification of steel gantry girders and plate girders as per IS-800	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Understand the loading and design principles involved in retarning walls, shear walls, water tanks, bunkers and silos, gantry girder.
2. Remember the codal provision available in the design of flat slabs, water tanks, plate girder.
3. Analyse the retaining walls and water tanks, gantry girder for the possible forces and perform stability checks.
4. Evaluate the available equations the design of bunkers and silos, gantry girder.
5. Design the retaining wall, plate girder and flat slabs

Text Books:

1. "Advanced R.C.C" by KrishnamRaju, CBS Publishers & distributors, New Delhi 3rd edition 2016.
2. "Structural Design and drawing (RCC and steel) " by KrishnamRaju, Univ.Press , New Delhi 3rd edition 2016.

References:

1. "R.C.C Structures" by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, New Delhi. 1st edition 2015.

BRIDGE ENGINEERING SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Explain the types of bridges and their components.
2. Describe the IS and other codal provisions for loading on bridges
3. Formulate design considerations for RCC and Steel bridges.
4. Design the slab, girder and truss bridges.
5. Analyse sub structure for a bridge and Analyse the long span bridges

Unit -1	**Hours**
Introduction: Definition, components of bridge, classification of bridges, selection of site, economical span, aesthetics consideration, necessary investigations, and essential design data.	**10**
Unit -2	
Standard Specifications for Roads and Railways Bridges: General, Indian Road Congress Bridge Code, width of carriage way, clearance, various loads to be considered for the design of roads and railway bridges, detailed explanation of IRC standard live loads- Railway loading standards	**10**
Unit – 3	
Design Consideration for R. C. C. Bridges: Various types of R.C.C. bridges (brief description of each type), design of R.C.C. slab and T-beam road bridges for IRC loading.	**10**
Unit – 4	
Design Consideration for Steel Bridges: Types of steel bridges (brief description of each), description of truss girder bridges & main elements, their design considerations- IRC &Railway loading.	**10**
Unit – 5	
Sub- Structure Design: Load & stability analysis for Piers, abutments, wingwall and approaches- design specifications. Introduction to Long span bridges and new technologies- relevant design concepts.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Explain the types of bridges and their components.
2. Describe the IS and other codal provisions for loading on bridges.
3. Formulate design considerations for RCC and Steel bridges.
4. Design the slab, girder and truss bridges.
5. Analyse sub structure for a bridge and analyse the long span bridges.

Text Books:

1. “Essentials of Bridge Engineering” by D.J.Victor, 6th Edition, Oxford & IBH Pub, N. Delhi,1 January 2019. 2. “Design of Bridges” by N. Krishna Raju, 5th Edition,Oxford & IBH, N. Delhi, 1 January 2019
1. “Bridge Engineering “by S. Ponnuswamy,3rd Edition, McGraw Hill Education (20 May 2017). 2. ‘’Design of Bridge Structures” by T. R. Jagadish & M.A.Jairam,2nd Edition, Prentice Hall of India, N. Delhi. 1 January 2009
Online sources
1. Bridge Engineering - Course (nptel.ac.in)

Honors
POOL-2

ROCK MECHANICS SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 4			

Course Objectives:

This course will enable students to:

1. Classify rock mass based on field investigation data
2. Select the rock strength parameters for design
3. Suggest suitable tests on rocks for intended purpose
4. Suggest suitable in-situ tests on rocks for intended purpose
5. Select Methods for Improving the Properties of Rock Masses

Unit -1	**Hours**
Introduction and Classification of Rocks: Development of Rock Mechanics: Applications of Rock Mechanics – Rock Vs. Soil: Engineering Classification of intact rock and fissured rocks: Classification based on Structural features – Rock quality Designation Number and Velocity Ratio Methods.	**10**
Unit -2	
Strength and Deformation Behaviour of Rocks: Typical Stress – Strain Curves – Static and Creep Test; Strength of rock – Unconfined Shear Strength and Triaxial Shear Strength of Rocks; Creep behaviour of Rocks	**10**
Unit – 3	
Laboratory Testing of Rock Samples – Factors affecting test results sampling procedure and preparation of specimens; Tensile Tests – Direct, Indirect and Flexural tests; Uniaxial compression test; Unconfined and Triaxial shear tests; Determination of Elastic constants – Pulse generation and Resonant Frequency of a vibrating bar methods.	**10**
Unit – 4	
In-Situ Testing of Rock masses Plate –bearing test, Pressure Tunnel test; Flat Jack Test; Permeability of Rock and rock masses; Pore water pressure in rocks.	**10**
Unit – 5	
Rock Failure Theories; rock fracture and friction; Coulomb – Navier; Mohr's and Griffith Theory and its Modification (General discussion only – derivation of equation not included.)	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Classify rock mass based on field investigation data
2. Select the rock strength parameters for design
3. Suggest suitable tests on rocks for intended purpose
4. Suggest suitable in-situ tests on rocks for intended purpose
5. Select Methods for Improving the Properties of Rock Masses

Text Books:

1. Jaegar, J.C., and Cook, N.G.W. – Fundamentals of Rock Mechanics
2. Stagg, K.C. and Zienkiewicz., O.C – Rock Mechanics in Engineering Practice.

References:

1. Obert, L & Duvall, W.L. – Rock Mechanics and the Design of Structures in Rock.

FOUNDATION ENGINEERING SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 4			

Course Objectives:

This course will enable students to:

1. To impart to the student knowledge of slopes and retaining structures
2. To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
3. To enable the student to compute immediate and consolidation settlements of shallow foundations.
4. To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.
5. To enable the student to imbibe the concepts of Well foundations.

Unit -1	**Hours**
Stability of Slopes: Infinite and finite earth slopes in sand and clay types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Taylor's Stability Number-Stability of slopes of dams and embankments - different conditions.	**10**
Unit -2	
Shallow Foundations – Bearing Capacity Criteria: Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination bearing capacity – factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory - IS Methods.	**10**
Unit – 3	
Settlement Criteria: Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination – allowable settlements of structures	**10**
Unit – 4	
Pile Foundations: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests – Load carrying capacity of pile groups in sands and clays	**10**
Unit – 5	
Well Foundations: Types – Different shapes of well – Components of well – functions – forces acting on well foundations - Design Criteria – Determination of steining thickness and plug - construction and Sinking of wells – Tilt and shift.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. The student must be able to understand the various types of shallow foundations and decide on their location based on soil characteristics.
2. The student must be able to compute the magnitude of foundation settlement to decide the size of the foundation.

3. The student must be able to use the field test data and arrive at the bearing capacity.
4. To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.
5. To enable the student to imbibe the concepts of Well foundations.

Text Books:

1. Principles of Foundation Engineering, Das, B.M., (2011), 6th edition Cengagelearning
2. Basic and Applied Soil Mechanics, GopalRanjan& A.S.R. Rao, New Age International Pvt. Ltd, (2004).

References:

1. Foundation Analysis and Design, Bowles, J.E., (1988), 4th Edition, McGraw-HillPublishing Company, Newyork.
2. Analysis and Design of Substructures by Swami Saran, SaritaPrakashan, Meerut.

ADVANCED FOUNDATION ENGINEERING SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Determine the bearing capacity of shallow foundations for different loading and ground conditions using different methods
2. Understand the Settlement Analysis
3. Understand classification of piles and determine the load carrying capacity of piles by various methods and the pull-out capacity of piles and down drag forces on piles due to negative skin friction.
4. Determine the load carrying capacity of pile groups.
5. Determine the load carrying capacity of laterally loaded piles.

Unit -1	**Hours**
Shallow Foundations –Bearing capacity – Terzaghi, Meyerhof's, Hansen's and Vesic's Bearing Capacity Theories – IS method of Bearing Capacity - Factors - Bearing Capacity of Stratified Soils - Bearing Capacity Based on Penetration Resistances - Safe Bearing Capacity and Allowable Bearing Pressure- Types and choice of type.	**10**
Unit -2	
Settlement Analysis – Elastic settlement in granular soils – Meyerhof's, De Beer and Marten's and Schemertmann'sequations-Elastic settlements of surface and subsurface footing in clays -Skempton and Bjerrum's pseudo three-dimensional approach to consolidation settlement, settlement from in-situ tests. Tolerable settlements.	**10**
Unit – 3	
Pile Foundation -Classification of Piles-Factors influencing - Choice- Load Carrying Capacity of Single Piles in Clays and Sands Using Static Pile Formulae- α - β - and λ - Methods –Dynamic Pile Formulations Pull-out resistance of piles -Meyerhof's, Vesic's equations Negative skin friction in piles	**10**
Unit – 4	
Pile Groups: ---Efficiency of Pile Groups- Different Formulae-Load Carrying Capacity of Pile Groups in Clays and Sands – Settlement of Pile Groups in Clays and Sands – Computation of Load on each Pile in a Group.	**10**
Unit – 5	
Laterally loaded vertical piles - Modulus of sub grade reaction – Piles in granular soils and cohesive soils subjected to lateral loading - Matlock & Reese analysis for piles in sands - Davisson & Gill analysis for piles in clays, Broms' Analysis for piles in sands and clays.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Determine the bearing capacity of shallow foundations for different loading and ground

conditions using different methods.

2. Understand the Settlement Analysis of foundations.
3. Understand classification of piles and determine the load carrying capacity of piles by various methods and the pull-out capacity of piles and down drag forces on piles due to negative skin friction.
4. Determine the load carrying capacity of pile groups.
5. Determine the load carrying capacity of laterally loaded piles.

Text Books:

1. Principles of Foundation Engineering -Braja M. Das
2. Foundation Analysis and Design – J.E. bowles, McGraw – Hill Publishing Co.,
3. Analysis and design of foundations and Earth Retaining Structures. –S. Prakash, GopalRajan and Swami Saran – SaritaPrakasan, Merut.

References:

1. Foundation Design and Construction – M.J. Tomlinson, Pitman
2. Soil Mechanics and Foundation Engineering, Vol. II, Foundation Engg., - VNS Murthy
3. Pile Foundation Analysis & Design by Poulos and Davis.

EARTH AND ROCK FILL DAMS SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Understand earth and rock fill dams causes of failures
2. Know slope stability
3. Know Prevention techniques for slope failures
4. Get familiar with slopes Stabilization
5. Understand rock fill dams

Unit -1	**Hours**
Earthen Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction and requirements, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.	**10**
Unit -2	
Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design	**10**
Unit – 3	
Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability,	**10**
Unit – 4	
Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/shotcrete).	**10**
Unit – 5	
Rock fill Dams: Requirements of compacted rock fill, Shear strength of rock fill, Rock fill mixtures, Rock fill embankments, Earth-core Rock fill dams, Stability, Upstream & Downstream slopes.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Design earthen dams
2. Get familiarity with slope stability calculations,
3. Know Prevention techniques for slope failures
4. Get familiar with slopes Stabilization

5. Design rock fill dams

Text Books:

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

References:

1. Bharat Singh and Sharma, H. D. – Earth and Rock fill Dams, 1999
2. Abramson, L. W., Lee, T. S. and Sharma, S. – Slope Stability and Stabilisation methods – John Wiley & sons. (2002)
3. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.

Honors
POOL-3

HIGHWAY ENGINEERING SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. To impart different concepts in the field of Highway Engineering.
2. To acquire design principles of Highway Geometrics and Pavements
3. To learn various highway construction and maintenance procedures
4. Road Aggregates and Bituminous Materials
5. Flexible Pavement Design Methods

Unit -1	**Hours**
Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.	**10**
Unit -2	
Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.	**10**
Unit – 3	
Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams.	**10**
Unit – 4	
PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.	**10**
Unit – 5	
Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design. Design Factors Flexible Pavements: Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC	**10**

Method for Low volume Flexible pavements.	

Course outcomes:

Upon successful completion of the course student will be able to

1. Plan highway network for a given area.
2. Determine Highway alignment and design highway geometrics
3. Design Intersections and prepare traffic management plans
4. Judge suitability of pavement materials and design flexible and rigid pavements
5. Construct and maintain highways and Analysis of pavements by different methods

Text Books:

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.
2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi.

References:

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi
2. Highway Engineering, Srinivasa Kumar R, Universities Press, Hyderabad

PAVEMENT ANALYSIS AND DESIGN SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. To learn about different types in pavements.
2. To evaluate the different factors effecting pavement design.
3. Evaluate different design methods in Flexible pavements.
4. To learn about different joints and its importance in rigid pavements.
5. Evaluate various design methods of rigid pavements and pavement maintenance methods.

Unit -1	**Hours**
Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements, functions of pavement components	**10**
Unit -2	
Pavement Design Factors: Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure. Drainage – Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures	**10**
Unit – 3	
Flexible Pavement Design: Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC, AASHTO Methods, applications of pavement design software	**10**
Unit – 4	
Rigid Pavement Design: Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints.	**10**
Unit – 5	
Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design; Pavement Management: Pavement failures, maintenance of highways, structural and functional condition evaluation of pavements, pavement management system.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Understand different types in pavements.
2. Learn different factors effecting pavement design

3. Evaluate different design methods in Flexible pavements
4. Understand the different joints and its importance in rigid pavements.
5. Evaluate various design methods of rigid pavements and Implementation of various pavement maintenance methods

Text Books:

1. Yoder and Witczak, Priniciples of Pavement Design, John Wiley and Sons
2. Yang. H. Huang, Pavement Analysis and Design, Second Edition, Prentice Hall Inc.

References:

1. Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering – Principles and Practice, CRC Press (Taylor and Francis Group)
2. W.Ronald Hudson, Ralph Haas and Zeniswki , Modern Pavement Management, McGraw Hill and Co

INTELLIGENT TRANSPORTATION SYSTEM SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. To learn about ITS System.
2. To evaluate the ITS Collection Techniques.
3. Learn the application of Telecommunications in ITS.
4. Understand the Guidelines for application of ITS.
5. Implementation of ITS in-Road System.

Unit -1	**Hours**
Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS.	**10**
Unit -2	
Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.	**10**
Unit – 3	
Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System	**10**
Unit – 4	
ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).	**10**
Unit – 5	
Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Understand the importance of ITS.
2. Analyse various ITS Collection Techniques
3. Learn the applications of telecommunications in ITS
4. Understand the Guidelines for application of ITS.
5. Implementation of ITS in-Road System

Text Books:

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005

Reference books:

1. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM
2. Institution of Transportation Engineers, Traffic Engineering Hand Book, 4th Edition, Prentice Hall,1999.

TRAFFIC ENGINEERING AND MANAGEMENT

SEMESTER –

Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives:

This course will enable students to:

1. To assess the traffic characteristics by performing various Spot studies.
2. To evaluate the various lane capacities by conducting speed studies.
3. Learn the parking studies and accident analysis on different road conditions.
4. Understand the traffic control by following road regulations and applying methods.
5. Apply the design procedures for Rotary intersections and other rotary elements and understand the environmental Regulations to minimize the detrimental effects of traffic.

Unit -1	**Hours**
Traffic Characteristics: Basic traffic characteristics - Speed, volume and concentration – Relationship between Flow, Speed and Concentration Traffic Measurement and Analysis: Volume Studies - Objectives, Methods, Speed studies - Objectives: Definition of Spot Speed, time mean speed and space mean speed, Methods of conducting speed studies.	**10**
Unit -2	
Speed Studies: Methods of conducting speed studies, Presentation of speed study data; Headways and Gaps, Critical Gap, Gap acceptance studies. Highway Capacity And Level Of Service: Basic definitions related to capacity, Level of service concept, Factors affecting capacity and level of service, Computation of capacity and level of service for two lane highways Multilane highways and freeways.	**10**
Unit – 3	
Parking Studies and Analysis: Types of parking facilities - on street parking and off street Parking facilities, Parking studies and analysis. Traffic Safety: Accident studies and analysis, Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.	**10**
Unit – 4	
Traffic Control And Regulation: Traffic Signals - Design of Isolated Traffic Signal by Webster method, Warrants for signalisation, Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems. At–grade intersections, sight distance considerations and principles of design, channelization, mini round-abouts, layout of round-abouts. Advantages and limitations of round-abouts.	**10**
Unit – 5	
Rotary Intersections: Definitions – Diverging, Merging, Weaving, Weaving Length, Advantages and Disadvantages. Rotary Design Elements – Design Speed,	**10**

Radius at Entry, Radius at Exit, Width of Rotary Carriage way, Entry and Exit angles, External kerb line, Super elevation and camber- Capacity of rotary. Interchanges – Advantages and Disadvantages, Major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design. Traffic And Environment: Detrimental effects of Traffic on Environment; Air pollution; Noise Pollution	

Course outcomes:

Upon successful completion of the course student will be able to

1. Analyse various Speeds and Relations.
2. Evaluate lane capacity.
3. Analyse on Parking facilities and Accident studies.
4. Design of Traffic signals by various methods.
5. Design of Rotary intersections and Asses the detrimental effects of Traffic on environment and its management measures.

Text Books:

1. Traffic Engineering and Transportation Planning - L.R. Kadiyali, KhannaPublishers.
2. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications.
3. Transportation Engineering - An introduction - C. JotinKhistry, Prentice HallPublication.
4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice HallIndia

Reference books:

1. Traffic Engineering - Theory &Practice - Louis J. Pignataro, Prentice HallPublication.
2. Principles of Highways Engineering and Traffic Analysis - Fred Mannering &Walter P. Kilareski, John Wiley &SonsPublication.

Honors
POOL-4

ENVIRONMENTAL LAW AND POLICY SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week		External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Impart the basic knowledge of environmental laws.
2. Know the Forest, Wildlife and Biodiversity related laws.
3. Know the Air, Water and Marine Laws.
4. Study the Environment protection laws and large Projects.
5. Understand the International Environmental law.

Unit -1Basic Concepts in Environmental Law	**Hours**
Basic Concepts in Environmental Law. An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, PIL–liberalization of the rule of locus standi, Judicial activism. Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Bhopal gas tragedy; Rio conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts	10
Unit -2 –Forest, Wildlife and Biodiversity related laws	
Evolution and Jurisprudence of Forest and Wildlife laws; Colonial Forest policies; Forest policies after independence. Statutory framework on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Modulew leopard.	10
Unit – 3 Air, Water and Marine Laws	
National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards. Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981; EPA, 1986	10
Unit – 4 –Environment protection laws and large Projects	
Legal framework on environment protection-Environment Protection Act as the framework legislation–strength and weaknesses; EIA; National Green tribunal. The courts infrastructure projects	10
Unit – 5 International Environmental law	
An introduction to international law; sources of international law; law of treaties; signature, ratification. Evolution of international environmental law: Customary principles; Common but differentiated responsibility, Polluter pays	10
Course outcomes:	

On successful completion of this course, students will be able to

1. Be familiar with the laws, policies and institutions in the field of environment.
2. Acquire the skills needed for interpreting laws, policies and judicial decisions in a holistic♣ perspective.
3. Acquire the ability to evaluate the role of law and policy in conservation and management of♣ natural resources and prevention of pollution
4. Understand the concepts of the Environment protection laws and large Projects.
5. Understand the concepts of the International Environmental law.

Text Books:

1. Divan S. and Rosencranz A. (2005) Environmental Law and Policy in India, 2 nd ed., Oxford, New Delhi
2. Leelakrishnan P. (2008) Environmental Law in India, 3rd ed., Lexis Nexis, India

Reference Books:

1. Kamala S. and Singh U.K. (eds.) (2008) Towards Legal Literacy: An Introduction to Law in India, Oxford, New Delhi.
2. Leelakrishnan P. (2006) Environmental Law Case Book, 2nd ed, Lexis Nexis, India.
3. Sands P. (2002) Principles of International Environmental Law, 2nd ed, Cambridge.
4. Singh C. (1986) Common Property and Common Poverty, Oxford, New Delhi.

Online sources:

1. https://environmentalpolicyandlaw.com/

ENVIRONMENTAL CHANGE AND SUSTAINABLE DEVELOPMENT SEMESTER -			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	4	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Sensitizing the business professionals on their affirmative role in environmental management and sustainable development;
2. Understanding planetary boundaries and the impacts of natural and anthropogenic interventions on these planetary boundaries;
3. Understanding Environmental Implications of Economic Growth and through appropriate methods of valuation in the context of well-developed markets and absence or failure of such markets (say, Risk Analysis, Policy Impacts, etc.);
4. Key aspects of Sustainability and Sustainable Development Goals (SDGs) and implications at the micro (resources) and macro (policy and advocacy) levels through various cases and discussions involving economy/ business sectors
5. Identifying appropriate strategies for sustainable environmental management systems, social innovative projects, key concepts in social innovation development through their own projects

Unit -1	
Conceptual Issues in Environmental and Natural Resources Management Environment and Its Integral Components: Ecology, Ecosystem & habitat Environmental Resources: Land (Agriculture), Water, Forests/ Wildlife, Fisheries Stakeholders of Environment. Carrying Capacity of Ecosystems (& Earth)	**Hours – 10**
Unit -2	
State of Natural Resources and Environment: Cases of Land, Water, Forestry, Fishery/ Environment and Development Since Industrial Revolution Environmental Degradation, & Pollution: the role of natural and anthropogenic factors Population Growth and Environmental Impact. Agriculture, Industrial Growth, Urbanization, Pollution & Pollution Control Wastes and Hazardous Wastes. Footprints: Ecological/ Water/ Energy/ Carbon.	**Hours – 10**
Unit – 3	
Dimensions of Environmental Management: Economic, Socio-cultural, Technological, Ethical & Moral, Political & Legal Dimensions Urban Environmental Management (UEM) Managing the local Environment Concepts of Good Environmental Management, Environmental Management System and Processes, Waste Management, Development Management Environmental Awareness	**Hours – 10**
Unit – 4	
Environmental Governance Institutions Legal Framework for Environmental Management, Environmental Regulations/ Compliance Mechanisms International and National Frameworks for, Environmental Protection. The	**Hours – 10**

Role and Performance of Environmental, Governance Institutions – International and National	
Unit – 5	
Sustainable Development in theory and practice Global Responses to Sustainable Development, Sustainable Development Goals (vs Millennium, Development Goals), The Paris and Post-Paris Convention on Climate Change and Sustainable Development Triple Bottomline of Sustainability: Food, Water, Energy nexus Potential and Barriers to Sustainable Business, Sustainable rural and urban livelihoods	**Hours – 10**

Course outcomes:

On successful completion of this course, students will be able to

1. Knowledge: - - Learning the role of the three basic components of eco systems and environment and underlying causes of their degradation.
2. Attitude: - To build proactive, analytical and professional initiatives towards developing management policies and practices through sensitization of needs and requirements of individuals and organizations for sustainable development.
3. Skill sets: - Development of skills of utilization of analytical tools for environmental planning.
4. Skill sets: Development of sustainable planning for sustainable development of environment, economy and firms.
5. Habit: - Finally, we wish that you form a Habit of living responsibly in this challenging era, and spread the message of Ecology, Equity and Economy. As future business managers, you have a huge potential to leave behind a very positive footprint.

Text Books:

1. Jacob Thomas, Environmental Management – Text and Cases, Dorling Kindersley (India) Pvt. Ltd. 2014
2. Environmental Management, Ajith Sankar, R.N., Oxford University Press, New Delhi, 2015
3. Environmental Management, N. K. Uberoi, Second Edition, Excel Books, 2003
4. Environmental Management and Development, C. J. Barrow, Routledge, 2006

Reference Books:

1. Jonathan M. Harris & Brian Roach (2013), Environmental and Natural Resource Economics: A Contemporary Approach, M.E. Sharpe, Armonk, New York/ London (UK).
2. Markandya, Anil and Julie Richardson (1997), Environmental Economics, Earthscan Publications, London .

Online Sources:

1. https://link.springer.com/referenceworkentry/10.1007/978-3-030-11352-0_469

ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT SEMESTER –			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week		External Marks	70
Total Number of Lecture Hours		Exam Hours	03
Credits – 04			

Course Objectives:

The course will address the following:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To pre-requisites for ISO 14001 certification
5. To know the procedures for environmental clearances and audit

Unit -1	**Hours**
Basic concept of EIA: Elements of EIA – factors affecting EIA-Initial environmental Examination – life cycle analysis preparation of Environmental Base map Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA	10
Unit -2	
E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis - EIS and EMP	10
Unit – 3	
Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives- application of remote sensing and GIS for EIA.	10
Unit – 4	
Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Generalized approach for assessment of Air pollution Impact	10
Unit – 5	
Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment advantage of Environmental Risk Assessment	10

Course outcomes:

On completion of this course student will able to:

1. Prepare EMP, EIS, and EIA report
2. Identify the risks and impacts of a project
3. Selection of an appropriate EIA methodology
4. Evaluation the EIA report

5. Estimate the cost benefit ratio of a project
Text Books: 1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996) 2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.
Reference Books: 1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers 2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. , Katania & Sons Publication., New Delhi.
Online Resources 1. https://nptel.ac.in/content/storage2/courses/120108004/

SUGGESTED COURSES FOR MINOR PROGRAM IN CE

The following are the Offline and MOOC courses offered by CE Departmet for the Minors program Starting from IV semster.

S.No	Subject Code	Name of the subject	Offered Semester	L	T	P	Cr
1		Building materials	IV Semester	3/4	0	0/2	4
2		Solid Waste & Hazardous Waste Management	V Semester	3/4	0	0/2	4
3		Traffic engineering	VI Semester	3/4	0	0/2	4
4		Ground Improvement Techniques	VII Semester	3/4	0	0/2	4

MOOC/NPTEL Courses for Minor program:

S.No	Name of the subject	Link	L	T	P	Cr
1	Digital Land Surveying and Mapping (DLS&M)	https://nptel.ac.in/courses/105107181	2	0	0	2
2	Environmental Remediation of Contaminated Sites	https://onlinecourses.nptel.ac.in/noc22_ce26/preview	2	0	0	2
3	Geographic Information Systems	https://nptel.ac.in/courses/105106052	2	0	0	2

S.No	Name of the subject	Link	L	T	P	Cr
1	Rural water resources management	https://archive.nptel.ac.in/courses/105/106/105106202/	2	0	0	2
2	Modern construction materials	https://onlinecourses.nptel.ac.in/noc22_ce31/preview	2	0	0	2
3	Probability methods in civil engineering	https://onlinecourses.swayam2.ac.in/nou20_cs11/preview	2	0	0	2

Note:

1. Students has to study all four regular/offline minor courses starting from **IV semster** and complete by **VII semester** by taking **one course per semester**.
2. Additionally, TWO MOOC courses of minimum EIGHT-week duration a total covering of 4 credits (offered by CE Department only).
3. Students can register for any two MOOC courses and one from each pool out of three courses listed in the each pool in the above table via the NPTEL online platform from IV semester to VII semester by prior information to concerned department.

Minor Courses Under Civil Engineering Department

BUILDING MATERIALS SEMESTER – IV			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 4			

Course Objectives:

This course will enable students to:

1. Have basic idea about the Stones, Bricks which are used as a building material.
2. Make aware about the properties and importance of tiles, timber and wood-based products as a construction material
3. Understand the concrete as a building material, its manufacturing process, various ingredients and its properties.
4. Understand the importance of steel and various of alloys as a construction material
5. Understand the importance of various building materials and their uses and identify different types of masonries and their applications.

Unit -1	**Hours**
Building Stones: Building stones, classification of building stones, quarrying procedures, structural Requirement, dressing, and tools for dressing of stones. **Bricks**: Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, structural requirements, classification and testing of bricks, field and lab test, special types of bricks and their uses, AAC blocks, other types of building blocks.	**10**
Unit -2	
Tiles: Types of tiles and their use in buildings. Manufacturing of tiles, structural requirement of tiles, Terracotta, stoneware. **Timber and Wood based products**: Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses.	**10**
Unit – 3	
Lime and cement: IS classification of lime and uses, flow diagram of manufacturing process of cements, chemical composition of cement, IS specifications and tests on Portland cement, different types of cements and their uses. **Mortar & concrete**: Preparation of cement mortar and concrete, proportion of mortars and concrete for different types of works, properties of concrete in plastic and hardened stages, factors affecting strength of concrete, types of concrete and their specific use.	**10**
Unit – 4	
Steel: Types of steel-mild steel, high carbon steel, high strength steel-properties and uses, commercial forms of steel and their uses. **Alloys:** Types, properties and uses - aluminium alloys, copper alloys. **Auxiliary Materials:** Glass Types of glasses, manufacturing of glass. Properties and their uses, Paints-Constituents of paints, types of paints, properties and their uses, admixtures - classification, properties and their uses.	**10**

Plastics, Paints, Plasticizers, AAC brick, Fibre Reinforced polymer, geopolymer, Ferro cement	
Unit – 5	
Masonry, Wall Elements and Formwork: Brick masonry: Types, bonds. Stone Masonry: Types, composite masonry, concrete reinforced bricks, and glass -reinforced brick. Finishing slope: plastering, pointing, and cladding- Types of ACP (Aluminium composite panel), High pressure laminations, composites - FRP, wall panelling elements -Types of roof sheeting -cold formed & light gauge steel. **Formwork**: requirements, standards, scaffolding, shoring, under pinning.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Determine the characteristics of a good building stone, bricks and their properties.
2. Determine the characteristics of a good tile, Timber and wood-based products and their properties.
3. Choose the particular cement needed for particular types of construction and can prepare concrete with correct proportions for different types of works.
4. Gain knowledge on steel and different types of alloys
5. Acquire knowledge of various types of building materials and Gain different types of masonries and their applications.

Text Books:

1. "Building materials and Construction" by Rangwala, Sushil Kumar, Bindra, kamala Standard Publishers, 33rd edition, Jan 2019.
2. “Building Construction”, by B C Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd., New Delhi, 11th Edition, 2016.

1. “Building Construction”, by P C Varghese, Prentice Hall of India Private Ltd., New Delhi, 2nd Edition, 2007.
2. “Construction Technology” Vol. – 1 & 2, by R. Choudly 2nd Edition, Longman, UK, 1987.

Online sources

1. NPTEL :: Architecture - NOC:Building Materials and Composites

SOLID AND HAZARDOUS WASTE MANAGEMENT SEMESTER – V			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Impart the basic knowledge of solid waste management.
2. Know the various methods solid waste collection.
3. Knowledge about waste minimization.
4. Study the design and operation of solid waste disposal.
5. Understand the hazardous waste management techniques.

Unit -1	**Hours**
Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste - Factors Influencing generation of solid waste - sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities, Terms related ISWM like WTE, ULB, TLV etc.	**10**
Unit -2	
Basic Elements in Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Type and methods of waste collection systems, analysis of collection system - optimization of collection routes– alternative techniques for collection system.	**10**
Unit – 3	
Transfer, Transport and Transformation of Waste: Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements. Unit operations used for separation and transformation: shredding - materials separation and recovery, source reduction and waste minimization. Warm composting, vermin composting	**10**
Unit – 4	
Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation. Case studies.	**10**
Unit – 5	
Hazardous Waste Management: sources, collection, transport, treatment and disposal methods. Incineration, Biomedical waste management, e-waste management and nuclear waste management.	**10**

Course outcomes:

On successful completion of this course, students will be able to

1. Understand the different solid waste management techniques.
2. Choose appropriate method of solid waste.
3. Suggest the solid waste minimization technique.
4. Design the solid waste management method.
5. Suggest the appropriate hazardous waste management technique.

Text Books:

1. Integrated Solid Waste Management, George Techobanoglous, McGraw Hill Publication, 1993
2. Solid Waste Engineering, Vesilind, P.A., Worrell, W., Reinhart, D., Cenage learning, New Delhi, 2004
3. Hazardous Waste Management, Charles A. Wentz, McGraw Hill Publication, 1995

Reference Books:

1. Solid and Hazardous Waste Management PM Cherry, CBS Publishers and Distriburs. New Delhi, 2016.
2. Solid Waste Engineering, William A Worrell, P Aarue Vesilind, Cengage Learning, New Delhi 2016.

Online Sources:

1. https://nptel.ac.in/courses/105106056

TRAFFIC ENGINEERING SEMESTER – VI			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

1. Understand the traffic characteristics by performing various Spot studies.
2. Know the various lane capacities by conducting speed studies.
3. Learn the parking studies and accident analysis on different road conditions.
4. Understand the traffic control by following road regulations and applying methods.
5. Understand the design procedures for Rotary intersections and other rotary elements and understand the environmental Regulations to minimize the detrimental effects of traffic.

Unit -1	**Hours**
Traffic Characteristics: Basic traffic characteristics - Speed, volume and concentration – Relationship between Flow, Speed and Concentration Traffic Measurement and Analysis: Volume Studies - Objectives, Methods, Speed studies - Objectives: Definition of Spot Speed, time mean speed and space mean speed, Methods of conducting speed studies.	**10**
Unit -2	
Speed Studies: Methods of conducting speed studies, Presentation of speed study data; Headways and Gaps, Critical Gap, Gap acceptance studies. Highway Capacity and Level of Service: Basic definitions related to capacity, Level of service concept, Factors affecting capacity and level of service, Computation of capacity and level of service for two lane highways Multilane highways and freeways.	**10**
Unit – 3	
Parking Studies and Analysis: Types of parking facilities - on street parking and off-street Parking facilities, Parking studies and analysis. Traffic Safety: Accident studies and analysis, Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.	**10**
Unit – 4	
Traffic Control and Regulation: Traffic Signals - Design of Isolated Traffic Signal by Webster method, Warrants for signalization, Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems. At–grade intersections, sight distance considerations and principles of design, channelization, mini round-abouts, layout of round-abouts. Advantages and limitations of round-abouts.	**10**
Unit – 5	
Rotary Intersections: Definitions – Diverging, Merging, Weaving, Weaving Length, Advantages and Disadvantages. Rotary Design Elements – Design Speed, Radius at Entry, Radius at Exit, Width of Rotary Carriage way, Entry and Exit angles, External kerb line, Super elevation and camber- Capacity of rotary. Interchanges – Advantages and Disadvantages, Major and minor interchanges,	**10**

entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design. **Traffic and Environment:** Detrimental effects of Traffic on Environment; Air pollution; Noise Pollution;	

Course outcomes:

Upon successful completion of the course student will be able to

1. Analyse various Speeds and Relations.
2. Evaluate lane capacity.
3. Analyse on Parking facilities and Accident studies.
4. Design of Traffic signals by various methods.
5. Design of Rotary intersections and Asses the detrimental effects of Traffic on environment and its management measures.

Text Books:

1. Traffic Engineering and Transportation Planning - L.R. Kadiyali, KhannaPublishers, Khanna Publishers, 1999.
2. Highway Engineering, S.K. Khanna and C.E.G Justo and A. Veeraragavan, Nemchand Brothers publications, 2001, Nem Chand & Bros.
3. Transportation Engineering - An introduction - C. Jotin Khistry, Prentice Hall Publication, 2002, Pearson.
4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India, Prentice Hall, 1987.

References:

1. Traffic Engineering - Theory &Practice - Louis J. Pignataro, Prentice Hall Publication, 1973, Prentice Hall.
2. Principles of Highways Engineering and Traffic Analysis - Fred Mannering &Walter P. Kilareski, John Wiley & Sons Publication, 2008.

Online Sources:

1. https://archive.nptel.ac.in/courses/105/105/105105215/

GROUND IMPROVEMENT TECHNIQUES SEMESTER – VII			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits –04			

Course Objectives:

This course will enable students to:

1. To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remolded and in-situ soils by adopting in situ densification.
2. To make the student appreciate the need for dewatering methods.
3. To make the student learn the concepts, purpose and effects of stabilizers.
4. To make the student learn the concepts, purpose and effects of grouting.
5. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls and to enable how geotextiles and geosynthetics can be used.

Unit -1	**Hours**
In situ densification methods: In-situ densification of granular soils-vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.	**10**
Unit -2	
Dewatering: Sumps and interceptor ditches – single and multi-stage well points – vacuum well points– horizontal wells – criteria for choice of filler material around drains – electro osmosis	**10**
Unit – 3	
Stabilization of soils: methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.	**10**
Unit – 4	
Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests. Introduction to Liquefaction& its effects & applications.	**10**
Unit – 5	
Reinforced earth: principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing. **Geosynthetics:** geotextiles – types – functions, properties and applications – geogrids, Geomembranes and gabions - properties and applications.	**10**

Course outcomes:

Upon successful completion of the course student will be able to

1. Know the importance and need for different ground improvement methods adopted for improving the properties of remolded and in-situ soils by adopting in situ densification.
2. Study the importance and need for dewatering methods.
3. Become acquainted with the concepts, purpose and effects of grouting.
4. Become acquainted with the concepts, purpose and effects of grouting.

5.	Understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls and appreciate use of how geotextiles and geosynthetics

Text Books:

1. Ground Improvement Techniques' by Purushotham Raj, 2016, Laxmi Publications.
2. 'Ground Improvement Techniques' by Nihar Ranjan Patro, 2012, Vikas Publishing House.
3. 'An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, 2005, Universities Press.

Reference Books

1. Ground Improvement' by MP Moseley, 2004, CRC Press.
2. 'Designing with Geosynthetics' by RM Koerner, 2012, Xlibris.

Online Sources:

1. https://nptel.ac.in/courses/105108075