DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC REGULATIONS (R23)

FOR

B. Tech Four Year Degree Programme

(Applicable for the batches admitted from the A.Y. 2023-24)

PACE INSTITUTE OF TECHNOLOGY AND SCIENCES
(Autonomous)

Approved by AICTE and Govt. of Andhra Pradesh, Accredited by NAAC (A Grade)
Recognized under 2(f) & 12(B) of UGC, Permanently Affiliated to JNTUK, Kakinada
NH-16, Near Valluramma Temple, Ongole-523272
Andhra Pradesh, India.

Academic Regulations (R23) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)

1. **Award of the Degree**

   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

      i. Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

      ii. Registers for 160 credits and secures all 160 credits.

   (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:

      i. Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.

      ii. Registering for Honors is optional.

      iii. Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. **Courses of study:**
   The following courses of study are offered at Pace Institute of Technology and Sciences,Ongole

Sl No	Branch	Short name	Code
1	Civil Engineering	CE	01
2	Electrical and Electronics Engineering	EEE	02
3	Mechanical Engineering	ME	03
4	Electronics & Communication Engineering	ECE	04
5	Computer Science and Engineering	CSE	05
6	Computer Science and Information Technology	CSIT	07
7	Information Technology	IT	12
8	Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)	CSE(IoT&CSBT)	47
9	Artificial Intelligence and Data Science	AIDS	54
10	Artificial Intelligence and Machine Learning	AIML	61
11	Computer Science and Engineering (Indian Language)	CSE-R	63
12	Electronics Engineering (VLSI Design & Technology)	EE(VLSID&T)	66

4. **Admissions**
   Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based

on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

5. **Program related terms**

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

   (b) **Credit Definition:**

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

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

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

6. **Semester/Credits:**

   (a) A semester comprises 90 working days and an academic year is divided into two semesters.

   (b) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

   (c) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

7. **Structure of the Undergraduate Programme**

   All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1	Humanities and Social Science including Management (HM)	13	8%	8-9%
2	Basic Sciences (BS)	20	13%	12-16%
3	Engineering Sciences (ES)	23.5	14%	10-18%
4	Professional Core (PC)	54.5	34%	30-36%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21%	19-23%
6	Internships & Project work (PR)	16	10%	8-11%
7	Mandatory Courses (MC)	Non-credit	Non-credit	-

8. **Course Classification:** All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.No.	Broad Course Classification	Course Category	Description
1	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

9. **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 days.

(d) There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.

(e) Health/wellness/yoga/sports and NSS /NCC /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.

(f) Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.

(g) Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.

(h) Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

(i) Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective

courses can lead to students specializing in emerging areas within the chosen field of study.

(j) A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

(k) While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

(l) A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

(m) Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

(n) There shall also be mandatory full internship in the final semester of the programme along with the project work.

(o) Undergraduate degree with Honors is introduced by the University for the students having good academic record.

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

(q) Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies /GATE /other competitive exams etc.

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

10. **Evaluation Process**

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end

examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

(A) **Theory Courses**

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i. For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii. For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

iii. If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

iv. If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

(a) **Continuous Internal Evaluation**

i. For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii. Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the respective institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course

content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iii. If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv. First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

* Marks obtained in first mid: 25
* Marks obtained in second mid: 20
* Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

⋆ Marks obtained in first mid: Absent
⋆ Marks obtained in second mid: 25
⋆ Final mid semester Marks: (25x0.8) + (0x0.2) =20

(b) **Semester End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

i. There shall be 6 questions and all questions are compulsory.

ii. Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.

iii. There shall be 2 short answer questions from each unit.

◇ In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

i. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

ii. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

iii. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

(B) **Practical Courses**

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

(a) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

(b) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

(c) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

i. Procedure: 20 marks

ii. Experimental work & Results: 30 marks

iii. Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

(d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination. Day-to-day work shall be evaluated for 15 marks

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum

of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing , multiple branches, etc is mentioned along with the syllabus.

(e) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re=examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

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

11. **Skill oriented Courses**

(a) There shall be five skill-oriented courses offered during III to VII semesters.

(b) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.

(c) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

(d) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

(e) 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 or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies,

the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. 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.

(f) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the principal at the beginning of the semester. The Head of the Department shall forward such proposals to the principal for approval.

(g) 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 principal.

12. **Massive Open Online Courses (MOOCs):**

A Student has to pursue and complete one course compulsorily through MOOCs approved by the principal. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the college.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

13. **Credit Transfer Policy**

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the institute shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

(a) The institute shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online

learning courses.

(b) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.

(c) Credit transfer policy will be applicable to the Professional & Open Elective courses only.

(d) The concerned department shall identify the courses permitted for credit transfer.

(e) The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.

(f) The department shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

(g) The institution shall ensure no overlap of MOOC exams with that of the semester end examination schedule. In case of delay in results, the institution will re-issue the marks sheet for such students.

(h) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

(i) The department shall submit the following to the examination cell & systems:

  i. List of students who have passed MOOC courses in the current semester along with the certificate of completion.

  ii. Undertaking form filled by the students for credit transfer.

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

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

14. **Academic Bank of Credits (ABC)**

The institute has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

(a) provide option of mobility for learners across the universities of their choice

(b) provide option to gain the credits through MOOCs from approved digital platforms.

(c) facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC

(d) execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

15. **Mandatory Internships**

Summer Internships : Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the institution.

Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) 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. 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 Exami-

nation conducted in the presence of internal examiner and external examiner appointed by the principal and is evaluated for 140 marks.

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.

16. **Guidelines for offering a Minor**

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

(a) The Minor program requires the completion of 12 credits in Minor stream chosen.

(b) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.

(c) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

17. **Guidelines for offering Honors**

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

(a) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

(b) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

(c) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

(d) The concerned Head of The Department shall arrange separate class work and timetable of the courses offered under Honors program.

(e) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

(f) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

(g) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

(h) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

(i) **A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors** degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.

(j) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

(k) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

(a) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

(b) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

(c) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

(d) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

(e) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

(a) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

(b) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

(c) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

(d) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

18. **Attendance Requirements:**

(a) A student shall be eligible to appear for the semester end examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

(b) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

(c) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

(d) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

(e) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

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

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

(h) For induction programme attendance shall be maintained as per AICTE norms.

19. **Promotion Rules:**

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

(a) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

(b) student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any *decimal* fraction should be *rounded off* to *lower* digit) up to in the subjects that have been studied up to III semester.

(c) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any *decimal* fraction should be *rounded off* to *lower* digit) in the subjects that have been studied up to V semester.

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

(d) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

20. **Grading:**

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

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

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
<40	F (Fail)	0
Absent	Ab (Absent)	0

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

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

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

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

$$SGPA = \frac{\sum(C_i \times G_i)}{\sum(C_i)}$$

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

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

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum(C_i)}$$

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

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

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

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

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/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	$\geq$ 7.5
First Class	$\geq$ 6.5 <7.5
Second Class	$\geq$ 5.5 <6.5
Pass Class	$\geq$ 5.0 <5.5

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

21. **With–holding of Results**

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

22. **Multiple Entry / Exit Option**

(a) **Exit Policy:** The students can choose to exit the four-year programme at the end of first/second/third year.

i. **UG Certificate in (Field of study/discipline) -** Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii. **UG Diploma (in Field of study/discipline) -** Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii. **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)-** Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) **Entry Policy:**

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

23. **Gap Year Concept:**

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Head of The Department shall forward such proposals submitted by the students to the principal. An evaluation committee constituted by the principal shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

24. **Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled

academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

25. **Minimum Instruction Days for a Semester:**

The minimum instruction days including exams for each semester shall be 90 days.

26. **Medium of Instruction:**

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only. Similarly, the medium of instruction and examinations in AICTE approved Indian language B.Tech programme are in Telugu and English.

27. **Student Transfers:**

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

28. **General Instructions:**

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

(b) Malpractices rules-nature and punishments are appended.

(c) Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

(d) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the competent authorities of institution is final.

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

(f) In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

Academic Regulations (R23)
for B. Tech (Lateral Entry Scheme)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024-25 onwards)

1. **Award of the Degree**

   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

      i. Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
      ii. Registers for 120 credits and secures all 120 credits.

   (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:

      i. Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
      ii. Registering for Honors is optional.
      iii. Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. **Minimum Academic Requirements** The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

   (a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

   (b) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

   And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. **Course Pattern**

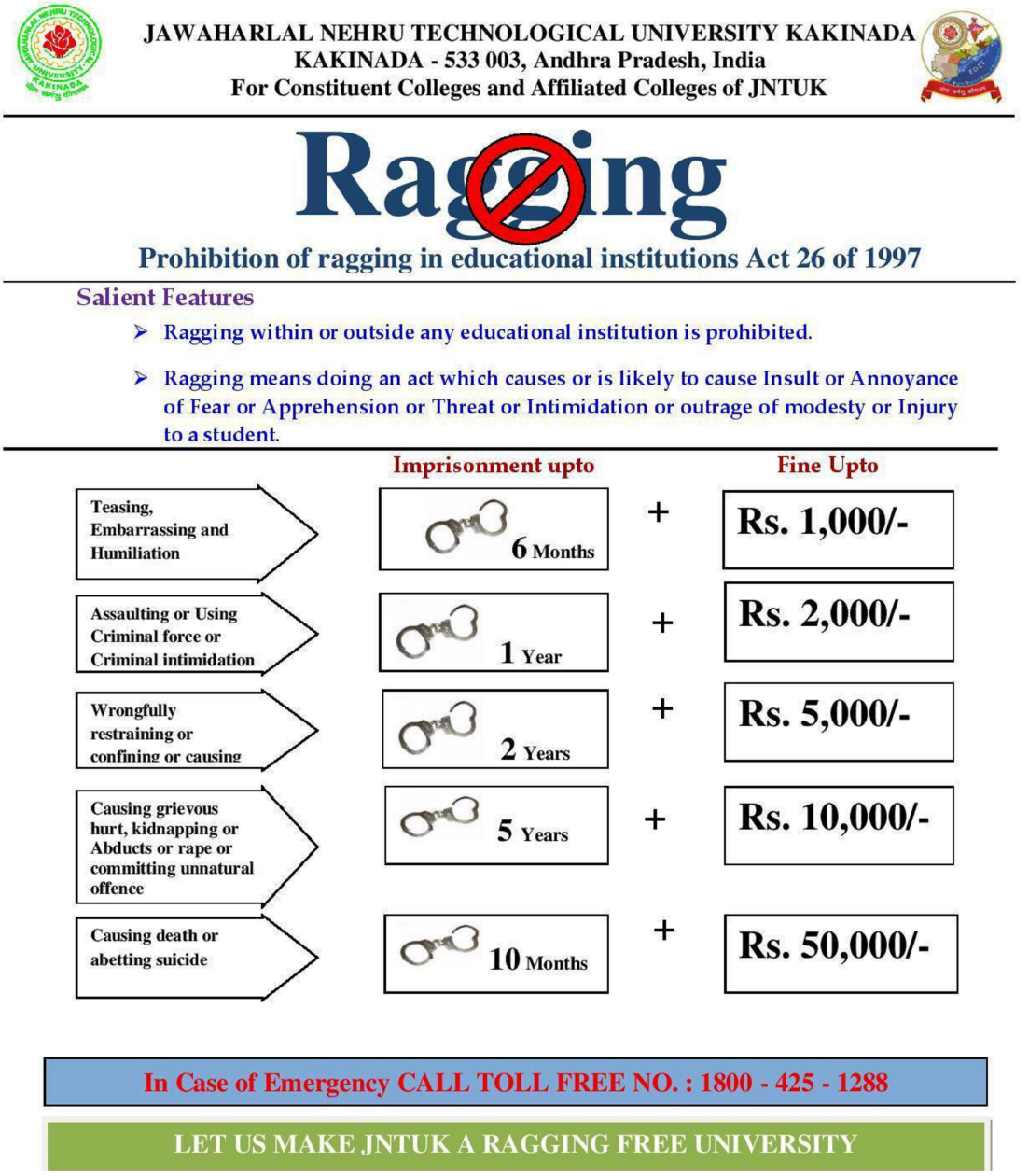
   (a) The entire course of study is three academic years on semester pattern.

(b) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

(c) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

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

Annexure-I


JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK
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.
Imprisonment upto
Fine Upto
Teasing, Embarrassing and Humiliation
6 Months
+
Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation
1 Year
+
Rs. 2,000/-
Wrongfully restraining or confining or causing
2 Years
+
Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence
5 Years
+
Rs. 10,000/-
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+
Rs. 50,000/-
In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288
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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

Jawaharlal Nehru Technological University Kakinada
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DEPARTMENT OF CIVIL ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

Induction Programme			
S.No.	Course Name	**Category**	L-T-P-C
1	Physical Activities – Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches – career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch – corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills – focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

DEPARTMENT OF CIVIL ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

I Year - I Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23BST04	Engineering Physics	3	0	0	3
2	P23BST02	Linear Algebra & Calculus	3	0	0	3
3	P23EST03	Basic Electrical and Electronics Engineering	3	0	0	3
4	P23EST04	Engineering Graphics	1	0	4	3
5	P23EST02	Introduction to Programming	3	0	0	3
6	P23ESL04	IT Workshop	0	0	2	1
7	P23BSL02	Engineering Physics Lab	0	0	2	1
8	P23ESL03	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	P23ESL02	Computer Programming Lab	0	0	3	1.5
10	P23BST08	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total Credits						20.5

I Year - II Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23BST01	Communicative English	2	0	0	2
2	P23BST05	Engineering Chemistry	3	0	0	3
3	P23BST03	Differential Equations & Vector Calculus	3	0	0	3
4	P23EST01	Basic Civil & Mechanical Engineering	3	0	0	3
5	P23EET02	Engineering Mechanics	3	0	0	3
6	P23BSL01	Communicative English Lab	0	0	2	1
7	P23BSL03	Engineering Chemistry Lab	0	0	2	1
8	P23ESL01	Engineering Workshop	0	0	3	1.5
9	P23CEL01	Engineering Mechanics & Building Practices Lab	-	-	1	0.5
10	P23BST07	Health and Wellness, Yoga and Sports	-	-	1	0.5
Total Credits						19.5

DEPARTMENT OF CIVIL ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

II Year I Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	BS&H	Engineering Mathematics (Branch specific)	3	0	0	3
2	BS&H	Universal Human Values – Understanding Harmony	2	1	0	3
3	Engineering Science		2	0	0	2
4	Professional Core		3	0	0	3
5	Professional Core		3	0	0	3
6	Engineering Science		0	0	2	1
7	Professional Core Lab		0	0	3	1.5
8	Professional Core Lab		0	0	3	1.5
9	Skill Enhancement course		0	1	2	2
10	Audit Course	Environmental Science	2	0	0	-
Total Credits			15	2	10	20

II Year II Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Management Course - I		2	0	0	2
2	Engineering Science		3	0	0	3
3	Professional Core		3	0	0	3
4	Professional Core		3	0	0	3
5	Professional Core		3	0	0	3
6	Professional Core		0	0	2	1
7	Professional Core		0	0	3	1.5
8	Professional Core		0	0	3	1.5
9	Skill Enhancement course		0	1	2	2
10	BS&H	Design Thinking & Innovation	1	0	2	2
Total Credits			15	1	12	22
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

DEPARTMENT OF CIVIL ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

III Year I Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Professional Elective - I		2	0	0	2
4	Open Elective - I		3	0	0	3
5	Open Elective - II		3	0	0	3
6	Professional Core		0	0	3	1.5
7	Professional Core		0	0	3	1.5
8	Skill Enhancement course		0	1	2	2
9	BS&H	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total Credits			14	1	10	22

III Year II Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Professional Core		3	0	0	3
4	Professional Elective - II		3	0	0	3
5	Professional Elective - III		2	0	0	2
6	Open Elective - III		3	0	0	3
7	Professional Core		0	0	2	1
8	Professional Core		0	0	2	1
9	Skill Enhancement course		0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total Credits			19	1	6	21
Mandatory Industry Internship of 08 weeks duration during summer vacation						

DEPARTMENT OF CIVIL ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

IV Year I Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Management Course - II		2	0	0	2
4	Professional Elective - IV		3	0	0	3
5	Professional Elective - V		3	0	0	3
6	Open Elective - IV		3	0	0	3
7	Professional Core		0	0	2	1
8	Professional Core		0	0	2	1
9	Skill Enhancement Course		0	1	2	2
10	Audit Course	Constitution of India	2	0	0	-
11	Internship	Evaluation of Industry Internship	-	-	-	2
Total Credits			19	1	6	23

IV Year II Semester						
S.No.	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST04	Engineering Physics (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes: At the end of the course, the student will be able to

CO1: Analyze the intensity variation of light due to interference, diffraction and polarization.

CO2: Familiarize with the basics of crystals and their structures.

CO3: Summarize various types of polarization of dielectrics and classify the magnetic materials.

CO4: Explain the basic concepts of Quantum Mechanics, free electron theory.

CO5: Apply the band theory of solids and Hall Effect to study the semiconductors.

UNIT–I: Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT–II: Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X- ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT–III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation

polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric

loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization- Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT–IV: Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT–V: Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Text Books:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11^{th} Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources:

1. `https://www.loc.gov/rr/scitech/selected-internet/physics.html`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST02	Linear Algebra & Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives: To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Demonstrate the understanding of rank of a matrix. Analyze the solutions of the system of linear equations.

CO2: Find the Eigen values and Eigen vectors of a matrix, apply Cayley-Hamilton theorem to determine inverse and power of a matrix and identify the nature of quadratic form.

CO3: Utilize mean value theorems to real life problems.

CO4: Familiarize with functions of several variables which are useful in optimization.

CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT–I: Matrices

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT–II: Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT–III: Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT–IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT–V: Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas by double integrals and volumes by double integrals and triple integrals.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44^{th} Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10^{th} Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5^{th} Edition (9^{th} reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th} Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9^{th} edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST03	Basic Electrical & Electronics Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: At the end of the course, the student will be able to

CO1: Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2)

CO2: Demonstrate the working of electrical machines, measuring instruments and power generation stations. (L2)

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines. (L3)

CO4: Calculate electrical load and electricity bill of residential and commercial buildings. (L4)

PART A: BASIC ELECTRICAL ENGINEERING

UNIT–I: DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT–II: Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, Applications.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT–III: Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical

energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

Course Outcomes: At the end of the course, the student will be able to

CO1: Compare the operation and characteristics of various semiconductor devices and their utilization.

CO2: Implement various power supply circuits using diodes and amplifier circuits using BJT.

CO3: Categorize various types of Logic gates and implement simple combinational logic circuits.

UNIT–I: SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction

Transistor — CB, CE, CC Configurations and Characteristics.

UNIT–II: BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT–III: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders.

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4^{th} Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Semester end examination pattern:

1. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
2. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
3. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
4. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST04	Engineering Graphics (Common to All branches of Engineering)	1	0	4	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
2. To impart knowledge on the projection of points, lines and plane surfaces
3. To improve the visualization skills for better understanding of projection of solids
4. To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
5. To make the students understand the viewing perception of a solid object in Isometric and orthographic projections.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand the principles of engineering drawing, including polygons, engineering curves, scales.

CO2: Draw and interpret orthographic projections of points, lines, planes.

CO3: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind sections of solids and development of surfaces.

CO5: Convert the isometric view into orthographic view and vice versa.

UNIT–I:

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT–II:

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT–III:

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT–IV:

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT–V: Semiconductors

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (Not for end examination).

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST02	Introduction To Programming (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce students to the fundamentals of computer programming.
2. To provide hands-on experience with coding and debugging.
3. To foster logical thinking and problem-solving skills using programming.
4. To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
5. To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand basics of computers, the concept of algorithm, flowcharts and algorithmic thinking.

CO2: Analyse a problem and develop programs involving decision structures and loops.

CO3: Implement different operations on arrays and solve problems using Strings.

CO4: Design the programs by applying the features of pointers, structures and unions.

CO5: Develop problem-solving skills and the ability to debug and optimize the code by using functions and files.

UNIT–I: Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms

UNIT–II: Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

UNIT–III: Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT–IV: Pointers & User Defined Data types

Pointers, dereferencing (Pointer to Pointer) and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT–V: Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2^{nd} edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL04	IT Workshop (Common to All branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
2. To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
3. To teach basic command line interface commands on Linux.
4. To teach the usage of Internet for productivity and self-paced life-long learning
5. To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1: Understand the fundamental principles of computer hardware components and their interconnections.

CO2: Analyze the historical development of the Internet and its impact on global communication.

CO3: Analyze the underlying principles and structure of LaTeX and Word documents.

CO4: Implement essential toolbars and ribbons for common spreadsheet tasks.

CO5: Understand the principles of effective content organization in presentations.

CO6: Implement AI tools like ChatGPT into their professional workflows for content creation and translation.

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot

(VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of

toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

◦ Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

◦ Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

◦ Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3^{rd} edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2^{nd} edition

4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3^{rd} edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3^{rd} edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL02	Engineering Physics Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes: At the end of the course, the student will be able to

CO1: Apply the concepts of wave optics to get wavelength of light.

CO2: Apply the concept of resonance in sonometer and melde's experiments for getting frequency.

CO3: Study the earth's gravity and rigidity modulus of material.

CO4: Study electrostatics and magnetism to determine its dependent properties.

CO5: Determine the properties of semiconductors and Planks constant.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.

12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources:

1. www.vlab.co.in
2. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL03	Electrical & Electronics Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes: At the end of the course, the student will be able to

CO1: Measure voltage, current and power in an electrical circuit. (L3)

CO2: **CO2:** Measure of Resistance using Wheat stone bridge (L4)

CO3: Discover critical field resistance and critical speed of DC shunt generators. (L4)

CO4: Investigate the effect of reactive power and power factor in electrical loads. (L5)

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.

   ◦ Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.

   ◦ Provide some exercises so that measuring instruments are learned to be used by the students.

3. Components:

   ◦ Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

   ◦ Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments.

CO3: Plot and discuss the characteristics of various electron devices.

CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers

4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Device & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4^{th} Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL02	Computer Programming Lab (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand and trace the execution of programs written in C language.

CO2: Analyze the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers and structures

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT–I:

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
2. Exposure to Turbo C, gcc
3. Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments/Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab2: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

1. Sum and average of 3 numbers
2. Conversion of Fahrenheit to Celsius and vice versa
3. Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:
Lab3: Simple computational problems using arithmetic expressions.

1. Finding the square root of a given number
2. Finding compound interest
3. Area of a triangle using heron's formulae
4. Distance travelled by an object

UNIT II
WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:
Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity

1. Evaluate the following expressions.
   (a) A+B*C+(D*E) + F*G
   (b) A/B*C-B+A*D/3
   (c) A+++B—A
   (d) J= (i++) + (++i)
2. Find the maximum of three numbers using conditional operator
3. Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for 'if construct'.

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab5: Problems involving if-then-else structures.

1. Write a C program to find the max and min of four numbers using if-else.

2. Write a C program to generate electricity bill.
3. TFind the roots of the quadratic equation.
4. Write a C program to simulate a calculator using switch case.
5. Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab6: Iterative problems e.g., the sum of series

1. Find the factorial of given number using any loop.
2. Find the given number is a prime or not.
3. Compute sine and cos series
4. Checking a number palindrome
5. Construct a pyramid of numbers.

UNIT III
WEEK 7

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab7: 1D Array manipulation, linear search

1. Find the min and max of a 1-D integer array.
2. Perform linear search on1D array.
3. The reverse of a 1D integer array
4. Find 2's complement of the given binary number.
5. Eliminate duplicate elements in an array.

WEEK 8

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D Arrays: sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort

1. Addition of two matrices
2. Multiplication two matrices
3. Sort array elements using bubble sort
4. Concatenate two strings without built-in functions
5. Reverse a string using built-in and without built-in string functions

UNIT IV
WEEK 9

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.

1. Write a C program to find the sum of a 1D array using malloc()
2. Write a C program to find the total, average of n students using structures
3. Enter n students data using calloc() and display failed students list
4. Read student name and marks from the command line and display the student details along with the total.
5. Write a C program to implement realloc()

WEEK 10

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

1. Create and display a singly linked list using self-referential structure.
2. Demonstrate the differences between structures and unions using a C program.
3. Write a C program to shift/rotate using bitfields.
4. Write a C program to copy one structure variable to another structure of the same type.

UNIT V
WEEK 11

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

1. Write a C function to calculate NCR value.
2. Write a C function to find the length of a string.
3. Write a C function to transpose of a matrix.
4. Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions

1. Write a recursive function to generate Fibonacci series.
2. Write a recursive function to find the lcm of two numbers.
3. Write a recursive function to find the factorial of a number.
4. Write a C Program to implement Ackermann function using recursion.
5. Write a recursive function to find the sum of series.

WEEK 13

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Simple functions using Call by reference, Dangling pointers.

1. Write a C program to swap two numbers using call by reference.
2. Demonstrate Dangling pointer problem using a C program.
3. Write a C program to copy one string into another using pointer.
4. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 14: File operations

1. Write a C program to write and read text into a file.
2. Write a C program to write and read text into a binary file using fread() and fwrite()
3. Copy the contents of one file to another file.
4. Write a C program to merge two files into the third file using command-line arguments.
5. Find no. of lines, words and characters in a file
6. Write a C program to print last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum & 39; Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST08	NSS/NCC/SCOUTS & Guides/Community Service (Common to All branches of Engineering)	0	0	1	0.5

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand the importance of discipline, character and service motto.

CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.

CO3: Explore human relationships by analyzing social problems.

CO4: Determine to extend their help for the fellow beings and downtrodden people.

CO5: Develop leadership skills and civic responsibilities.

UNIT–I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

1. Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
2. Conducting orientations programs for the students –future plans-activities-releasing road map etc.
3. Displaying success stories-motivational biopics- award winning movies on societal issues etc.
4. Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT–II: Nature & Care :

Activities:

1. Best out of waste competition.
2. Poster and signs making competition to spread environmental awareness.
3. Recycling and environmental pollution article writing competition.
4. Organising Zero-waste day.
5. Digital Environmental awareness activity via various social media platforms.
6. Virtual demonstration of different eco-friendly approaches for sustainable living.

7. Write a summary on any book related to environmental issues.

UNIT–III: Community Service
Activities:

1. Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
2. Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
3. Conducting consumer Awareness. Explaining various legal provisions etc.
4. Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
5. Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST01	Communicative English (Common to All Branches of Engineering)	2	0	0	2

Internal Marks: 30 External Marks: 70

Course Objectives: The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

CO2: Apply grammatical structures to formulate sentences and correct word forms.

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.

CO4: Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.

CO5: Create a coherent paragraph, essay, and resume

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Readinga text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1^{st} Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx
7. https://www.youtube.com/c/DailyVideoVocabulary/videos

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST06	Chemistry (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives: At the end of the course the student can be able

1. To predict the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.
2. To Illustrate the commonly used industrial materials.
3. To train the students on the principles and applications of electrochemistry.
4. To train the students on the principles and applications of polymers.
5. To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the student will be able to

CO1: Explain the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.
CO2: Explain the. commonly used industrial materials.
CO3: Explain the principles and applications of electrochemistry.
CO4: Explain the principles and applications of polymers.
CO5: Explain the instrumental methods and applications.

UNIT–I: Structure and Bonding Models

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of ψ and $\psi 2$, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, N_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT–II: Modern Engineering materials

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT–III: Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT–IV: Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT–V: Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5^{th} Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3^{rd} Edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST03	Differential Equations and Vector Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.

CO2: Find the complete solution to the higher order linear differential equations and apply these methods to find the current in complex electrical circuits.

CO3: Identify solution methods for partial differential equations that model physical processes.

CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO4: Estimate the work done against a field, circulation and flux using vector calculus.

UNIT–I: 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- Electrical circuits.

UNIT–II: Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, particular integral, general solution, Wronskian, Method of variation of parameters, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT–III: Partial Differential Equations

Introduction, Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method and non-linear(standard types) equations, Second order PDE: solution of linear PDE with constant coefficients- RHS term of the type $e^{ax+by}, sin(ax+by), cos(ax+by), x^m y^n$

UNIT–IV: Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, Scalar potential functions, Vector identities.

UNIT–V: Vector integration

LWithoutegral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44^{th} Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10^{th} Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5^{th} Edition(9^{th} reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th} Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9^{th} edition
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST01	Basic Civil and Mechanical Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Get familiarized with the scope and importance of Civil Engineering sub-divisions.
2. Introduce the preliminary concepts of surveying.
3. Acquire preliminary knowledge on Transportation and its importance in nation's economy.
4. Get familiarized with the importance of quality, conveyance and storage of water.
5. Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: At the end of the course, the student will be able to

CO1: Summarize various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Identity the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

UNIT–I:

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering • Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT–II:

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements - Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT–III: Polymers and Fuel Chemistry

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting- Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Text Books:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38^{th} Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10^{th} Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

1. Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
2. Explain different engineering materials and different manufacturing processes.
3. Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand the role of mechnical engineering and different engineering materials.

CO2: Explain the basics of manufacturing processes, thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems,power plants, basics of robotics and its applications.

UNIT–I:

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT–II:

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT–III:

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(**Note:** The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject.)

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt.
2. A text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt.

Reference Books:

1. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt.
2. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
3. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
4. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EET02	Network Analysis (ECE & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
2. To impart knowledge on applying appropriate theorem for electrical circuit analysis
3. To explain transient behavior of circuits in time and frequency domains
4. To teach concepts of resonance
5. To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand basic electrical circuits with nodal and mesh analysis.
CO2: Analyse the circuit using network simplification theorems.
CO3: Find Transient response and Steady state response of a network.
CO4: Analyse electrical networks in the Laplace domain.
CO5: Compute the parameters of a two-port network.

UNIT–I:

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT–II:

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.

Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT–III:

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L- C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT–IV:

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT–V:

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

Text Books:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3^{rd} Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9^{th} Edition 2020.
3. Network lines and Fields by John. D. Ryder 2^{nd} Edition, PHI

Reference Books:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7^{th} Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL01	Communicative English Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives: The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.

CO5: Create effective Course Objectives

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

1. Walden Infotech
2. Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL04	Chemistry Lab (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the student will be able to

CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer Bakelite materials.
CO3: Measure the strength of an acid present in secondary batteries
CO4: Analyse the IR spectra of some organic compounds.
CO5: Calculate strength of acid in Pb-Acid battery

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

References:

1. "Vogel's Quantitative Chemical Analysis 6^{th} Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL01	Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and plumbing.

CO3: Apply sheet metal working operations in various applications and basic repairs of two weeler vehicle.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

SYLLABUS

1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.

   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.

   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.

   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.

   a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.
9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019.
2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5^{th} Edn. 2015.
3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14^{th} edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EET02	Network Analysis and Simulation Laboratory (ECE & allied branches)	0	0	3	1.5

Internal Marks: 15 External Marks: 35

Course Objectives:

1. To gain hands on experience in verifying Kirchoff's laws and network theorems
2. To analyze transient behavior of circuits
3. To study resonance characteristics
4. To determine 2-port network parameters

Course Outcomes: On Completion of the course, the student should be able to

CO1: Verify Kirchoff's laws and network theorems.
CO2: Measure time constants of RL & RC circuits.
CO3: Analyze behavior of RLC circuit for different cases.
CO4: Design resonant circuit for given specifications.
CO5: Characterize and model the network in terms of all network parameters.

The following experiments need to be performed using both Hardware and simulation Software.
The experiments need to be simulated using software and the same need to be verified using the hardware.

List of Experiments:

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis for AC circuits
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits
4. Verification of maximum power transfer theorem for AC circuits
5. Verification of Tellegen's theorem for two networks of the same topology.
6. Study of DC transients in RL, RC and RLC circuits
7. To study frequency response of various 1^{st} order RL & RC networks
8. To study the transient and steady state response of a 2^{nd} order circuit by varying its various parameters and studying their effects on responses
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.

10. Determination of open circuit (Z) and short circuit (Y) parameters
11. Determination of hybrid (H) and transmission (ABCD) parameters
12. To measure two port parameters of a twin-T network and study its frequency response.

Hardware Requirements:
Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

Software requirements:
Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3^{rd} Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9^{th} Edition 2020.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST07	Health and Wellness, Yoga and Sports (Common to All branches of Engineering)	0	0	1	0.5

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels.

CO5: Develop Positive Personality

UNIT–I:

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

1. Organizing health awareness programmes in community
2. Preparation of health profile
3. Preparation of chart for balance diet for all age groups

UNIT–II:

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT–III:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

1. Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.

   Practicing general and specific warm up, aerobics
2. Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14^{th} Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. – 3^{rd} ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST07	NUMERICAL TECHNIQUES AND STATISTICAL METHODS	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Prerequisite: Engineering Mathematics, Engineering Mechanics.

Course Objectives:

- To solve engineering problems using numerical methods.
- To understand error analysis and iterative solutions.
- To analyze determinate structures using different classical methods.
- To compute deflections in beams using energy and other methods.
- To understand the principles of moving loads and influence lines.

Course Outcomes:

CO 1: Solve algebraic and transcendental equations using numerical techniques. L3

CO 2: Apply numerical techniques for interpolation and numerical integration. L3

CO 3: Analyze statically determinate structures like beams and trusses. L3

CO 4: Compute slopes and deflections using energy methods and moment area theorems. L3

CO 5: Analyze beams for moving loads and draw influence line diagrams. L3

UNIT-I (8 Lectures)

Solution of Algebraic and Transcendental Equations

- Bisection Method, Method of False Position
- Newton-Raphson Method
- Solution of linear simultaneous equations: Gauss Elimination, Gauss Seidel
- Applications in Civil Engineering

UNIT-II (8 Lectures)

Interpolation and Numerical Integration

- Newton's Forward and Backward Interpolation
- Lagrange's Interpolation
- Numerical integration: Trapezoidal Rule and Simpson's Rule
- Applications to Civil Engineering problems

UNIT-III (8 Lectures)

Analysis of Perfect Frames and Beams

- Types of Frames – Perfect, Imperfect and Redundant
- Analytical methods for perfect frames
- Shear force and bending moment diagrams for various types of beams

UNIT-IV (8 Lectures)
Deflection of Beams

- Moment area theorems
- Macaulay's method
- Energy methods – Castigliano's theorem

UNIT-V (8 Lectures)
Moving Loads and Influence Lines

- Moving loads on simply supported beams
- Influence line diagrams for reactions, shear force and bending moment
- Absolute maximum bending moment and shear force

Text Books:

- R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House.
- R.S. Khurmi, "Strength of Materials", S. Chand Company Ltd.

Reference Books:

- B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers.
- Punmia B.C., "Strength of Materials and Theory of Structures", Laxmi Publications.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST12	Universal Human Values (Common to All Branches of Engineering)	2	0	0	2

Internal Marks: 30 External Marks: 70

Course Objectives: The objective of this course is to help students understand the basic guidelines, content, and process of value education. It develops critical ability to distinguish between what is of value and what is superficial in life. The course facilitates students in applying these understanding in their real-life situations at different levels such as individual, family, society and nature.

Course Outcomes:

CO1: Understand the need, basic guidelines, and content of human values.
CO2: Apply the concepts of harmony in the self and harmony in the family.
CO3: Analyze the concepts of harmony in society and nature.
CO4: Evaluate the implications of holistic understanding of harmony on professional ethics.
CO5: Develop commitment and competence to act with values and live in harmony.

UNIT I: Introduction to Value Education

- Purpose and motivation for the course.
- Self-exploration – its content and process.
- Natural acceptance and experiential validation.
- Continuous happiness and prosperity – A look at basic human aspirations.
- Right understanding, relationship and physical facilities – basic requirements for fulfillment of aspirations.
- The basic human aspirations and their fulfillment through right understanding and resolution.

UNIT II: Harmony in the Human Being

- Understanding human being as co-existence of the sentient 'I' and material body.
- The needs of Self ('I') and 'Body' – Sukh and Suvidha.
- Body as an instrument of 'I'.
- Characteristics and activities of 'I' and harmony in 'I'.
- Understanding harmony in the Self.

UNIT III: Harmony in the Family and Society

- Family as a basic unit of human interaction and values in relationships.

- Understanding values in human relationships; trust and respect as the foundation.
- Understanding the harmony in the society and universal order.
- Hierarchical structure of the society and organization of human work.
- The concept of undivided society and universal order – from family to world family.

UNIT IV: Harmony in Nature and Existence

- Understanding the harmony in the nature.
- Interconnectedness and mutual fulfillment among four orders of nature.
- Holistic perception of harmony in existence.
- The four orders – Material order, Plant/Bio order, Animal order and Human order.
- Realization of coexistence and understanding the eco-friendly production system.

UNIT V: Implications of Holistic Understanding

- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Professional ethics in light of right understanding.
- Vision for holistic technologies, production systems and management models.
- Journey towards harmony – Education, Sansthans, Politics and Media.

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at
Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual:

Text Books:

1. R. R. Gaur, R. Asthana, G. P. Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN: 978-93-87034-47-1

Teacher's Manual:

1. R. R. Gaur, R. Asthana, G. P. Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN: 978-93-87034-53-2

Reference Books:

1. *Jeevan Vidya: Ek Parichaya*, A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age International Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth*, Mohandas Karamchand Gandhi.
5. *Small is Beautiful*, E. F. Schumacher.
6. *Slow is Beautiful*, Cecile Andrews.
7. *Economy of Permanence*, J. C. Kumarappa.
8. *Bharat Mein Angreji Raj*, Pandit Sunderlal.
9. *Rediscovering India*, Dharampal.
10. *Hind Swaraj or Indian Home Rule*, Mohandas K. Gandhi.
11. *India Wins Freedom*, Maulana Abdul Kalam Azad.
12. *Vivekananda*, Romain Rolland (English).
13. *Gandhi*, Romain Rolland (English).

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is to highlight essential elements and help in identifying them amidst surface-level ideas. In other words, the mentor helps students explore the critical aspects of the subject.

In the discussions—particularly during practice sessions (tutorials)—the mentor encourages students to connect with their own self through self-observation, self-reflection, and self-exploration.

Scenarios may be used to initiate discussion. Students are encouraged to take up ”ordinary” situations rather than ”extra-ordinary” ones. Such observations and their analyses are shared and discussed with peers and faculty mentors in group sittings.

Tutorials (experiments or practicals) are an important part of the course. The difference here is that the laboratory is real life itself, and practicals refer to how students behave and respond in real situations.

Depending on the nature of the topic, worksheets, home assignments, and/or activities may be included. The practice sessions are also intended to support students in performing actions that align with their beliefs. This is expected to lead to the development of commitment—acting and working in accordance with basic human values.

It is recommended that this content be presented to students in its entirety as a foundation course, without omitting or appending content. Additional material may be included in separate, higher-level courses. This course is to be delivered by faculty from all departments, not exclusively by any single department.

Teacher preparation with at least one 8-day Faculty Development Program (FDP) on Universal Human Values is considered essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicteindia.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDPSI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicteindia.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universalhuman-values/chapter-5-holistic-understanding-of-harmony-onprofessional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST05	Surveying (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- To understand the basic principles and classification of surveying.
- To learn linear and angular measurement methods using instruments.
- To apply chain, compass, and plane table methods in the field.
- To use leveling instruments for determining elevations.
- To acquire knowledge on modern surveying techniques.

Course Outcomes:

CO1: Understand principles and types of surveying.
CO2: Apply linear and angular measurement techniques.
CO3: Conduct surveys using chain, compass, and plane table.
CO4: Utilize leveling instruments to determine elevations.
CO5: Use modern surveying instruments and interpret data.

UNIT I: Introduction and Linear Measurements

- Definition, Principles of Surveying, Objectives, Classification.
- Errors and accuracy, types of errors, tape corrections.
- Linear measurements, chaining, ranging (direct and indirect).
- Obstacles in chaining and methods to overcome them.

UNIT II: Compass and Plane Table Surveying

- Compass types: Prismatic and Surveyor's Compass.
- Bearings – WCB and QB – Magnetic Declination – Local Attraction.
- Plane Table Instruments and Accessories.
- Methods: Radiation, Intersection, Traversing, and Resection.

UNIT III: Levelling and Contouring

- Levelling – Definition, Instruments – Types of Levelling.
- Temporary adjustments, Bench Marks, Booking and Reduction.
- Contours – Characteristics, Methods of contouring.
- Uses and interpretation of contour maps.

UNIT IV: Theodolite Surveying

- Components of Theodolite – Temporary Adjustments.
- Measurement of horizontal and vertical angles.
- Traversing using theodolite – Gale's table – Omitted measurements.
- Introduction to Trigonometric Levelling.

UNIT V: Modern Surveying Techniques

- Electronic Distance Measurement (EDM) instruments.
- Total Station – Features, operation, advantages.
- GPS – Principles, applications in surveying.
- Introduction to GIS – Data capture and applications.

Text Books:

1. B.C. Punmia, *Surveying Vol. I*, Laxmi Publications.
2. K.R. Arora, *Surveying Vol. I*, Standard Book House.
3. N.N. Basak, *Surveying and Levelling*, McGraw Hill Education.

Reference Books:

1. A.M. Chandra, *Higher Surveying*, New Age International.
2. T.P. Kanetkar & S.V. Kulkarni, *Surveying and Levelling*, PVG Prakashan.
3. S.K. Duggal, *Surveying Vol. I & II*, Tata McGraw Hill.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEL02	Strength of Materials (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Understand the nature of stresses developed in simple geometries such as bars, cantilevers, and beams.
- Learn to evaluate strain energy in members due to different types of loading.
- Develop the ability to draw shear force and bending moment diagrams for different loading cases.
- Understand the theory of simple bending and apply it to compute stresses and strains in beams.
- Study the concept of torsion and apply it to shafts and springs.

Course Outcomes:

CO1: Understand the concept of stress and strain under axial loads.
CO2: Calculate strain energy and apply energy theorems.
CO3: Draw shear force and bending moment diagrams for statically determinate beams.
CO4: Apply bending and shear stress formulas to different cross-sections.
CO5: Understand torsion in circular shafts and helical springs.

UNIT I: SIMPLE STRESSES AND STRAINS

- Concept of stress and strain, Hooke's Law and stress-strain diagram for mild steel.
- Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain.
- Elastic moduli and relationships between them.
- Bars of varying section, Composite bars, Temperature stresses.

UNIT II: STRAIN ENERGY

- Definition – Resilience, proof resilience, modulus of resilience, toughness.
- Strain energy due to axial load, gradually applied load, suddenly applied load, and impact load.
- Simple applications.

UNIT III: SHEAR FORCE AND BENDING MOMENT

- Definition of beam – Types of beams – Concept of shear force and bending moment.
- Shear force and bending moment diagrams for cantilever, simply supported, and overhanging beams subjected to point loads, UDL, uniformly varying loads and moments.
- Point of contraflexure – Relationship between shear force, bending moment and loading.

UNIT IV: FLEXURAL AND SHEAR STRESSES IN BEAMS

- Theory of simple bending – Assumptions – Derivation of bending equation.
- Neutral axis, Moment of resistance, Section modulus.
- Shear stress distribution across various beam sections.

UNIT V: TORSION

- Torsion of circular shafts – Derivation of torsion equation – Assumptions.
- Stress and deformation in circular solid and hollow shafts – Stepped shafts.
- Twisting moment diagram – Power transmitted by shafts.
- Torsional rigidity – Strain energy in shafts – Closed and open coiled helical springs.

Text Books:

1. R.K. Bansal, *Strength of Materials*, Laxmi Publications.
2. S. Ramamrutham, *Strength of Materials*, Dhanpat Rai Publishing.
3. Ferdinand P. Beer, E. Russell Johnston Jr., *Mechanics of Materials*, McGraw Hill.

Reference Books:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, *Mechanics of Materials*, Laxmi Publications.
2. James M. Gere, *Mechanics of Materials*, Cengage Learning.
3. Egor P. Popov, *Engineering Mechanics of Solids*, Pearson.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET02	Fluid Mechanics (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Understand the physical properties of fluids and their behavior under various conditions.
- Apply basic fluid statics and dynamics principles.
- Learn the use of devices for flow measurements.
- Analyze fluid flow in pipelines.
- Apply dimensional analysis and similitude for model testing.

Course Outcomes:

CO1: Explain fundamental properties and types of fluids.
CO2: Apply fluid statics to determine pressures and forces on surfaces.
CO3: Use Bernoulli's and continuity equations to analyze fluid flow.
CO4: Measure discharge using standard hydraulic devices.
CO5: Perform dimensional analysis and understand model laws.

UNIT I: FLUID PROPERTIES AND STATICS

- Definition of fluid – Properties: density, viscosity, surface tension, compressibility.
- Pressure concepts – Pascal's law – Hydrostatic law.
- Manometers and pressure gauges.
- Pressure on plane and curved surfaces.
- Buoyancy and floatation – stability of floating bodies.

UNIT II: FLUID KINEMATICS AND DYNAMICS

- Classification of flows – steady/unsteady, uniform/non-uniform.
- Streamline, path line, streak line.
- Continuity equation (1D).
- Euler's equation, Bernoulli's equation and its applications.
- Momentum equation.

UNIT III: FLOW MEASUREMENT

- Orifice, mouthpiece, venturimeter, orifice meter, pitot tube.

- Flow over notches and weirs – rectangular, triangular, trapezoidal.
- Discharge formulas and calibration.

UNIT IV: FLOW THROUGH PIPES

- Reynolds experiment – laminar and turbulent flow.
- Major losses – Darcy–Weisbach equation.
- Minor losses – bends, expansions, contractions.
- Pipes in series and parallel.
- Hydraulic gradient line and total energy line.

UNIT V: DIMENSIONAL ANALYSIS AND MODEL STUDIES

- Dimensional homogeneity – Rayleigh's method – Buckingham's Pi theorem.
- Similarity laws – Geometric, kinematic and dynamic similarity.
- Dimensionless numbers – Reynolds, Froude, Euler, Weber, Mach.
- Model laws and applications.

Text Books:

1. R.K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications.
2. Modi and Seth, *Hydraulics and Fluid Mechanics*, Standard Book House.

Reference Books:

1. K. Subramanya, *Fluid Mechanics*, Tata McGraw Hill.
2. Frank M. White, *Fluid Mechanics*, McGraw Hill Education.
3. P.N. Modi and S.M. Seth, *Hydraulics and Fluid Mechanics Including Hydraulic Machines*, Standard Book House.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEL03	Surveying Lab (Civil Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

- Understand the principles and practices of land surveying techniques.
- Learn to use various traditional and modern surveying instruments.
- Apply field observation methods for distance and angle measurements.
- Perform levelling, compass, and plane table surveying in the field.
- Gain practical knowledge in data collection and mapping.

Course Outcomes:

CO1: Use appropriate instruments for chain, compass, and leveling surveys.
CO2: Conduct plane table surveys and plotting of details.
CO3: Compute reduced levels and contours using leveling data.
CO4: Apply theodolite for angular measurements and traversing.
CO5: Use modern survey instruments like total station effectively.

List of Experiments:

1. Study of Surveying Instruments.
2. Ranging and Measurement of Distance by Chain.
3. Compass Traversing and Calculation of Included Angles.
4. Radiation Method and Intersection Method by Plane Table Surveying.
5. Two Point and Three Point Problems in Plane Table Surveying.
6. Profile Leveling and Cross-Sectioning by Dumpy Level.
7. Contour Surveying and Plotting using Leveling Instruments.
8. Measurement of Horizontal Angles by Theodolite.
9. Measurement of Vertical Angle by Theodolite.
10. Determination of Height of an Object using Theodolite (Trigonometrical Leveling).
11. Traversing by Theodolite and Calculation of Coordinates.
12. Demonstration of Total Station – Measurement of Distance and Angles.

Text Books:

1. B.C. Punmia, *Surveying Vol. I*, Laxmi Publications.
2. K.R. Arora, *Surveying Vol. I*, Standard Book House.

3. N.N. Basak, *Surveying and Levelling*, McGraw Hill.

Reference Books:

1. A.M. Chandra, *Higher Surveying*, New Age International.
2. S.K. Duggal, *Surveying Vol. I & II*, Tata McGraw Hill.
3. Kanetkar and Kulkarni, *Surveying and Levelling*, PVG Prakashan.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEL02	Strength of Materials Lab (Civil Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

- Understand the mechanical behavior of structural materials through experimentation.
- Determine various mechanical properties such as tensile strength, shear strength, hardness, and toughness.
- Analyze deflections, impact resistance, and modulus of rigidity using different tests.
- Interpret experimental data and correlate with theoretical concepts.
- Gain hands-on experience in using universal testing machines and related equipment.

Course Outcomes:

CO1: Conduct tests to determine mechanical properties of materials.
CO2: Evaluate material strength and deformation behavior.
CO3: Analyze deflection in beams and understand stiffness.
CO4: Assess hardness and impact resistance through appropriate experiments.
CO5: Apply knowledge to select materials for engineering applications.

List of Experiments:

1. Tension test on mild steel rod.
2. Compression test on wood or concrete cube.
3. Shear test on mild steel.
4. Torsion test on mild steel rod.
5. Bending test on simply supported beam.
6. Bending test on cantilever beam.
7. Impact test – Charpy and Izod tests.
8. Hardness test – Brinell and Rockwell tests.
9. Spring test – Close and open coiled springs.
10. Deflection test on beams.
11. Verification of Maxwell's reciprocal theorem.

12. Determination of modulus of rigidity using torsion setup.

Text Books:

1. R.K. Bansal, *Strength of Materials*, Laxmi Publications.
2. S. Ramamrutham, *Strength of Materials*, Dhanpat Rai Publishing.

Reference Books:

1. S.S. Bhavikatti, *Strength of Materials*, Vikas Publishing House.
2. Ferdinand P. Beer et al., *Mechanics of Materials*, McGraw Hill Education.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CES01	Building Planning and Drawing (Civil Engineering)	2	0	2	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Introduce the basic principles of planning and building bye-laws.
- Understand the design and drawing of residential and public buildings.
- Develop skills to prepare detailed building drawings.
- Learn about building services and approval procedures.

Course Outcomes:

CO1: Understand building bye-laws and regulations.
CO2: Apply principles of planning for various types of buildings.
CO3: Prepare plan, elevation and section of buildings.
CO4: Develop line drawings and detailed drawings using AutoCAD.
CO5: Identify procedures for obtaining building approvals and service installations.

UNIT I: BUILDING BYE-LAWS AND REGULATIONS

- Introduction – Building Rules and Bye-Laws.
- Objectives of Bye-Laws – Principle of Bye-Laws.
- Classification of buildings – Rules for residential buildings.
- Open space requirements – Floor Area Ratio (FAR) – Height regulation.

UNIT II: PRINCIPLES OF BUILDING PLANNING

- Principles of planning – Aspect, Prospect, Privacy, Grouping, Circulation, Roominess.
- Orientation – Requirements of various types of rooms.
- Design of Residential Buildings – Minimum standards for various parts.

UNIT III: PUBLIC BUILDINGS

- Planning and Design of Public Buildings: Schools, Hospitals, Hostels, Office Buildings.
- Principles and layouts.
- Functional requirements of public buildings.

UNIT IV: BUILDING SERVICES

- Plumbing and Sanitation – Electrical Layout – Water Supply – Rain Water Harvesting.
- Fire safety norms and standards.
- Energy efficient building concepts.
- Building approval procedures – Role of local authorities.

UNIT V: DRAWING PRACTICE

- Planning and Drawing of Residential Buildings: Single storey and Multi-storey.
- Preparation of line drawings and dimensioned drawings.
- Elevation and section drawings.
- Introduction to AutoCAD – Simple commands and drawing practice.

Text Books:

1. N. Kumaraswamy and A. Kameswara Rao, *Building Planning and Drawing*, Charotar Publishing House.
2. Shah, Kale Patki, *Building Drawing*, Tata McGraw Hill Publishing.

Reference Books:

1. Malik and Meo, *Building Design and Drawing*, Computech Publications Ltd.
2. M. G. Shah et al., *Building Planning and Drawing*, McGraw Hill Education.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ACT01	Environmental Science (Common to all branches)	3	0	0	0

Internal Marks: 30 External Marks: 70

Course Objectives:

- Creating awareness on the environmental problems of air, water, soil, forest, etc.
- Educating the ways and means to protect the environment.
- Enforcing the protection acts and regulations.
- Developing technologies for sustainable development.

Course Outcomes:

CO1: Understand the importance of environmental studies.

CO2: Identify and analyze various environmental pollution issues and methods to overcome.

CO3: Relate the global climate change, ozone layer depletion, acid rain and its impacts.

CO4: Apply the environmental legislation and regulations to protect the environment.

CO5: Understand the concepts of sustainable development.

UNIT I: NATURAL RESOURCES

- Forest Resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people.
- Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems.
- Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
- Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

UNIT II: ECOSYSTEMS

- Concept of an ecosystem – Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.

- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Types of Ecosystems: Forest, Grassland, Desert and Aquatic.

UNIT III: BIODIVERSITY AND ITS CONSERVATION

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Threats to biodiversity – Endangered and endemic species of India.
- Conservation of biodiversity: In-situ and Ex-situ.

UNIT IV: ENVIRONMENTAL POLLUTION

- Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.
- Solid waste Management: Causes, effects and control measures.
- Disaster Management: Floods, Earthquakes, Cyclones and Landslides.

UNIT V: SOCIAL ISSUES AND THE ENVIRONMENT

- Urban problems related to energy.
- Water conservation, rainwater harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns.
- Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.
- Environmental Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.
- Public awareness.

Text Books:

1. P. Meenakshi, *Elements of Environmental Science and Engineering*, Prentice-Hall of India.
2. Erach Bharucha, *Environmental Studies for UG courses*, University Grants Commission.

Reference Books:

1. S.S. Dara, *Environmental Chemistry and Pollution Control*, S. Chand.
2. R.C. Sharma and M. Kaur, *Environmental Studies*, Kalyani Publishers.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23MBT01	Managerial Economics and Financial Analysis (Common to all branches)	2	0	0	2

Internal Marks: 30 External Marks: 70

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products and input-output relationships for optimizing production and cost.
- To know the various types of market structures and pricing methods and strategy.
- To give an overview on investment appraisal methods for long-term decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

CO1: Define the concepts related to Managerial Economics, financial accounting and management. (L2)

CO2: Understand the fundamentals of Economics viz., Demand, Production, Cost, Revenue and Markets. (L2)

CO3: Apply the concept of production, cost and revenues for effective business decisions. (L3)

CO4: Analyze how to invest their capital and maximize returns. (L4)

CO5: Evaluate capital budgeting techniques. (L5)

CO6: Develop accounting statements and evaluate the financial performance of business entities. (L5)

UNIT I: MANAGERIAL ECONOMICS

- Introduction – Nature, meaning, significance, functions, and advantages.
- Demand – Concept, Function, Law of Demand, Demand Elasticity – Types – Measurement.
- Demand Forecasting – Factors governing forecasting, methods.
- Managerial Economics and Financial Accounting and Management.

UNIT II: PRODUCTION AND COST ANALYSIS

- Introduction – Nature, meaning, significance, functions and advantages.
- Production Function – Least-cost combination – Short-run and Long-run Production Function – Isoquants and Isocosts.
- Cost and Break-Even Analysis – Cost concepts and cost behaviour – Break-Even Analysis (BEA).
- Determination of Break-Even Point (Simple Problems).

UNIT III: BUSINESS ORGANIZATIONS AND MARKETS

- Introduction – Forms of Business Organizations: Sole Proprietorship, Partnership, Joint Stock Companies, Public Sector Enterprises.
- Types of Markets – Perfect and Imperfect Competition.
- Features of Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly.
- Price-Output Determination, Pricing Methods and Strategies.

UNIT IV: CAPITAL BUDGETING

- Introduction – Nature, meaning, significance.
- Types of Working Capital – Components – Sources of Short-term and Long-term Capital.
- Estimating Working Capital Requirements.
- Capital Budgeting – Features, Proposals, Methods and Evaluation.
- Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR) Method (Sample Problems).

UNIT V: FINANCIAL ACCOUNTING AND ANALYSIS

- Introduction – Concepts and Conventions – Double-entry Bookkeeping – Journal, Ledger, Trial Balance.
- Final Accounts: Trading Account, Profit and Loss Account, and Balance Sheet with simple adjustments.
- Introduction to Financial Analysis – Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital Structure Ratios, and Profitability.

Text Books:

1. Varshney & Maheswari, *Managerial Economics*, Sultan Chand.
2. Aryasri, *Business Economics and Financial Analysis*, 4/e, McGraw Hill.

Reference Books:

1. Ahuja H.L., *Managerial Economics*, S. Chand.

2. S.A. Siddiqui and A.S. Siddiqui, *Managerial Economics and Financial Analysis*, New Age International.
3. Joseph G. Nellis and David Parker, *Principles of Business Economics*, 2/e, Pearson.
4. Domnick Salvatore, *Managerial Economics in a Global Economy*, Cengage.

Online Learning Resources:

- https://www.slideshare.net/123ps/managerial-economics-ppt
- https://www.slideshare.net/rossanz/production-and-cost-45827016
- https://www.slideshare.net/darkyla/business-organizations-19917607
- https://www.slideshare.net/balarajbl/market-and-classification-of-market
- https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
- https://www.slideshare.net/ashu1983/financial-accounting

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST10	Hydraulic and Hydraulic Machinery (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Learning Objectives:

- Evaluate the properties of uniform and non-uniform flow in open channels, including critical flow and hydraulic jumps.
- Explore dimensional analysis concepts and establish model-prototype relationships in hydraulic studies.
- Analyze the effects of jets on various vanes in turbomachinery and derive expressions for performance metrics.
- Understand the working principles and selection criteria of Pelton, Francis, and Kaplan turbines.
- Study the classification, operation, and performance of centrifugal and reciprocating pumps.

Course Outcomes:

CO1: Analyze uniform and non-uniform flow in open channels using key principles and formulas.

CO2: Apply dimensional analysis to hydraulic models using Rayleigh's method and Buckingham's Pi theorem.

CO3: Analyze hydrodynamic forces in turbomachinery and calculate work done and efficiency.

CO4: Evaluate the layout, efficiency, and design of various hydraulic turbines.

CO5: Analyze the performance and design of centrifugal and reciprocating pumps.

UNIT I: UNIFORM AND NON-UNIFORM FLOW IN OPEN CHANNELS

- Types of channels, types of flows, velocity distribution, energy and momentum correction factors.
- Chezy's and Manning's formulae for uniform flow, most economical sections.
- Critical flow: specific energy, critical depth, computation of critical depth.
- Steady gradually varied flow: dynamic equation, surface profiles – mild, critical, steep, horizontal, adverse slopes.
- Direct step method, rapidly varied flow, hydraulic jump, energy dissipation.

UNIT II: HYDRAULIC SIMILITUDE

- Dimensional analysis – Rayleigh's method and Buckingham's Pi theorem.
- Hydraulic models – geometric, kinematic and dynamic similarities.
- Dimensionless numbers, model and prototype relationships.

UNIT III: BASICS OF TURBO MACHINERY

- Hydrodynamic force of jets on stationary and moving vanes – flat, inclined, and curved.
- Jet striking centrally and at tip, velocity triangles at inlet and outlet.
- Expressions for work done and efficiency.

UNIT IV: HYDRAULIC TURBINES

- Layout of a typical hydropower installation – heads and efficiencies.
- Classification of turbines: Pelton wheel, Francis turbine, Kaplan turbine – working principles, velocity diagrams, work done and efficiency.
- Hydraulic design, draft tube theory and efficiency.
- Governing of turbines, surge tanks, unit and specific quantities, selection of turbines.

UNIT V: CENTRIFUGAL AND RECIPROCATING PUMPS

- Centrifugal pumps: installation, classification, work done, manometric head, minimum starting speed, losses and efficiencies, specific speed, multistage pumps, pumps in parallel and series.
- Reciprocating pumps: introduction, classification, components, working, discharge, indicator diagram, work done, and slip.

Text Books:

1. K. Subramanya, *Open Channel Flow*, Tata McGraw Hill Publishers.
2. A.K. Rajput, *Fluid Mechanics and Hydraulic Machines*, S. Chand, 2018.
3. Modi and Seth, *Fluid Mechanics*, Standard Book House.

Reference Books:

1. G.L. Asawa, *Fluid Flow in Pipes and Channels*, CBS.
2. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *Fluid Mechanics and Machinery*, Oxford Higher Education.
3. Md. Kaleem Khan, *Fluid Mechanics and Machinery*, Oxford Higher Education.
4. R.K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, New Delhi.

Web Materials:

- https://archive.nptel.ac.in/courses/105/105/105105203/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET03	Building Materials and Concrete Technology (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Learning Objectives:

- To learn about uses of different building materials.
- To learn materials and their properties used in the production of concrete.
- To learn the behavior of concrete at fresh stage.
- To learn the behavior of concrete at hardened stage.
- To learn the methodology of Mix design.

Course Outcomes:

CO1: Know various engineering properties of building construction materials and suggest their suitability.

CO2: Familiarise the basic ingredients of concrete and their role in the production of concrete.

CO3: Summarize fresh concrete manufacturing process and tests involved to check workability.

CO4: Familiarize the basic properties of hardened concrete and different strength tests conducted.

CO5: Design the concrete mix by using BIS 10262:2019.

UNIT I: BUILDING MATERIALS (9 Lectures)

- Bricks: Composition of good brick earth, manufacturing methods.
- Timber: Structure, properties, seasoning, classification, defects.
- Tiles: Characteristics, manufacturing, types.
- UPVC: Definition and use for doors and windows.
- Glass: Definition and use for doors and windows.

UNIT II: AGGREGATES, CEMENT AND ADMIXTURES (10 Lectures)

- Aggregates: Classification, mechanical and physical properties, bulking of sand, deleterious substances, alkali-aggregate reaction, thermal properties, sieve analysis, grading.
- Portland Cement: Chemical composition, hydration, setting, structure, physical tests, grades.

- Admixtures: Types – accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash, silica fume.

UNIT III: FRESH CONCRETE (9 Lectures)

- Manufacturing steps, properties – workability, segregation, bleeding.
- Workability tests, effect of time and temperature.
- Ready-mix concrete, shotcrete.

UNIT IV: HARDENED CONCRETE (10 Lectures)

- Water/cement ratio – Abram's Law – Gel/space ratio – maturity concept.
- Factors affecting strength, compressive vs. tensile strength, curing.
- Strength tests: compression, tension, flexure, splitting.
- Non-destructive tests – codal provisions, properties (elasticity, creep, shrinkage, Poisson's ratio, water absorption, permeability).

UNIT V: MIX DESIGN AND QUALITY CONTROL (10 Lectures)

- Factors in mix proportioning, quality control of concrete.
- Statistical methods, acceptance criteria.
- BIS method of mix design (IS 10262:2019).

Text Books:

1. M.S. Shetty, *Concrete Technology*, S. Chand, 8th edition, 2019.
2. S.C. Rangwala, *Engineering Materials*, 43rd edition, Charotar Publishing House, 2019.
3. Shantha Kumar, *Concrete Technology*, Oxford Publications, 2018.

Reference Books:

1. S.K. Duggal, *Building Materials*, New Age International, 5th edition, 2019.
2. P.C. Verghese, *Building Materials*, PHI Learning Pvt. Ltd., 2009.
3. A.M. Neville, *Properties of Concrete*, Pearson, 5th edition, 2013.

Web Resources:

- https://www.sanfoundry.com/1000-concrete-technology-questions-answers/
- https://www.sanfoundry.com/1000-construction-building-materials-questions-a

- https://lecturenotes.in/subject/145/building-materials-and-building-constru

List of Experiments:

1. Determination of normal consistency and fineness of cement.
2. Determination of initial and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Sieve analysis and fineness modulus of coarse aggregates.
6. Specific gravity of coarse aggregate.
7. Sieve analysis and fineness modulus of fine aggregate (sand).
8. Bulking of sand.
9. Workability of concrete by compaction factor method.
10. Workability of concrete by slump test.
11. Compressive strength and Young's modulus of cement concrete.
12. Split tensile strength of concrete.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET04	Structural Analysis (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Learning Objectives:

- Understand bending moment and shear force in propped cantilevers.
- Apply elastic theory to three-hinged arches and suspension bridges under load and temperature changes.
- Use Slope-Deflection and energy methods to analyze beams under various conditions.
- Apply the Moment Distribution Method to analyze continuous beams and portal frames.
- Use Flexibility and Stiffness Methods to analyze beams and rigid jointed frames using matrices.

Course Outcomes:

CO1: Draw Shear Force Diagrams (SFD), Bending Moment Diagrams (BMD), and deflections for propped cantilevers.

CO2: Analyze three-hinged arches and suspension bridges using elastic theory and Eddy's theorem.

CO3: Use Slope-Deflection and energy methods for analyzing continuous beams and determining deflections.

CO4: Evaluate portal frames and beams using the Moment Distribution Method including sway.

CO5: Apply matrix Flexibility and Stiffness Methods for continuous beams and rigid jointed frames.

UNIT I: PROPPED CANTILEVERS

- Analysis of propped cantilevers.
- Shear force and bending moment diagrams.
- Deflection of propped cantilevers.

UNIT II: THREE-HINGED ARCHES AND SUSPENSION BRIDGES

- Introduction and types of arches.
- Elastic theory, Eddy's theorem.

- Determination of horizontal thrust, bending moment, normal thrust, radial shear, effect of temperature.
- Arches with supports at different levels.
- Cable structures and suspension bridges: characteristics, analysis of cables under point and UDL loads.
- Analysis of simple suspension bridges, three-hinged and two-hinged stiffening girder suspension bridges.

UNIT III: SLOPE-DEFLECTION METHOD AND ENERGY THEOREMS

- Slope-Deflection Method: derivation and application to continuous beams with and without support settlement.
- Energy theorems: strain energy in linear elastic systems.
- Expressions for strain energy due to axial force, bending, and shear.
- Castigliano's first theorem, deflections of simple beams.

UNIT IV: MOMENT DISTRIBUTION METHOD

- Stiffness and carry-over factors, distribution factors.
- Analysis of continuous beams with and without sinking of supports.
- Analysis of portal frames including sway.
- Substitute frame analysis using two cycles.

UNIT V: FLEXIBILITY AND STIFFNESS METHODS

- Flexibility method: matrix analysis of continuous beams and rigid jointed plane frames (Single bay, single storey, vertical legs).
- Stiffness method: formulation of stiffness matrix, relationship to flexibility matrix.
- Analysis of continuous beams and rigid jointed frames by stiffness matrix method.

Text Books:

1. T. S. Thandavamoorthy, *Structural Analysis*, Oxford University Press.
2. R.C. Hibbeler, *Structural Analysis*, Pearson Education.
3. B.C. Punmia, Jain Jain, *Theory of Structures – II*, Laxmi Publications.
4. C.S. Reddy, *Structural Analysis*, Tata McGraw Hill.

Reference Books:

1. C.K. Wang, *Intermediate Structural Analysis*, Tata McGraw Hill.
2. Ramamrutham, *Theory of Structures*, Dhanpat Rai Publications.
3. Vazrani Ratwani, *Analysis of Structures*, Khanna Publications.
4. R. Vaidyanathan P. Perumal, *Comprehensive Structural Analysis Vol. I & II*, Laxmi Publications.
5. P.N. Chandramouli, *Structural Analysis I*, Yesdee Publishing.

Web Resources:

- https://nptel.ac.in/courses/105105166
- https://www.aceenggacademy.com/wp-content/uploads/2019/08/Structural-Analys
- https://archive.nptel.ac.in/courses/105/105/105105166/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET05	Environmental Engineering (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Pre-requisites: Engineering Chemistry, Environmental Science

Course Objectives:

- To understand water sources, characteristics, and methods for estimating water demand.
- To learn about water collection, conveyance systems, and treatment processes.
- To study the design and analysis of efficient water distribution systems.
- To explore sanitation systems and analyze wastewater characteristics for safe disposal.
- To understand the design, construction, and maintenance of sewer systems.

Course Outcomes:

CO1: Understand water sources, characteristics, and estimation of water demand.

CO2: Comprehend water collection methods, conveyance systems, and treatment processes.

CO3: Analyze and design efficient water distribution systems with leakage prevention.

CO4: Evaluate sanitation systems and wastewater characteristics for proper disposal.

CO5: Design and maintain sewer systems considering hydraulic and material factors.

UNIT I: SOURCES, QUALITY AND QUANTITY PERSPECTIVES OF WATER (08 Lectures)

- Surface and subsurface sources.
- Physical, chemical and biological characteristics of water.
- Estimation of water demand, water consumption rate.
- Fluctuations in rate of demand, design period, population forecasting methods.

UNIT II: COLLECTION, CONVEYANCE AND TREATMENT OF WATER (08 Lectures)

- Intakes: types and location factors.
- Pumps, types of conduits and pipes, pipe appurtenances.
- Water treatment units: screening, sedimentation, coagulation, filtration, disinfection, softening, miscellaneous treatments.

UNIT III: DISTRIBUTION SYSTEM (10 Lectures)

- Requirements of a good distribution system.
- Types and layouts of distribution systems.
- Distribution reservoirs and appurtenances.
- Design and analysis of pipe networks.
- Detection and prevention of water wastage.

UNIT IV: SANITATION SYSTEMS AND WASTEWATER ANALYSIS (10 Lectures)

- Systems of sanitation: merits and demerits.
- Collection and conveyance of wastewater, sewerage systems classification.
- Characteristics and analysis of wastewater: physical, chemical, biological.
- BOD, COD, effluent standards, disposal impacts.

UNIT V: SEWERS AND SEWER APPURTENANCES (10 Lectures)

- Estimation of dry weather and storm water flow.
- Hydraulic design and types of sewers, storm water drains.
- Sewer construction materials and jointing.
- Shapes, maintenance, cleaning, and ventilation of sewers.
- Sewer appurtenances.

Textbooks:

1. Peavy H.S., Rowe D.R., Tchobanoglous G., *Environmental Engineering*, McGraw Hill, 2017, 1st Indian Edition.
2. Mackenzie L. Davis, *Water and Wastewater Engineering: Design Principles and Practice*, McGraw Hill, 2017, 1st Edition.
3. P.N. Modi, *Environmental Engineering (Vol. I): Water Supply Engineering*, Standard Book House, 2018, 5th Edition.

Reference Books:

1. S.K. Garg, *Environmental Engineering (Vol. I)*, Khanna Publishers, 2017, 34th Edition.
2. John C. Crittenden et al., *MWH's Water Treatment: Principles and Design*, John Wiley & Sons, 2012, 3rd Edition.
3. Mackenzie L. Davis, *Water and Wastewater Engineering*, McGraw Hill Education, 2017, 1st Edition.

Web Resources:

- https://onlinecourses.nptel.ac.in/noc20$_ce23$/*preview*
- https://archive.nptel.ac.in/courses/105/105/105105201/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEL04	Fluid Mechanics and Hydraulic Machines Lab (Civil Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

- To compare the behavior of analytical models taught in class to the behavior of real fluid flows.
- To describe the typical fluid mechanics measuring techniques and their applications.
- To show students the components and operating principles of hydraulic machines such as turbines, pumps, and other hydraulic equipment.
- To analyze laboratory measurements and document the results appropriately.

Course Outcomes:

CO1: Examine the discharge coefficients for the venturimeter, orifice, small orifice, and external mouthpiece.

CO2: Assess head loss due to abrupt contraction and pipe friction.

CO3: Verify Bernoulli's equation experimentally.

CO4: Determine the efficiencies of turbines and pumps.

List of Experiments:

1. Determination of coefficient of discharge for Venturimeter.
2. Determination of coefficient of discharge for Orifice meter.
3. Determination of coefficient of discharge for a small orifice by constant head method.
4. Determination of coefficient of discharge for an external mouthpiece by variable head method.
5. Determination of loss of head in a sudden contraction.
6. Determination of friction factor due to pipe friction in circular pipes.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Efficiency test on Pelton wheel turbine.
10. Efficiency test on Francis turbine.

11. Efficiency test on centrifugal pump.
12. Efficiency test on reciprocating pump.

Web References:

- https://archive.nptel.ac.in/courses/112/106/112106311/
- https://fmc-nitk.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEL05	Environmental Engineering Lab (Civil Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Learning Objectives:

- Learn to measure and analyze various water quality parameters essential for assessing water quality.
- Gain hands-on experience in using laboratory equipment and conducting standard water quality tests.
- Develop the ability to interpret experimental results and apply them to real-world water treatment and management scenarios.

Course Outcomes:

CO1: Determine and understand key water quality parameters.

CO2: Demonstrate competence in performing standard water quality tests and using relevant laboratory equipment.

CO3: Analyze and apply water quality data to make informed decisions in water treatment and environmental management.

List of Experiments:

1. Determination of pH.
2. Determination of Electrical Conductivity.
3. Determination of Total solids.
4. Determination of Acidity.
5. Determination of Alkalinity.
6. Determination of Hardness.
7. Determination of Chlorides.
8. Determination of Sulphates.
9. Determination of Optimum Coagulant Dosage.
10. Determination of Turbidity.
11. Determination of Iron.
12. Determination of Dissolved Oxygen.
13. Determination of Chlorine demand.

14. Determination of Fluorides.

Reference Books:

1. Gilbert M. Masters, *Introduction to Environmental Engineering and Science*, Prentice Hall, New Jersey.
2. Peavy H.S., Rowe D.R., Tchobanoglous G., *Environmental Engineering*, McGraw Hill International Editions, New York, 1985.

Web References:

- `https://ee1-nitk.vlabs.ac.in/`
- `https://ee2-nitk.vlabs.ac.in/`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CES02	Remote Sensing and GIS (Civil Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Learning Objectives:

- Introduce the basic principles of Remote Sensing and GIS techniques and their application to Civil Engineering.
- Learn various types of sensors and platforms, and understand the principles of spatial analysis techniques in GIS.
- Introduce GIS software for digitization, thematic map creation from toposheets and maps.

Course Outcomes:

CO1: Acquire knowledge about concepts of remote sensing, sensors and their characteristics.

CO2: Familiarize with data models and data structures to understand Raster and Vector Analysis in GIS.

CO3: Digitize and create thematic maps and extract features to calculate geometry.

CO4: Perform surface analysis over contour to develop digital elevation models.

CO5: Use GIS software to perform basic analyses in water resources and transportation engineering.

UNIT I: INTRODUCTION TO REMOTE SENSING

- History of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum.
- Energy interaction with atmosphere and Earth's surface.
- Characteristics of remote sensing systems, sensor resolutions, advantages and limitations.
- Platforms: Types of sensors, airborne and spaceborne sensing (IRS, LANDSAT, SPOT, and recent satellites).

UNIT II: DIGITAL IMAGE ANALYSIS

- Digital image characteristics and formats: BIP, BIL, BSQ.
- Visual interpretation elements, preprocessing, enhancement, classification.

- Supervised and unsupervised classification.

UNIT III: GEOGRAPHIC INFORMATION SYSTEM (GIS)

- Principles, components and applications of GIS.
- Map projections, spatial data structures: raster and vector formats.
- Data input, manipulation, retrieval, and analysis.
- Spatial data analysis: Overlay functions, vector and raster overlay, arithmetic, logical, conditional operators.
- Network analysis: components, transportation networks, optimum path analysis.

Textbooks:

1. Basudeb Bhatta, *Remote Sensing and GIS*, 3rd ed., Oxford University Press, 2021.
2. S. Kumar, *Basics of Remote Sensing & GIS*, Laxmi Publications, 2016.
3. Lillesand, T.M., R.W. Kiefer and J.W. Chipman, *Remote Sensing and Image Interpretation*, 7th ed., Wiley India, 2022.
4. M.N. Demers, *Fundamentals of Geographic Information Systems*, 4th ed., Wiley India, 2013.

List of Experiments:

1. Georeferencing a Toposheet or Map.
2. Digitization and attribute table creation.
3. Creation of Thematic Map.
4. Calculation of feature geometry – Length, Area, and Perimeter.
5. Contour map – developing TIN and DEM from contours.
6. Stream network – Stream ordering map.
7. Watershed – calculate hydro-geomorphological parameters.
8. Transportation network map – route analysis.

GIS Software: QGIS / ArcGIS

Textbooks for Practical:

- QGIS User Guide.
- ArcGIS User Manual by ESRI.

Reference Books:

1. R.A. Schowengerdt, *Remote Sensing*, Elsevier, 2006.
2. Burrough P.A. and R.A. McDonnell, *Principles of Geographical Information Systems*, Oxford University Press, 1998.
3. George Joseph, *Fundamentals of Remote Sensing*, Universities Press, 2013.

Web References:

- `https://nptel.ac.in/courses/10510319`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST17	Design Thinking and Innovation (Common to all branches)	1	0	2	2

Internal Marks: 30 External Marks: 70

Course Objectives:

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

Course Outcomes:

CO1 Define the concepts related to design thinking. **L1**

CO2 Explain the fundamentals of design thinking and innovation. **L2**

CO3 Apply design thinking techniques for solving problems in various sectors. **L3**

CO4 Analyse to work in a multidisciplinary environment. **L4**

CO5 Evaluate the value of creativity. **L5**

UNIT I: INTRODUCTION TO DESIGN THINKING

- Elements and principles of design.
- Basics of design: dot, line, shape, form.
- History and introduction to design thinking.
- New materials in industry.

UNIT II: DESIGN THINKING PROCESS

- Stages: Empathize, Analyze, Ideate, Prototype.
- Implementation in invention and social innovation.
- Tools: Person, Customer Journey Map, Brainstorming, Product Development.

Activity:

- Every student presents their idea in 3 minutes.
- Present design process as flow diagram.

- Explain their product development process.

UNIT III: INNOVATION

- Art of innovation, differences between innovation and creativity.
- Role of innovation and creativity in organizations.
- Teams for innovation, measuring impact and value of creativity.

Activity:

- Debate on innovation vs creativity.
- Planning from idea to innovation.
- Debate on value-based innovation.

UNIT IV: PRODUCT DESIGN

- Problem formation, introduction to product design.
- Product strategies, value, planning, and specifications.
- Innovation towards product design – Case studies.

Activity:

- Model importance and specification setting.
- Explain own product design.

UNIT V: DESIGN THINKING IN BUSINESS PROCESSES

- Application in business and strategic innovation.
- Redefining business using design thinking.
- Addressing business challenges using design thinking.
- Design thinking for startups, defining business models.
- Developing and testing prototypes.

Activity:

- Product marketing, maintenance, reliability, startup planning.

Textbooks:

1. Tim Brown, *Change by Design*, 1/e, Harper Collins, 2009.
2. Idris Mootee, *Design Thinking for Strategic Innovation*, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, *Design Thinking in the Classroom*, Ulysses Press, 2018.
2. Shrrutin N Shetty, *Design the Future*, 1/e, Norton Press, 2018.
3. William Lidwell et al., *Universal Principles of Design*, 2/e, Rockport Publishers, 2010.
4. Chesbrough H., *The Era of Open Innovation*, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1$_n$oc19$_m$g60/*preview*https://onlinecourses.nptel.ac.in/noc22$_d$

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ACT02	Engineering Geology (Civil Engineering)	3	0	0	0

Internal Marks: – External Marks: –

Course Objectives:

- To identify the Megascopic types of Ore minerals and Rock forming minerals.
- Identify Megascopic rocks and their properties.
- To identify the topography of the site and material selection.

Course Outcomes:

CO1: Identify Megascopic minerals and their properties.

CO2: Identify Megascopic rocks and their properties.

CO3: Identify the site parameters such as contour, slope and aspect for topography.

CO4: Know the occurrence of materials using the strike and dip problems.

List of Experiments (Any eight):

1. **Physical properties of minerals:** Megascopic identification of
   - Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group, Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmaline, Calcite, Gypsum, etc.
   - Ore forming minerals – Magnetite, Hematite, Pyrite, Pyrolusite, Graphite, Chromite, etc.
2. **Megascopic description and identification of rocks:**
   - Igneous rocks – Granite types, Pegmatite, Gabbro, Dolerite, Syenite, Granite Porphyry, Basalt.
   - Sedimentary rocks – Sandstone, Ferruginous sandstone, Limestone, Shale, Laterite, Conglomerate.
   - Metamorphic rocks – Biotite Granite Gneiss, Slate, Muscovite Biotite Schist, Marble, Khondalite.
3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities, etc.
4. Simple structural geology problems.
5. Bore hole data.
6. Strength of rock using laboratory tests.

7. Field work – To identify Minerals, Rocks, Geomorphology and Structural Geology.
8. Project report on geology.

Lab Examination Pattern:

- Description and identification of FOUR minerals.
- Description and identification of FOUR rocks (including igneous, sedimentary, and metamorphic).
- ONE Question on Interpretation of a Geological map along with a geological section.
- TWO Questions on Simple strike and dip problems.
- Bore hole problems.

Text Books:

1. M.T. Mauthesha Reddy, *Applied Engineering Geology Practicals*, New Age International Publishers, 2nd Edition.
2. Tony Waltham, *Foundations of Engineering Geology*, Spon Press, 3rd Edition, 2009.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET06	Design and Drawing of Reinforced Concrete Structures	3	0	0	3

Internal Marks: 40 External Marks: 60

Course Prerequisites: Concrete Technology

Course Objectives:

- Familiarize students with different types of design philosophies.
- Equip students with concepts of design of flexural members.
- Understand concepts of shear, bond, and torsion.
- Familiarize students with different types of compression members and their design.
- Understand different types of footings and their design.

Course Outcomes:

CO1: Work on different types of design philosophies.

CO2: Carry out analysis and design of flexural members and detailing.

CO3: Design structures subjected to shear, bond, and torsion.

CO4: Design different types of compression members and footings.

UNIT I: Introduction to RCC Design (10 Lectures)

- Working Stress Method: Design codes and handbooks, loading standards (Dead, Live, Wind, Earthquake), elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance.
- Types of sections: Balanced, under-reinforced, and over-reinforced.
- WSM design of singly and doubly reinforced beams.
- Limit State Design: Concepts, statistical principles, characteristic loads/strengths, safety factors.
- Stress-strain curves for steel, stress-block parameters, limiting moment of resistance.

UNIT II: Design for Flexure (08 Lectures)

- Limit state analysis of singly reinforced sections: Effective depth, moment of resistance.
- Design of doubly reinforced and T-beam sections.

- Minimum and maximum reinforcement, limiting steel percentage.
- Effective width of flange, design behavior of flanged sections.

UNIT III: Design for Shear, Torsion and Bond (09 Lectures)

- LSM design of sections for shear and torsion – L-beam.
- Concepts of bond, anchorage, and development length as per IS code.
- Design examples in simply supported and continuous beams, detailing.
- Serviceability checks: Deflection, cracking, code provisions.

UNIT IV: Compression Members and Footings (08 Lectures)

- Design of columns: Effective length, short vs. long columns, axial load, uniaxial and biaxial bending.
- Braced and unbraced columns – IS code provisions.
- Types of footings: Isolated, square, rectangular, circular, spread sloped.
- Design of footings under axial loads.

UNIT V: Slabs and Staircases (10 Lectures)

- Slab types: One-way, two-way, continuous.
- IS Coefficients for slab design (conventional method).
- Design of waist slab staircase.

NOTE:

- All designs are to be taught using the Limit State Method.
- Drawing classes must be conducted weekly.

Plates to be Prepared:

- Reinforcement detailing of T-beams, L-beams, continuous beams, cantilevers.
- Detailing of columns and isolated footings.
- Detailing of slabs (one-way, two-way, continuous) and waist-slab staircases.

Final Examination Pattern:

- Part A: 2 questions in Design Drawing, 1 to be answered (40
- Part B: 5 questions in design, 3 to be answered (60

Textbooks:

1. A.K. Jain, *Limit State Design*.
2. S. Unnikrishna Pillai Devdas Menon, *Reinforced Concrete Structures*, Tata McGraw Hill.

Reference Books:

1. N. Krishna Raju, *Design of Concrete Structures*.
2. Park and Pauley, *Reinforced Concrete Structures*, John Wiley Sons.

Web Resources:

- https://archive.nptel.ac.in/courses/105/105/105105105/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET07	Engineering Hydrology	3	0	0	3

Internal Marks: 40 External Marks: 60

Course Prerequisites: Fluid Mechanics

Course Objectives:

- Understand hydrologic cycle and its relevance to Civil engineering.
- Learn physical processes and their interactions in hydrology.
- Learn measurement and estimation of the components of hydrologic cycle.
- Have an overview and understanding of Hydrographs.
- Learn flood frequency analysis, design flood and flood routing methods.

Course Outcomes:

CO1: Have a thorough understanding of the theories and principles governing hydrologic processes.

CO2: Be able to quantify hydrologic components and apply concepts in hydrologic design of water resources projects.

CO3: Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.

CO4: Develop design storms and carry out frequency analysis.

UNIT I: Precipitation and Rainfall Analysis (10 Lectures)

- Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources.
- Precipitation: Types and forms, measurement, radar measurement of rainfall.
- Rain gauge network, presentation and consistency of rainfall data.
- Frequency of rainfall, IDF and DAD curves, PMP and design storm.

UNIT II: Abstractions from Precipitation (08 Lectures)

- Initial abstractions.
- Evaporation: Factors, measurement, estimation, reduction.
- Evapotranspiration: Factors, measurement, estimation, control.
- Infiltration: Factors, capacity curve, measurement, infiltration indices.

UNIT III: Runoff and Hydrograph Analysis (09 Lectures)

- Runoff: Factors, components, empirical formulae, stream gauging.
- Rating curve, flow mass curve and flow duration curve.
- Hydrograph: Components, base flow separation, ERH and DRH.
- Unit hydrograph: Derivation, assumptions, duration, S-hydrograph, dimensionless UH, synthetic UH, IUH.

UNIT IV: Floods and Flood Routing (08 Lectures)

- Causes and effects of floods, flood frequency analysis: Gumbel's and Log-Pearson Type III.
- Standard Project Flood (SPF), Probable Maximum Flood (PMF).
- Flood control methods and management.
- Flood Routing: Hydrologic routing, channel and reservoir routing – Muskingum and Puls methods.

UNIT V: Groundwater Hydrology (10 Lectures)

- Groundwater: Occurrence, types of aquifers, porosity, specific yield, permeability, transmissivity, storage coefficient.
- Types of wells, Darcy's law, Dupuit's equation.
- Steady radial flow in confined and unconfined aquifers.
- Yield of open well – Recuperation test.

Textbooks:

1. K. Subramanya, *Engineering Hydrology*, Tata McGraw-Hill, 2013.
2. P. Jayarami Reddy, *Engineering Hydrology*, Laxmi Publications, 2013.

Reference Books:

1. L.W. Mays, *Water Resources Engineering*, Wiley India, 2013.
2. H.M. Raghunath, *Hydrology*, New Age International Publishers, 2010.

Web Resources:

- `https://archive.nptel.ac.in/courses/105/103/105103213/`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CET08	Geotechnical Engineering	3	0	0	3

Internal Marks: 40 External Marks: 60

Course Prerequisites: Engineering Geology

Course Objectives:

- To enable the student to determine the index properties of the soil and classify it.
- To impart the concept of seepage of water through soils and determine the discharge through soils.
- To impart the principles of compaction and consolidation of soils and determine magnitude and rate of settlement.
- To understand the concept of shear strength and determine parameters of sands and clays.
- To determine the index properties of soil and classify it (reiterated).

Course Outcomes:

CO1: Understand soil formation, index properties, and classification.

CO2: Understand soil moisture and water flow through soils and its effects.

CO3: Understand stress distribution in soils.

CO4: Understand compressibility characteristics under partial and full saturation.

CO5: Understand shear strength under various loading and drainage conditions.

UNIT I: Soil Properties and Classification (10 Lectures)

- Soil formation, structure, texture, three-phase system, phase relationships.
- Index properties, density index.
- Grain size analysis – sieve and hydrometer.
- Consistency, activity, thixotropy of clays.
- Soil classification – Unified and I.S. classification systems.

UNIT II: Soil Moisture and Permeability (08 Lectures)

- Soil moisture modes, total/neutral/effective pressures.
- Capillarity in soils.
- Permeability: Darcy's law, factors, laboratory determination.

- Permeability of layered systems.

UNIT III: Seepage and Stress Distribution (09 Lectures)

- Seepage: 1D and 2D flow, basic equations, flow nets, quicksand condition, seepage forces.
- Stress Distribution: Boussinesq's and Westergaard's theories, Newmark's chart, 2:1 method, pressure bulbs.

UNIT IV: Compaction and Consolidation (08 Lectures)

- Compaction: Mechanism, factors, effects, control.
- Consolidation: Compressibility, e-p and e-log p curves, stress history, spring analogy.
- Terzaghi's 1D consolidation theory, time rate, coefficient determination.
- Overconsolidated and normally consolidated clays.

UNIT V: Shear Strength of Soils (10 Lectures)

- Mechanism of shear strength, Mohr–Coulomb failure.
- Total and effective parameters.
- Stress-strain behavior of sands and clays.
- Critical void ratio, drainage conditions, stress paths.

Textbooks:

1. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standard Publishers.
2. Gopal Ranjan A.S.R. Rao, *Basic and Applied Soil Mechanics*, New Age International.

Reference Books:

1. D.W. Taylor, *Fundamentals of Soil Mechanics*, Wiley.
2. Holtz and Kovacs, *An Introduction to Geotechnical Engineering*, Prentice Hall.

Web Resources:

- `https://archive.nptel.ac.in/courses/105/101/105101201/`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEE01	Advanced Structural Analysis (Professional Elective – I)	3	0	0	3

Internal Marks: 40 External Marks: 60

Course Prerequisites: Structural Analysis

Course Objectives:

- Differentiate between determinate and indeterminate structures based on static and kinematic criteria, and explain their significance in structural analysis.
- Perform lateral load analysis on structural systems subjected to wind and seismic forces using appropriate analytical methods.
- Analyze the behavior and internal forces in cable-supported structures, including cables and suspension bridges.
- Apply advanced methods such as Moment Distribution and Kani's Method to analyze indeterminate structures like continuous beams and rigid frames.
- Analyze structures using Matrix method.

Course Outcomes:

CO1: Differentiate Determinate and Indeterminate Structures.

CO2: Carry out lateral Load analysis of structures.

CO3: Analyze Cable and Suspension Bridge structures.

CO4: Analyze structures using Moment Distribution and Kani's Method.

UNIT I: Propped Cantilevers (08 Lectures)

- Degree of Static and Kinematic indeterminacy of Beams, Frames, and Trusses.
- Analysis of Propped Cantilevers – Shear Force and Bending Moment Diagrams.
- Elastic Curve – Deflection of Propped Cantilever Beams.

UNIT II: Arches and Cable Structures (14 Lectures)

- Three Hinged Arches: Types, Elastic Theory, Eddy's Theorem.
- Horizontal Thrust, Bending Moment, Normal Thrust, Radial Shear, Temperature Effects.
- Hinges with Supports at Different Levels.

- Cable Structures and Suspension Bridges: Characteristics of Cables.
- Analysis of Cables under Concentrated and UDLs.
- Analysis of Simple Suspension Bridge.
- Three Hinged and Two Hinged Stiffening Girder Suspension Bridges.

UNIT III: Lateral Load Analysis Using Approximate Methods (09 Lectures)

- Application to Building Frames:
  - Portal Method.
  - Cantilever Method.

UNIT IV: Kani's Method (10 Lectures)

- Analysis of Continuous Beams – Including Settlement of Supports.
- Single Bay Portal Frames with and without Side Sway.

UNIT V: Matrix Methods of Analysis (10 Lectures)

- **Flexibility Method:**
  - Flexibility Matrix Analysis of Continuous Beams and Rigid Jointed Plane Frames (Single Bay, Single Storey with Vertical Legs Only).
- **Stiffness Method:**
  - Stiffness Matrix.
  - Relationship Between Flexibility and Stiffness Matrix.
  - Analysis of Continuous Beams and Rigid Jointed Plane Frames (Single Bay, Single Storey with Vertical Legs Only).

Textbooks:

1. R.C. Hibbeler, *Structural Analysis*, Pearson, New Delhi.
2. V.N. Vazirani and M.M. Ratwani, *Analysis of Structures – Vol. I and II*, Khanna Publishers, New Delhi.

Reference Books:

1. H.J. Shah and S.B. Junnarkar, *Mechanics of Structures Vol – II*, Charotar Publishing House Pvt. Ltd.
2. Devdas Menon, *Structural Analysis*, Narosa Publishing House Pvt. Ltd.

Web Resources:

- https://archive.nptel.ac.in/courses/105/106/105106050/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CEE02	Architecture and Town Planning (Professional Elective – I)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Introduce students to different architectures of the world, emphasizing eastern and western distinctions.
- Study features of Egyptian, Greek, Roman, Indian Vedic, Indus Valley, Buddhist, Hindu, and Indo-Sarsanic architectures.
- Learn architectural design concepts, principles of planning and composition.
- Understand town planning evolution from ancient to modern times.
- Understand town planning standards, landscaping, and town expansion.

Course Outcomes:

CO1: Distinguish architectural styles of eastern and western worlds.

CO2: Understand the importance of Orders of Architecture.

CO3: Apply design concepts and planning principles to building layouts.

CO4: Understand town planning standards, landscaping features, and urban expansion regulations.

UNIT I: History of Architecture (10 Lectures)

- Western Architecture: Egyptian, Greek, Roman – Orders.
- Indian Architecture: Vedic age, Indus Valley Civilization.
- Buddhist Architecture: Stambas, Stupas, Toranas, Chaityas, Viharas.
- Hindu Temples: Dravidian and Indo-Aryan Styles – Temples of Aihole, Madurai, Bhubaneshwar, Mount Abu.
- Indo-Sarsanic (Islamic) Architecture: Mosque, Palace, Fort, Tomb.

UNIT II: Principles of Designing and Planning (08 Lectures)

- Planning a residence: Site selection, orientation – aspect, prospect, grouping, circulation, privacy, furniture, services.
- Post-Classic Architecture: Contributions of Edward Lutyens, Le Corbusier, Frank Lloyd Wright, Walter Gropius.

UNIT III: Historical Background of Town Planning (09 Lectures)

- Town planning in India.
- Mythological Manasa town plan.
- Ancient town plans: Harappa, Mohenjo-Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT IV: Modern Town Planning and Standards (08 Lectures)

- Zoning, roads and traffic, housing, slums, parks, playgrounds.
- Public utility services, surveys and maps, neighborhood planning.
- Planning new towns, national and regional planning, legislation and regulations.

UNIT V: Landscaping and Town Expansion (10 Lectures)

- Landscaping towns.
- Town expansion: Horizontal and vertical.
- Garden cities, satellite towns, floating towns, skyscrapers, pyramidal cities.

Textbooks:

1. G.K. Hiraskar, *The Great Ages of World Architecture*.
2. Y.S. Sane, *Planning and Design of Buildings by Section of Architecture*.

Reference Books:

1. Hepler, *Drafting and Design for Architecture*, Cengage Learning.
2. John Patten Guthrie, *Architect's Portable Handbook*, McGraw-Hill.

Web Resources:

- `https://archive.nptel.ac.in/courses/105/106/105106050/`

Course Code	Course Name	L	T	P	C
P23CEE03	Construction Technology & Management (Professional Elective – I)	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To introduce the student to the concept of project management including network drawing and monitoring.
- To introduce various equipment related to construction such as earth moving equipment, trucks and handling equipment, aggregate production, and construction equipment and machinery.
- To introduce the importance of safety in construction projects.

Course Outcomes:

CO1: Appreciate the importance of construction planning.

CO2: Understand the functioning of various earth moving equipment.

CO3: Know the methods of production of aggregate products and concreting.

CO4: Apply the gained knowledge to project management and construction techniques.

Course Content:

UNIT – I **Lecture Hours: 10**

- Construction project management and its relevance.
- Qualities of a project manager.
- Project planning, coordination, scheduling, monitoring.
- Bar charts, milestone charts, critical path method.

UNIT – II **Lecture Hours: 08**

- Project Evaluation and Review Technique (PERT).
- Cost analysis, updating, crashing for optimum cost and resources.
- Resource allocation.
- Introduction to software for construction/project management (PRIMAVERA or equivalent).

UNIT – III **Lecture Hours: 09**

- Construction equipment and economical considerations.
- Earthwork equipment; Trucks and handling equipment; Dump trucks.

- Capacities and production of trucks and handling equipment.
- Compaction equipment – types of rollers.
- Hoisting and earth work equipment – hoists, cranes, tractors, bulldozers, graders, scrapers, draglines, clam shell buckets.

UNIT – IV **Lecture Hours: 08**

- Concreting equipment – concrete mixers, batching plants, mobile mixing plants (e.g., Ajax).
- Mixing and placing of concrete.
- Consolidating and finishing.

UNIT – V **Lecture Hours: 10**

- Construction methods – earthwork, piling, placing of concrete, formwork, fabrication and erection.
- Quality control and safety engineering.
- Introduction to Building Information Modeling (BIM) for Civil Engineers.

Textbooks:

1. Peurifoy, Schexnayder, Shapira, *Construction Planning, Equipment and Methods*, Tata McGraw-Hill.
2. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, Pearson, 2011.

Reference Books:

1. Peter Fewings, *Construction Project Management – An Integrated Approach*, Taylor and Francis.
2. Trefor Williams, *Construction Management: Emerging Trends and Technologies*, Cengage Learning.

Web References:

- https://archive.nptel.ac.in/courses/124/107/124107161/

Course Code	Course Name	L	T	P	C
P23CEL06	Geotechnical Engineering Lab	0	0	3	1.5

Internal Marks: 30 **External Marks:** 70

Course Prerequisites: Soil and Geotechnical Engineering

Course Objectives:

- To determine the index properties for soil classification – Grain size distribution and Atterberg's limits.
- To determine the engineering properties – Permeability, compaction, consolidation, shear strength parameters, and CBR value.
- To find the degree of swelling by DFS test.
- To impart knowledge of determination of index properties required for classification of soils.
- To teach determination of compaction characteristics and consolidation behavior from lab tests.
- To teach determination of shear parameters of soil through various laboratory tests.

Course Outcomes:

CO1: Determine index properties of soil and classify them.

CO2: Determine permeability of soils.

CO3: Determine compaction, consolidation, and shear strength characteristics.

List of Experiments

1. Specific Gravity, G
2. Atterberg's Limits
3. Field Density – Core Cutter and Sand Replacement Methods
4. Grain Size Analysis by Sieving
5. Permeability of Soil – Constant and Variable Head Tests
6. Compaction Test
7. Consolidation Test (Demonstration)
8. Direct Shear Test
9. Triaxial Compression Test
10. Unconfined Compression Test
11. Vane Shear Test

12. Differential Free Swell (DFS)
13. Field Plate Load Test (Demonstration)
14. Field CBR Test (Demonstration)

List of Equipment

1. Casagrande's Liquid Limit Apparatus
2. Apparatus for Plastic and Shrinkage Limits
3. Field Density Apparatus:
    - Core Cutter Method
    - Sand Replacement Method
4. Set of Sieves: 4.75 mm, 2 mm, 1 mm, 0.6 mm, 0.42 mm, 0.3 mm, 0.15 mm, 0.075 mm
5. Hydrometer
6. Permeability Apparatus:
    - Constant Head Test
    - Variable Head Test
7. Universal Auto Compactor (Light and Heavy Compaction Tests)
8. Shaking Table, Funnel (Sand Raining Technique)
9. Apparatus for CBR Test
10. 10-ton Loading Frame with Proving Rings (0.5 and 5 tons)
11. One-Dimensional Consolidation Apparatus
12. Triaxial Cell (for 38 mm dia specimens)
13. Box Shear Test Apparatus
14. Laboratory Vane Shear Apparatus
15. Hot Air Ovens (Range: 50–150°C)
16. Field Plate Load Test Equipment
17. Field CBR Test Equipment

Reference Books:

1. J.E. Bowles, *Determination of Soil Properties*
2. IS Code 2720 – Relevant Parts

Web References:

- `https://nptel.ac.in/courses/105101160`
- `https://gte-nitk.vlabs.ac.in/`

Course Code	Course Name	L	T	P	C
P23CEL07	Structural Engineering Lab	0	0	3	1.5

Internal Marks: 30 **External Marks:** 35

Course Prerequisites: Design of Reinforced Concrete Structures

Course Objectives:

- To equip the students to conduct all fundamental experiments on beams.
- To impart adequate knowledge on various deflections and cracks.
- To enable the students to investigate the performance of RCC Beams designed for Bending and failing in Shear.
- To impart adequate knowledge on RCC Beams designed for Shear and failing in Bending.
- To make the students investigate RCC One-way and Two-way slabs.

Course Outcomes:

CO1: Explain knowledge of deflection and cracks on under-reinforced, over-reinforced and balanced sections.

CO2: Perform tests on RCC beams designed for bending and failing in shear.

CO3: Perform tests on RCC one-way and two-way slabs.

CO4: Conduct various laboratory tests on concrete to determine Young's modulus of elasticity.

CO5: Learn the extraction and evaluation of concrete core samples from pavements.

List of Experiments

1. Study on deflection and cracks in under-reinforced, over-reinforced, and balanced sections.
2. Study on performance of RCC beams designed for bending and failing in shear.
3. Study on performance of RCC beams designed for shear and failing in bending.
4. Study on performance of RCC one-way slabs.
5. Study on performance of RCC two-way slabs with simply supported edge conditions.
6. Study on performance of RCC two-way slabs with fixed edge conditions.

7. Calculation of Young's modulus of elasticity of concrete.
8. Extraction and study of concrete core samples from pavements.

List of Equipment

- Loading frame with 100 Ton capacity
- Compressometer
- Compression testing machine
- Concrete core sample extractor

Reference Books:

1. N. Krishna Raju, *Design of Concrete Structures*
2. Park and Pauley, *Reinforced Concrete Structures*, John Wiley and Sons

Course Code	Course Name	L	T	P	C
P23CES03	Estimation, Specification & Contracts	3	0	0	3

Internal Marks: 0 **External Marks:** 100

Course Prerequisites: Building Planning and Drawing, Building Materials

Course Objectives:

- Understand the quantity calculations of different components of the buildings.
- Understand the rate analysis of different quantities of the building components.
- Learn various specifications and components of the buildings.

Course Outcomes:

CO1: Determine the quantities of different components of buildings.

CO2: Estimate the cost of various building components.

CO3: Finalize the value of structures.

Course Content:

UNIT - 1 **Lecture Hours: 10**

- Contracts – Types of contracts – Contract Documents – Conditions of contract
- Valuation of buildings
- Concepts of e-procurement and reverse auctions
- Standard specifications for different items of building construction

UNIT - 2 **Lecture Hours: 08**

- General items of work in building
- Standard Units
- Principles of working out quantities for detailed and abstract estimates
- Approximate method of estimating

UNIT - 3 **Lecture Hours: 09**

- Rate Analysis
- Working out data for various items of work, overhead and contingent charges
- Earthwork for roads and canals
- Reinforcement bar bending and bar requirement schedules

UNIT - 4 **Lecture Hours: 08**

- Detailed estimation of buildings using individual wall method for single, double, and four roomed buildings

UNIT - 5 **Lecture Hours: 10**

- Detailed estimation of buildings using centre line method for single, double, and four roomed buildings
- Standard software like building estimator

Textbooks:

1. B.N. Dutta, *Estimating and Costing*, UBS Publishers, 2000.
2. B.S. Patil, *Civil Engineering Contracts and Estimates*, Universities Press (India) Pvt. Ltd., Hyderabad.

Reference Books:

1. *Standard Schedule of Rates and Standard Data Book*, Public Works Department.
2. IS 1200 (Parts I to XXV – 1974), *Method of Measurement of Building & Civil Engineering Works – B.I.S.*

Web References:

- https://onlinecourses.swayam2.ac.in/nou20$_c$s11/*preview*

Course Code	Course Name	L	T	P	C
P23CEO01	Green Buildings	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To provide knowledge on the principles and practices of green building design and construction.
- To introduce national and international green building rating systems (e.g., LEED, IGBC, GRIHA).
- To educate students on sustainable site selection, energy efficiency, water conservation, and material selection for green buildings.
- To develop awareness about indoor environmental quality and the health, safety, and comfort of building occupants.
- To enable students to evaluate the environmental impacts and economic benefits of green buildings.

Course Outcomes:

CO1: Explain the concepts, goals, and importance of sustainable and green building practices.

CO2: Interpret and apply green building rating systems to assess sustainability in building projects.

CO3: Analyse sustainable building site practices, energy-efficient systems, and water-saving strategies.

CO4: Select appropriate eco-friendly materials and technologies for green building construction.

CO5: Evaluate the performance, environmental benefits, and economic feasibility of green buildings.

UNIT-I: Green Buildings

Lecture Hours: 08

- Definition of Green Buildings, typical features, benefits.
- Sustainable site selection and planning to maximize comfort, day lighting, ventilation.
- Planning for storm water drainage.

UNIT-II: Environmentally Friendly Materials and Technologies

Lecture Hours: 08

- Natural materials: bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime and lime-pozzolana cements.
- Materials from agro and industrial waste.
- Ferrocement, ferroconcrete, alternative roofing systems.
- Paints reducing heat gain, etc.

UNIT-III: Energy and Resource Conservation
Lecture Hours: 07

- Need for energy conservation and types of energy in buildings.
- Embodied energy of materials, energy used in transportation and construction.
- Water conservation systems, water harvesting.
- Waste to energy management in residential complexes.

UNIT-IV: Renewable Energy and Climate Design
Lecture Hours: 08

- Wind and solar energy harvesting – potential in India and world.
- Construction and operation of solar appliances, case studies of solar buildings in India.
- Climate design: temperature, humidity, wind – impact on built environment.
- Principles of thermal design – thermal comfort, lighting, acoustics, energy efficient lighting, ventilation.
- Techniques for passive cooling – garden roofs, case studies.

UNIT-V: Green Building Rating Systems
Lecture Hours: 08

- Introduction to LEED, GRIHA.
- Modular wastewater treatment systems for built environment.
- Building automation and management systems.

Textbooks:

1. K.S. Jagadish, B.V. Venkatarama Reddy, K.S. Nanjunda Rao, *Alternative Building Materials and Technologies*.
2. G.D. Rai, *Non-Conventional Energy Resources*, Khanna Publishers.

Reference Books:

1. IGBC (Indian Green Building Council) Manuals and Guidelines

2. GRIHA (Green Rating for Integrated Habitat Assessment) Manuals
3. National Building Code of India – Sustainability Section

Web References:

- https://archive.nptel.ac.in/courses/105/102/105102195/

Course Code	Course Name	L	T	P	C
P23CEO02	Construction Project Management	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To provide an overview of the construction industry, its challenges, history, and the evolving role of a construction manager.
- To develop the ability to apply decision-making tools like cost-benefit analysis, risk analysis, and break-even analysis in construction contexts.
- To introduce the principles of value engineering and life cycle costing, with emphasis on maximizing project value and efficiency.
- To emphasize the importance of safety management in construction, including risks, benefits, and methods to enhance safety practices.
- To familiarize students with Management Information Systems (MIS) and their role in improving communication, decision-making, and efficiency in construction projects.

Course Outcomes:

CO1: Identify major challenges in the construction industry and explain the evolving role and responsibilities of a construction manager using real-world case studies.

CO2: Apply engineering economic decision-making techniques such as benefit-cost analysis, break-even analysis, and replacement analysis to support construction project choices.

CO3: Implement value engineering concepts and life cycle costing to improve project design, cost-efficiency, and stakeholder satisfaction.

CO4: Assess safety risks in construction projects and recommend strategies to improve safety for workers, employers, and the public.

CO5: Design and evaluate Management Information Systems (MIS) for effective communication and control within construction project environments.

UNIT-I: Introduction to Construction Management
Lecture Hours: 08

- Introduction and major problems in the construction industry.
- History of construction management.
- Functions and responsibilities of construction manager.
- Case studies and future of construction management.

UNIT-II: Decision Making in Construction
Lecture Hours: 08

- Benefit-cost analysis.
- Replacement analysis.
- Break-even analysis.
- Risk management in construction industry.

UNIT-III: Value Engineering and Life Cycle Costing
Lecture Hours: 07

- Definition and fundamentals of value engineering.
- Life cycle costing.
- Delphi technique and uses.
- Applications of value engineering in construction industry.

UNIT-IV: Safety in Construction
Lecture Hours: 08

- Importance of construction safety.
- Benefits of safety to employers, employees, and customers.
- Construction safety problems.
- Approaches to improve construction safety.

UNIT-V: Management Information and Control Systems
Lecture Hours: 08

- Communication and system concepts.
- Need for management information.
- Design of MIS and computer processing.
- Value of information and MIS in construction industry.

Textbooks:

1. Dykstra, A. (2018). *Construction Project Management: A Complete Introduction*, Kirshner Publishing.
2. Sears, S. K., Sears, G. A., Clough, R. H., Rounds, J. L., & Segner, R. O. (2015). *Construction Project Management: A Practical Guide to Field Construction Management* (6th ed.), Wiley.
3. Halpin, D. W., & Senior, B. A. (2010). *Construction Management* (4th ed.), Wiley.

Reference Books:

1. Oberlender, G. D. (2014). *Project Management for Engineering and Construction* (3rd ed.), McGraw-Hill Education.
2. Gould, F. E., & Joyce, N. E. (2013). *Construction Project Management* (4th ed.), Pearson.

Web References:

- https://archive.nptel.ac.in/courses/105/104/105104161/
- https://archive.nptel.ac.in/courses/105/103/105103093/

III B.Tech I Semester Open Elective-I Regulation: R23

Course Code	Course Name	L	T	P	C
P23CEO03	Climate Change impact on Eco System	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To provide an overview of the construction industry, its challenges, history, and the evolving role of a construction manager.
- To develop the ability to apply decision-making tools like cost-benefit analysis, risk analysis, and break-even analysis in construction contexts.
- To introduce the principles of value engineering and life cycle costing, with emphasis on maximizing project value and efficiency.
- To emphasize the importance of safety management in construction, including risks, benefits, and methods to enhance safety practices.
- To familiarize students with Management Information Systems (MIS) and their role in improving communication, decision-making, and efficiency in construction projects.

Course Outcomes:

CO1: Identify major challenges in the construction industry and explain the evolving role and responsibilities of a construction manager using real-world case studies.

CO2: Apply engineering economic decision-making techniques such as benefit-cost analysis, break-even analysis, and replacement analysis to support construction project choices.

CO3: Implement value engineering concepts and life cycle costing to improve project design, cost-efficiency, and stakeholder satisfaction.

CO4: Assess safety risks in construction projects and recommend strategies to improve safety for workers, employers, and the public.

CO5: Design and evaluate Management Information Systems (MIS) for effective communication and control within construction project environments.

UNIT-I: Introduction to Construction Management
Lecture Hours: 08

- Introduction and major problems in the construction industry.
- History of construction management.
- Functions and responsibilities of construction manager.

- Case studies and future of construction management.

UNIT-II: Decision Making in Construction
Lecture Hours: 08

- Benefit-cost analysis.
- Replacement analysis.
- Break-even analysis.
- Risk management in construction industry.

UNIT-III: Value Engineering and Life Cycle Costing
Lecture Hours: 07

- Definition and fundamentals of value engineering.
- Life cycle costing.
- Delphi technique and uses.
- Applications of value engineering in construction industry.

UNIT-IV: Safety in Construction
Lecture Hours: 08

- Importance of construction safety.
- Benefits of safety to employers, employees, and customers.
- Construction safety problems.
- Approaches to improve construction safety.

UNIT-V: Management Information and Control Systems
Lecture Hours: 08

- Communication and system concepts.
- Need for management information.
- Design of MIS and computer processing.
- Value of information and MIS in construction industry.

Textbooks:

1. Dykstra, A. (2018). *Construction Project Management: A Complete Introduction*, Kirshner Publishing.
2. Sears, S. K., Sears, G. A., Clough, R. H., Rounds, J. L., & Segner, R. O. (2015). *Construction Project Management: A Practical Guide to Field Construction Management* (6th ed.), Wiley.

3. Halpin, D. W., & Senior, B. A. (2010). *Construction Management* (4th ed.), Wiley.

Reference Books:

1. Oberlender, G. D. (2014). *Project Management for Engineering and Construction* (3rd ed.), McGraw-Hill Education.
2. Gould, F. E., & Joyce, N. E. (2013). *Construction Project Management* (4th ed.), Pearson.

Web References:

- https://archive.nptel.ac.in/courses/105/104/105104161/
- https://archive.nptel.ac.in/courses/105/103/105103093/

Course Code	Course Name	L	T	P	C
P23CET09	Design and Drawing of Steel Structures	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Prerequisites: Structural Analysis, Mechanics of Materials

Course Objectives:

- Familiarize students with different types of connections and relevant IS codes.
- Equip students with the concepts of designing flexural members.
- Understand design concepts of tension and compression members in trusses.
- Familiarize students with different types of columns and column bases and their design.
- Familiarize students with Plate girder and Gantry Girder and their design.

Course Outcomes:

CO1: Analyze and design steel structural members with relevant IS codes.

CO2: Carry out analysis and design of flexural members and detailing.

CO3: Design compression members of different types with connection detailing.

CO4: Design Plate Girder and Gantry Girder with connection detailing.

CO5: Produce the drawings pertaining to different components of steel structures.

Course Content:

UNIT – I

Connections: Riveted connections – definition, rivet strength and capacity. 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.

UNIT – II

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, bearing – Laterally unsupported beams.

UNIT – III

Tension and Compression Members: Effective length, slenderness ratio, permissible stresses.
Design of compression members subjected to axial and eccentric loading.

Design of members subjected to direct tension and bending.
Roof Trusses: Types, design loads, load combinations as per IS Code, structural details, design of purlins, members, and joints.

UNIT – IV
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 to moment.

UNIT – V
Design of Plate Girder: Design considerations – IS Code recommendations.
Design of welded plate girder – Curtailment of flange plates – Stiffeners – Splicing and connections.
Design of Gantry Girder: Impact factors, longitudinal forces, design of gantry girders.

Drawing Plates (to be covered weekly):

1. Detailing of simple beams
2. Detailing of compound beams including curtailment of flange plates
3. Detailing of column including lacing and battens
4. Detailing of column bases – slab base and gusseted base
5. Detailing of steel roof trusses including joint details
6. Detailing of plate girder including curtailment, splicing and stiffeners
7. Detailing of gantry girder

Final Examination Pattern:

- **Part A:** Two questions in Design and Drawing – attempt one. (Weightage: 40%)
- **Part B:** Five design questions – attempt three. (Weightage: 60%)

Textbooks:

1. N. Subramanian, *Steel Structures Design and Practice*, Oxford University Press.
2. Ramachandra, *Design of Steel Structures*, Vol–1, Universities Press.
3. S.K. Duggal, *Design of Steel Structures*, Tata McGraw-Hill, New Delhi.

Reference Books:

1. Sarwar Alam Raz, *Structural Design in Steel*, New Age International Publishers.

2. P. Dayaratnam, *Design of Steel Structures*, S. Chand Publishers.
3. M. Raghupathi, *Design of Steel Structures*, Tata McGraw-Hill.
4. N. Krishna Raju, *Structural Design and Drawing*, University Press.

Web Links:

- https://archive.nptel.ac.in/courses/105/105/105105162/

Course Code	Course Name	L	T	P	C
P23CET10	Highway Engineering	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Learning Objectives:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements.
- To acquire design principles of Intersections.

Course Outcomes:

CO1: Plan highway network for a given area.

CO2: Determine highway alignment and design highway geometrics.

CO3: Design intersections and prepare traffic management plans.

CO4: Judge suitability of pavement materials and design flexible and rigid pavements.

Course Content:

UNIT – I: Highway Planning and Alignment

- Highway development in India; Classification of Roads; Road Network Patterns
- Necessity for Highway Planning; Different Road Development Plans– First, Second, Third, Vision 2021
- Rural Road Development Plan – Vision 2025
- Planning Surveys; Highway Alignment- Factors affecting Alignment
- Engineering Surveys – Drawings and Reports

UNIT – II: Highway Geometric Design

- Importance of Geometric Design
- Design controls and Criteria; Highway Cross Section Elements
- Sight Distance Elements – SSD, OSD, ISD
- Design of Horizontal Alignment – Super elevation, Extra widening, Transition Curves
- Vertical Alignment – Gradients, Vertical Curves

UNIT – III: Traffic Engineering

- Basic Parameters: Volume, Speed, Density

- Volume Studies, Speed Studies (Spot Speed, Speed and Delay), Parking Studies
- Road Accidents – Causes, Prevention – Condition and Collision Diagrams
- PCU Factors, Capacity, LOS Concepts
- Road Signs and Markings
- Intersections – At-grade: Plain, Flared, Rotary, Channelized
- Design of Traffic Signals – Webster and IRC Methods

UNIT – IV: Highway Materials

- Subgrade soil: Classification, Group Index, CBR, Modulus of Subgrade Reaction
- Stone Aggregates: Properties, Tests
- Bituminous Materials: Types, Properties, Tests on Bitumen
- Bituminous Paving Mixes – Requirements, Marshall Method of Mix Design

UNIT – V: Design of Pavements

- Types and Functions of Pavements; Design Factors
- Flexible Pavements: CBR Method, IRC Method, Burmister Method, Mechanistic Method
- IRC Method for Low Volume Flexible Pavements
- Rigid Pavements: Design Considerations – Wheel Load, Temperature, Frictional and Combined Stresses
- Design of Slabs and Joints – IRC Method
- Rigid Pavements for Low Volume Roads
- Continuously Reinforced Concrete Pavements, Roller Compacted Concrete Pavements

Textbooks:

1. S.K. Khanna, C.E.G. Justo, A. Veeraragavan, *Highway Engineering*, Nem Chand Bros., Roorkee.
2. L.R. Kadiyali, *Traffic Engineering and Transportation Planning*, Khanna Publishers, New Delhi.

References:

1. L.R. Kadiyali, *Principles of Highway Engineering*, Khanna Publishers, New Delhi.
2. Partha Chakraborty and Animesh Das, *Principles of Transportation Engineering*, PHI Learning Pvt. Ltd., Delhi.

Course Code	Course Name	L	T	P	C
P23CET11	Foundation Engineering	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Prerequisites: Geotechnical Engineering

Course Learning Objectives:

- To impart to the student knowledge of types of shallow foundations and the theories required for the determination of their bearing capacity.
- To enable the student to compute immediate and consolidation settlements of shallow foundations.
- To impart the principles of important field tests such as SPT and Plate bearing test.
- To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.

Course Outcomes:

CO1: Plan highway network for a given area.

CO2: Determine highway alignment and design highway geometrics.

CO3: Design intersections and prepare traffic management plans.

CO4: Judge suitability of pavement materials and design flexible and rigid pavements.

Course Content:

UNIT – I: Soil Exploration

- Need for soil exploration.
- Methods of soil exploration – Boring and Sampling.
- Field tests – Penetration Tests, Pressuremeter test.
- Planning of program and preparation of soil investigation report.

UNIT – II: Earth and Earth-Retaining Structures

- 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, slope stability of dams and embankments.
- Earth pressure theories: Rankine's and Coulomb's theory.
- Cullman's graphical method, Earth pressures in layered soils.

UNIT – III: Shallow Foundations – Bearing Capacity Criteria

- Types of foundations, factors for selection of location.
- Bearing capacity – determination criteria.
- Factors influencing bearing capacity.
- Analytical methods – Terzaghi's theory and IS methods.

UNIT – IV: Shallow Foundations – 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 for different structures.

UNIT – V: Deep Foundations

- **Pile Foundations:** Types of piles; Load carrying capacity using static and dynamic formulae.
- Pile load tests; Group capacity in sands and clays.
- **Well Foundations:** Types, shapes, caissons, components and functions.
- Forces on well foundations; Design criteria.
- Determination of staining thickness and plug.
- Construction and sinking of wells; Tilt and shift.

Textbooks:

1. Das, B.M., *Principles of Foundation Engineering*, 6th Edition (Indian Edition), Cengage Learning, 2011.
2. Gopal Ranjan and A.S.R. Rao, *Basic and Applied Soil Mechanics*, New Age International Pvt. Ltd., 2004.
3. Arora, *Soil Mechanics and Foundation Engineering*.

References:

1. Bowles, J.E., *Foundation Analysis and Design*, 4th Edition, McGraw-Hill, 1988.
2. N.N. Som and S.C. Das, *Theory and Practice of Foundation Design*, PHI Learning Pvt. Ltd.

Web Links:

- https://archive.nptel.ac.in/courses/105/105/105105176/
- https://unacademy.com/course/complete-course-on-foundation-engineering/3DM0

Course Code	Course Name	L	T	P	C
P23CEE08	Bridge Engineering	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To impart knowledge on planning, analysis, and design of bridges.
- To understand the types of bridges and their structural behavior.
- To familiarize with design specifications and IRC codes.
- To enable students to design substructures and superstructures of different bridge types.

Course Outcomes:

CO1: Understand classification, planning, and site selection for bridges.

CO2: Analyze and design different bridge superstructures as per IRC codes.

CO3: Design various types of bridge substructures including piers and abutments.

CO4: Apply construction methods for different types of bridges.

CO5: Analyze the loading standards and assess stability/safety of bridges.

UNIT-I: Introduction and Planning
Lecture Hours: 08

- Components of a bridge.
- Classification and site selection.
- Design loads and forces as per IRC standards.
- Design discharge and linear waterway.
- Economic span and afflux.

UNIT-II: Bridge Superstructure Design
Lecture Hours: 08

- Types of bridge decks – slab, T-beam, box, and pre-stressed concrete decks.
- Design of RCC slab bridges.
- Design of RCC T-beam bridges using Courbon's method.

UNIT-III: Substructure Design
Lecture Hours: 07

- Types and design of piers and abutments.

- Types and design of bearings.
- Design of bridge foundations – open, well, and pile.

UNIT-IV: Bridge Construction and Maintenance
Lecture Hours: 08

- Methods of bridge construction – cast-in-situ, precast, and incremental launching.
- Inspection, maintenance, and rehabilitation of bridges.
- Bridge failure causes and case studies.

UNIT-V: IRC Loadings and Modern Trends
Lecture Hours: 08

- IRC loadings: IRC Class A, AA, 70R – tracked and wheeled.
- Application of software tools in bridge design.
- Introduction to cable-stayed and suspension bridges.

Textbooks:

1. S. Ponnuswamy, *Bridge Engineering*, Tata McGraw-Hill.
2. Raju N. Krishna, *Design of Bridges*, Oxford University Press.

Reference Books:

1. Johnson Victor, *Essentials of Bridge Engineering*, Oxford IBH Publishing.
2. IRC:5, IRC:6, IRC:21, IRC:78 – Indian Roads Congress Standards.

Web References:

- `https://nptel.ac.in/courses/105/107/105107121`
- `https://www.irc.nic.in`

III B.Tech II Semester Open Elective-II Regulation: R23

Course Code	Course Name	L	T	P	C
P23CEO05	Sustainability in Engineering Practices	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To equip students with a foundational understanding of sustainability principles and how they apply to engineering design, materials selection, and project execution.
- To develop the ability to assess the environmental, economic, and social impacts of engineering decisions using tools such as Life Cycle Assessment (LCA) and carbon footprint analysis.
- To encourage sustainable innovation and problem-solving skills through the integration of green technologies, renewable resources, and circular economy concepts in engineering projects.

Course Outcomes:

CO1: Explain sustainable development and different environmental agreements and protocols.

CO2: Discuss real time activities causing environmental issues and different methods to use renewable energy resources.

CO3: Explain local and global environmental issues.

CO4: Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability.

CO5: Discuss different renewable energy resources and explain methods to implement green technology.

UNIT-I: Introduction to Sustainable Engineering

Lecture Hours: 10

- Sustainable development concepts: three pillar model, egg of sustainability, Atkisson's pyramid, prism model.
- Principles of sustainable development, sustainable engineering, threats to sustainability.
- Environmental ethics and education.
- Environmental legislation: Water Act, Air Act, Environment Act, and multilateral agreements.

UNIT-II: Environmental Issues
Lecture Hours: 08

- Local issues: solid waste, resource impact, zero waste concept, 3R (Reduce, Reuse, Recycle).
- Waste to energy: thermo-chemical and biochemical conversion.
- Global issues: water deterioration, land degradation, air pollution, climate change, global warming.
- Ozone depletion, carbon footprint, and carbon trading.

UNIT-III: Tools for Sustainability
Lecture Hours: 09

- Environmental Management System (EMS), ISO14000.
- Life Cycle Assessment (LCA): components, pros/cons, case study.
- Environmental Impact Assessment (EIA), auditing, biomimicking, case studies.

UNIT-IV: Sustainable Habitat and Industrialization
Lecture Hours: 09

- Green building concepts and materials.
- Certification and ratings: GRIHA, LEED.
- Energy-efficient buildings, sustainable cities, transport, pavements.
- Case studies: green buildings, sustainable cities, transport systems.
- Sustainable industrialization, urbanization, pollution prevention.
- Industrial ecology, symbiosis, material selection, poverty reduction.

UNIT-V: Renewable Energy and Green Technologies
Lecture Hours: 09

- Energy types: conventional and non-conventional.
- Solar energy, fuel cells, wind, small hydro, biogas, biofuels.
- Ocean and geothermal energy, conservation.
- Green technology and business: green energy, construction, transportation, chemistry, computing.

Textbooks:

1. R. L. Rag and Lekshmi Dinachandran Remesh, *Introduction to Sustainable Engineering*, 2nd Ed., PHI Learning Pvt. Ltd., 2016.

2. D. T. Allen and D. R. Shonnard, *Sustainability Engineering: Concepts, Design and Case Studies*, 1st Ed., Prentice Hall, 2011.

Reference Books:

1. A. S. Bradley, A. O. Adebayo, P. Maria, *Engineering Applications in Sustainable Design and Development*, 1st Ed., Cengage Learning, 2016.

Web References:

- https://archive.nptel.ac.in/courses/105/105/105105157/

III B.Tech II Semester Open Elective-II Regulation: R23

Course Prerequisites: Geotechnical Engineering

Course Code	Course Name	L	T	P	C
P23CEO06	Water Supply Systems	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
- To enable the student to compute immediate and consolidation settlements of shallow foundations.
- To impart the principles of important field tests such as SPT and Plate bearing test.
- To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.

Course Outcomes:

CO1: Understand and explain various types of shallow foundations and apply relevant bearing capacity theories to evaluate their load-bearing potential.

CO2: Analyse and compute both immediate and consolidation settlements for shallow foundations under various soil conditions.

CO3: Demonstrate knowledge of key geotechnical field tests, including the Standard Penetration Test (SPT) and Plate Load Test, and interpret their results for design purposes.

CO4: Understand the principles of pile foundations and accurately determine their load-carrying capacity using analytical and empirical methods.

UNIT-I: Water and Life

Lecture Hours: 08

- Necessity of water.
- Domestic and public demand.
- Uses in irrigation, transportation, sanitation, dilution of waste waters.
- Dust palliative, recreation, fire protection.

UNIT-II: Sources of Water

Lecture Hours: 08

- Surface and ground sources.
- Atmospheric water.
- Desalination.
- Recycling of waste water.
- Recharging of aquifers.

UNIT-III: Dual Supply of Water
Lecture Hours: 09

- Potable and non-potable water.
- Protected water, grey water, black water.
- Water-borne and water-related diseases.
- Sewage irrigation.

UNIT-IV: Distribution of Water
Lecture Hours: 08

- Distribution based on topography: gravity, direct pumping, combined systems.
- Service reservoirs, continuous and intermittent supply.
- Network distribution.
- Emergency supply during fire accidents.
- Valves, hydrants, and meters.

UNIT-V: Industrial Water
Lecture Hours: 10

- Industry location and proximity to water sources.
- Quality of water for industrial operations.
- Characteristics of industrial waste water.
- Effluent discharge standards.

Textbooks:

1. K.N. Duggal, *Elements of Environmental Engineering*, 7th Ed., S. Chand Publishers, 2010.
2. Hammer and Hammer, *Water and Wastewater Technology*, 4th Ed., Prentice Hall of India, 2003.
3. Howard S. Peavy, Donald P. Rowe, George Tchobanoglous, *Environmental Engineering*, 1st Ed., McGraw–Hill, 1985.

Reference Books:

1. B.C. Punmia, *Water Supply Engineering, Vol. 1* and *Wastewater Engineering, Vol. II*, 2nd Ed., Laxmi Publications, 2008.
2. Fair, Geyer, and Okun, *Water and Wastewater Engineering*, 3rd Ed., Wiley, 2010.

Web References:

- https://archive.nptel.ac.in/courses/105/105/105105201/

Course Code	Course Name	L	T	P	C
P23CEO04	Disaster Management	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To introduce the concepts and classifications of natural and man-made disasters, along with the global and regional disaster trends.
- To provide knowledge of disaster risk reduction (DRR) frameworks, policies, and institutions at the local, national, and international levels.
- To develop skills in vulnerability assessment and hazard mapping, especially in urban and rural planning contexts.
- To familiarize students with disaster preparedness, response, and recovery strategies, including early warning systems and community-based disaster management.
- To impart practical knowledge on structural and non-structural mitigation measures, with a focus on sustainable and resilient infrastructure.

Course Outcomes:

CO1: Identify and classify various types of disasters and analyze their causes and effects on society and infrastructure.

CO2: Demonstrate understanding of disaster risk reduction strategies, policies, and frameworks such as the Sendai Framework for Disaster Risk Reduction.

CO3: Gain the ability to assess risk and vulnerability, and prepare hazard maps using basic GIS and remote sensing tools.

CO4: Develop preparedness and response plans, including evacuation routes, emergency kits, and public awareness programs.

CO5: Evaluate structural and non-structural mitigation techniques, and apply them in designing disaster-resilient buildings and communities.

UNIT-I: Natural Hazards and Disaster Management

Lecture Hours: 08

- Introduction to disaster management, interdisciplinary nature, disaster management cycle.
- Five priorities for action.
- Case study methods: floods, droughts, earthquakes, landslides, global warming, cyclones, tsunamis.
- Post-tsunami hazards along the Indian coast.

UNIT-II: Man-Made Disasters and Their Management
Lecture Hours: 08

- Fire hazards, transport hazard dynamics, solid waste management.
- Post-disaster management, bioterrorism threats in mega cities.
- Rail and aircraft accidents, groundwater contamination, industrial accidents.
- Emerging infectious diseases and AIDS management.

UNIT-III: Risk and Vulnerability
Lecture Hours: 07

- Building codes and land use planning.
- Social and environmental vulnerability.
- Macro-economic management and sustainable development.
- Climate change risk rendition.
- Financial management of disaster-related losses.

UNIT-IV: Role of Technology in Disaster Management
Lecture Hours: 08

- Infrastructure taxonomy and disaster management for infrastructures.
- Treatment plants, process facilities, electrical substations, roads, and bridges.
- Earthquake mitigation programs, geospatial information in agriculture.
- Drought assessment using technology.

UNIT-V: Multi-sectoral Issues, Education and Community Preparedness
Lecture Hours: 08

- Impact of disasters on poverty and deprivation.
- Climate change adaptation and human health.
- Exposure, health hazards, and environmental risks.
- Forest management and disaster risk reduction.
- Role of the Red Cross and Red Crescent movement.
- Community-based disaster management and social capital.
- Designing resilience and building community capacity.

Textbooks:

1. S. Vaidyanathan, *An Introduction of Disaster Management - Natural Disasters & Vulnerable Hazards*, CBS Publishers & Distributors Pvt. Ltd.
2. R.B. Singh, *Natural Hazards & Disaster Management, Vulnerability and Mitigation*, Rawat Publications.
3. Tushar Bhattacharya, *Disaster Science & Management*, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. Jagbir Singh (2007), *Disaster Management – Future Challenges and Opportunities*, I K International Publishing House Pvt. Ltd.

Reference Books:

1. H. K. Gupta (2003), *Disaster Management*, Universities Press.
2. Rajib Shah & R. Krishnamurthy (2009), *Disaster Management – Global Challenges and Local Solutions*, Universities Press.
3. R. Nishith, Singh A.K., *Disaster Management in India: Perspectives, Issues and Strategies*.

Web References:

- https://archive.nptel.ac.in/courses/124/107/124107010/

Course Code	Course Name	L	T	P	C
P23CEE07	Finite Element Method	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To introduce the fundamentals and mathematical foundations of the Finite Element Method (FEM).
- To develop skills in formulation and solving FEM problems in structural analysis.
- To apply FEM to 1D and 2D problems including bars, beams, trusses, and plane stress/strain elements.
- To familiarize students with the use of FEM software tools.

Course Outcomes:

CO1: Understand the basic principles and steps in finite element formulation.

CO2: Formulate and solve bar, truss, and beam element problems.

CO3: Apply shape functions and numerical integration for element matrices.

CO4: Analyze 2D plane stress, strain, and axisymmetric problems.

CO5: Use FEM software for engineering problem-solving.

UNIT-I: Introduction to FEM
Lecture Hours: 08

- Historical background and applications.
- Steps in FEM.
- Advantages and limitations.
- Direct stiffness method.

UNIT-II: Bar and Truss Elements
Lecture Hours: 08

- Bar element: stiffness matrix, assembly, and boundary conditions.
- Truss elements in 2D: formulation and analysis.
- Transformation of coordinates.

UNIT-III: Beam and Frame Elements
Lecture Hours: 08

- Beam elements: shape functions, stiffness matrix.

- Analysis of continuous beams.
- Frame elements and stiffness formulations.

UNIT-IV: 2D Finite Elements
Lecture Hours: 08

- Plane stress and plane strain problems.
- Constant strain triangle (CST), Linear strain triangle (LST).
- Isoparametric elements: concept and application.

UNIT-V: Numerical Integration and Software Applications
Lecture Hours: 08

- Gaussian quadrature.
- Shape functions and Jacobian matrix.
- Introduction to FEM software (ANSYS/ABAQUS).
- Case studies and interpretation of software results.

Textbooks:

1. S.S. Bhavikatti, *Finite Element Analysis*, New Age International Publishers.
2. C.S. Krishnamoorthy, *Finite Element Analysis: Theory and Programming*, Tata McGraw-Hill.

Reference Books:

1. Daryl L. Logan, *A First Course in the Finite Element Method*, Cengage Learning.
2. J.N. Reddy, *An Introduction to the Finite Element Method*, McGraw-Hill Education.

Web References:

- https://nptel.ac.in/courses/112/104/112104116
- https://nptel.ac.in/courses/105/105/105105041

P23CEE09**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
P23PEC12	Water Resources Engineering	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To provide understanding of water resource systems and hydrologic processes.
- To study irrigation systems and their design.
- To introduce principles of canal systems and canal regulation structures.
- To understand reservoir planning and dam engineering.
- To explore ground water hydrology and well hydraulics.

Course Outcomes:

CO1: Understand components of hydrologic cycle and water resource development.

CO2: Design canal systems, alignments, and control structures.

CO3: Analyze reservoir planning and design storage capacity.

CO4: Apply principles of irrigation and water distribution.

CO5: Analyze groundwater flow and well development techniques.

UNIT-I: Introduction to Water Resources

Lecture Hours: 08

- Hydrologic cycle and components.
- Precipitation, infiltration, evaporation, and runoff.
- Surface water and groundwater resources.
- Water requirement for crops.

UNIT-II: Irrigation and Canal Systems

Lecture Hours: 08

- Types of irrigation: surface and subsurface.
- Canal alignment and design.
- Kennedy's and Lacey's theories.
- Canal lining and maintenance.

UNIT-III: Canal Regulation and Control Structures

Lecture Hours: 07

- Falls, regulators, cross-drainage works.
- Design of canal headworks and outlets.
- Distribution of water through control structures.

UNIT-IV: Dams and Reservoirs
Lecture Hours: 08

- Types of dams: gravity, earth, rock-fill.
- Design of reservoirs, storage zones.
- Spillways and energy dissipators.
- Stability and safety of dams.

UNIT-V: Groundwater Hydrology
Lecture Hours: 08

- Aquifers and properties.
- Darcy's law, transmissivity, and storage coefficient.
- Well hydraulics: confined and unconfined aquifers.
- Well development and groundwater recharge.

Textbooks:

1. Punmia, B.C., *Irrigation and Water Power Engineering*, Laxmi Publications.
2. Modi, P.N., *Irrigation Water Resources and Water Power Engineering*, Standard Book House.

Reference Books:

1. K. Subramanya, *Engineering Hydrology*, Tata McGraw-Hill.
2. Satyanarayana Murthy, *Water Resources Engineering*.
3. Asawa, G.L., *Irrigation Engineering*, New Age International.

Web References:

- `https://nptel.ac.in/courses/105/105/105105110`
- `https://www.indiawaterportal.org`

Course Code	Course Name	L	T	P	C
P23CEE06	Valuation and Quantity Surveying	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Prerequisites: Building Materials and Construction, Estimation and Costing

Course Objectives:

- To understand methods and principles of valuation.
- To impart knowledge on rent fixation and value assessment.
- To provide techniques for detailed estimation and quantity surveying.

Course Outcomes:

CO1: Understand principles and methods of valuation.

CO2: Perform valuation of buildings and properties.

CO3: Estimate rental value and sinking fund.

CO4: Prepare detailed estimates and bar bending schedules.

CO5: Apply standard specifications and measurement rules.

UNIT-I: Valuation – Basics

- Definition and purpose of valuation.
- Types of value – market, book, scrap, salvage, and rental value.
- Depreciation – methods and calculations.
- Valuation methods – rental method, land and building method, profit method, etc.

UNIT-II: Rent and Sinking Fund Calculations

- Standard rent, gross income, net income.
- Outgoings – municipal taxes, insurance, repairs.
- Sinking fund – calculation using tables and formulae.
- Capitalized value.

UNIT-III: Quantity Surveying – Introduction

- Types of estimates – detailed, abstract, revised.
- Estimation of RCC, brickwork, plastering, painting, etc.
- Analysis of rates – material, labour, machinery, overheads.

UNIT-IV: Bar Bending Schedule and Specifications

- Bar bending schedule – format and preparation.
- Quantity calculation for reinforcement.
- Specifications – general, detailed, standard formats.

UNIT-V: Measurement and Contracts

- Standard method of measurement (IS 1200).
- Principles of measurement for different items.
- Tendering and contracting – types and procedures.

Text Books:

1. B. N. Dutta, *Estimating and Costing in Civil Engineering*, UBS Publishers.
2. Rangwala, *Valuation of Real Properties*, Charotar Publishing House.

Reference Books:

1. M. Chakraborti, *Estimation, Costing, Specification and Valuation in Civil Engineering.*
2. IS 1200 – Methods of Measurement of Building Works.

Web References:

- `https://nptel.ac.in/courses/105104065`
- `https://cpwd.gov.in`

Course Code	Course Name	L	T	P	C
P23CEE05	Repair and Rehabilitation of Structures	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To provide knowledge on various types of deterioration in structures.
- To understand methods for inspection, assessment, and diagnosis of structural distress.
- To impart techniques for repairing and strengthening concrete structures.
- To introduce modern materials and methods used in rehabilitation.

Course Outcomes:

CO1: Identify causes and types of deterioration in structures.

CO2: Carry out condition assessment and evaluation of structural damages.

CO3: Recommend appropriate repair materials and techniques.

CO4: Apply strengthening techniques and retrofitting methods.

CO5: Use modern equipment and technology in structural rehabilitation.

UNIT-I: Introduction to Distress in Structures
Lecture Hours: 08

- Causes of deterioration: physical, chemical, environmental.
- Symptoms of distress.
- Effects of corrosion in steel and concrete.
- Case studies of structural failures.

UNIT-II: Condition Assessment and Evaluation
Lecture Hours: 08

- Inspection procedures.
- Non-destructive testing (NDT): rebound hammer, ultrasonic pulse velocity, carbonation testing, corrosion mapping.
- Load testing.
- Damage classification.

UNIT-III: Materials for Repair and Rehabilitation
Lecture Hours: 07

- Repair materials: polymers, resins, grouts, steel plates, fiber reinforced composites.
- Bonding agents and surface coatings.
- Selection criteria for materials.

UNIT-IV: Repair Techniques
Lecture Hours: 08

- Crack repair techniques: stitching, grouting, sealing.
- Concrete replacement methods.
- Strengthening of structural elements using steel plates and FRP.
- Jacketing of columns and beams.

UNIT-V: Modern Methods and Case Studies
Lecture Hours: 08

- Electrochemical techniques: cathodic protection, re-alkalization.
- Seismic retrofitting techniques.
- Health monitoring of structures.
- Real-time case studies on rehabilitation.

Textbooks:

1. Denison Campbell, Allen and Harold Roper, *Concrete Structures: Materials, Maintenance and Repair*, Longman Scientific and Technical.
2. P. I. Modi, *Repair and Rehabilitation of Structures*, Standard Book House.

Reference Books:

1. CPWD and Indian Standard Codes on Maintenance and Repair of Buildings.
2. Ravindra K. Dhir and M.R. Jones, *Repair and Renovation of Concrete Structures*, Thomas Telford.

Web References:

- `https://nptel.ac.in/courses/105/106/105106180/`
- `https://www.cpwd.gov.in/`

Course Code	Course Name	L	T	P	C
P23CEE04	Ground Improvement Techniques	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Prerequisites: Geotechnical Engineering

Course Objectives:

- To understand the need and objectives of ground improvement.
- To learn different methods for improving soil properties.
- To design techniques to stabilize and reinforce soils.

Course Outcomes:

CO1: Identify suitable ground improvement techniques based on soil conditions.

CO2: Apply mechanical and hydraulic methods for densification.

CO3: Design vertical drains and preloading systems.

CO4: Understand grouting techniques and applications.

CO5: Use reinforcement and geosynthetics for soil stability.

UNIT-I: Introduction

- Need for ground improvement.
- Objectives of ground improvement.
- Classification of ground improvement techniques.

UNIT-II: Mechanical and Hydraulic Modification

- Compaction – surface, deep, dynamic compaction, vibroflotation.
- Preloading – methods, vacuum consolidation.
- Drainage – well point systems, sand drains, vertical drains.

UNIT-III: Physical and Chemical Modification

- Grouting – types, methods, applications.
- Soil stabilization – lime, cement, fly ash.
- Thermal methods.

UNIT-IV: Reinforced Earth and Geosynthetics

- Reinforced soil – principles, design of retaining walls.

- Geosynthetics – types, functions, applications.

UNIT-V: Special Ground Improvement Techniques

- Soil nailing, stone columns, jet grouting, micro piles.
- Applications in embankments, slopes, and foundations.

Text Books:

1. M. P. Moseley and K. Kirsch, *Ground Improvement*, CRC Press.
2. P. Purushothama Raj, *Ground Improvement Techniques*, Laxmi Publications.

Reference Books:

1. Hausmann, M. R., *Engineering Principles of Ground Modification*, McGraw Hill.
2. IS Code 15284 – Design and Construction for Ground Improvement.

Web References:

- `https://nptel.ac.in/courses/105107120`
- `https://nptel.ac.in/courses/105101005`