DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC REGULATIONS
AND
COURSE STRUCTURE & SYLLABUS

(For the students admitted to B.Tech regular Four Year Degree
Programme from the academic year 2021-22 and
B. Tech Lateral Entry Scheme from the Academic Year 2022-23)

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 (R21) FOR B. TECH. (REGULAR)
Applicable for students of B. Tech. (Regular) from Academic Year 2021-22 onwards

Pace Institute of Technology and Sciences,Ongole, 2021 Regulations (R21 Regulations) applicable for all the students admitted into first year of all B.Tech programmes from the academic year 2021-22 & B.Tech Lateral Entry Scheme from the Academic Year 2022-23 onwards

1. 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

* Notified in A.Y: 2022-2023

2. 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.

3. Admissions:

Admission to the B. Tech Programme 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 on the basis of the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or on the basis of 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.

4. Programme Pattern:

(i) Total duration of the B. Tech (Regular) Programme is four academic years.

(ii) Each Academic year of study is divided in to two semesters.

(iii) Minimum number of instruction days in each semester is 90.

(iv) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

(v) The total credits for the Programme are 160.

(vi) A three-week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

(vii) Student is introduced to "Choice Based Credit System (CBCS)".

(viii) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of con- cerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

(ix) A student has to register for all courses in a semester.

(x) All the registered credits will be considered for the calculation of final CGPA.

(xi) Each semester has – "Continuous Internal Evaluation" (CIE) and "Semester End Examination" (SEE). Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

(xii) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and prepare engineering graduates to connect with the needs of the industry and society at large.

(xiii) The charactor of students and make them aware of social needs, the extracurricular/co-curricular activities are included, which do not carry any credits. These activities include National Service Scheme (NSS), Na- tional Cadet Corps (NCC), Yoga & Meditation, Sports & Games and Pro- fessional Club Activities.

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

5. **Subject/Course Classification:**
   All subjects/courses offered for the undergraduate programme in E & T (B. Tech degree programmes) are broadly classified as follows.

6. **Registration for Courses:**

   (i) The Department shall invite registration forms from the students at the beginning of the semester for the registration for courses each semester. The registration process shall be closed within one week. If any student

Sl No	Category	Code	APSCHE breakup of Credits	AICTE Credits of breakup
1	Humanities and social science including Management courses	HSMC	10.5	12
2	Basic Science courses	BSC	21	25
3	Engineering courses science	ESC	24	24
4	Professional core Courses	PCC	51	48
5	Open Elective Courses	OEC	12	18
6	Professional Courses Elective	PEC	15	18
7	Internship, seminar, project work	PROJ	16.5	15
8	Skill Oriented Courses	SC	10	-
9	Laboratory Courses	LC	-	-
10	Mandatory courses	MC	Non-credit	Non-credit
			160	160

wishes to withdraw the registration, he/she shall submit a letter to the principal through the class teacher/instructor and HOD. The principal shall communicate the registration and withdraw details courses of each student in a consolidated form to the college examination section.

(ii) There are four open electives in each branch. All Open Electives are offered to students of all branches in general. A student shall choose an open elective, by consulting the HOD/advisor, from the list in such a manner that he/she has not studied the same course in any form during the Programme.

(iii) A student shall be mandated to pursue two elective courses under MOOCs during the programme. Students are advised to register for only for minimum 12 weeks in duration MOOCs courses. Student has to pursue and acquire a certificate for a MOOC course only from the SWAYAM/NPTEL through online with the approval of Head of the Department in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester. The details of the MOOCs courses registered by the students shall be submitted to the college ex- amination center. The Head of the Department shall appoint a mentor for each of the MOOC subjects registered by the students to monitor the stu- dent's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed. Even,if any student not cleared the courses through MOOCs up to the 7th semester, he/she has to register for external examination through offline

mode in last semester of the programme (i.e., 8th Semester) at college level.

(iv) Two summer internships or one internship and one Community Ser- vice Project (CSP), each with a minimum of six weeks duration shall be mandatorily done/completed respectively at the end of second and third years (during summer vacations). The internship can be done by the students at local industries, Govt. Organizations, Construction agen- cies, Industries, Hydel and thermal power projects and also in software MNCs. After completing the summer internship, the students shall reg- ister in the immediate respective odd semester and it will be evaluated at the end of the semester as per norms of the college. The student has to produce the summer internship satisfactory report and certificate taken from the organization to be considered for evaluation. The Department 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. The information per- taining to CSP is mentioned in Annexure-I.

(v) In the final semester, the student should mandatorily register and un- dergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A stu- dent 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.

(vi) Curricular Framework for Skill oriented courses

(a) There are five (05) skill-oriented courses shall be offered during III to VII semesters and students must register and pass the courses successfully.

(b) For skill oriented/skill advanced course, one theory and two practical hours (1-0-2) or two theory hours (2-0-0) may be allotted as per the decision of concerned BOS.

(c) Out of the five skill courses; (i) two shall be skill-oriented courses from the same domain and shall be completed in second year (ii) Of the remaining three skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or job-oriented skill courses, which can be of inter disciplinary nature.

(d) Students may register the interdisciplinary job-oriented skill courses based on the prerequisites and eligibility in consultation with HOD of the college.

(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

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offered by Industries/Professional bodies/APSSDC or any other accredited bodies. However, the department has to assign mentors in the college to monitor the performance of the students.

(f) If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, then the department shall mark overall attendance of the student for the remaining courses in that semester excluding the skill course in allthe calculations of mandatory attendance requirements upon pro- ducing a valid certificate. However, the student is deemed to have fulfilled the attendance requirement of the course, if the external agency issues a certificate with satisfactory condition. If the cer- tificate issued by external agency is marked with unsatisfactory con- dition, then the student shall repeat the course either in the college or at external agency. The credits will be awarded to the student upon producing the successful Course Completion Certificate from the agency/professional bodies and after passing in the viva-voce ex- amination conducted at college as per college norms at the end of the semester.

7. Award of B. Tech. Degree:

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

(a) A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years.

(b) After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

(c) The student shall register for 160 credits and must secure all the 160 credits.

(d) All students shall register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Un- satisfactory in the mark sheet on the basis of participation, atten- dance, performance and behavior. If a student gets an unsatisfac- tory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

(e) Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks

allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

(f) Credit Definition:

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
1 Hour Practical (P) per week	0.5 Credit
2 Hours Practical (Lab) per week	1 Credit

(ii) Award of B. Tech. (Honor)/B. Tech. (Minor):

B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for Honors/Minor is optional.

8. Attendance Requirements:

(i) A student is eligible to write the semester end examinations if he acquires a minimum of 40% in each course and 75% of attendance in aggregate of all the courses.

(ii) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) may be granted by the College Academic Commit- tee. However, this condonation concession is applicable only to any two semesters during the entire programme.

(iii) Shortage of Attendance below 65% in aggregate shall not be condoned.

(iv) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of com- mencement of class work.

(v) Students whose shortage of attendance is not condoned in any semester are not eligible to write their semester end examination of that class.

(vi) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing con- donation on medical ground shall produce a medical certificate issued by the competitive authority.

(vii) A student will be promoted to the next semester if he satisfies the (i) at- tendance requirement of the present semester and (ii) minimum required credits.

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

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

(x) For non-credit mandatory courses the students shall maintain the atten-dance similar to credit courses.

9. Evaluation-Distribution and Weightage of marks:

(i) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the College Examination section from time to time.

(ii) For non-credit mandatory courses, like Environmental Sciences, Univer- sal Human Values, Ethics, Indian Constitution, Essence of Indian Tradi- tional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

(iii) A student is deemed to have satisfied the minimum academic require- ments if he has earned the credits allotted to each theory/practical de- sign/drawing subject/ project etc by securing not less than 35% of marks in the semester end exam and minimum 40% of marks in the sum total of the internal marks and semester end examination marks together.

(iv) Distribution and Weightage of marks:

The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Ex- amination (SEE). The performance of a student in each semester shall be evaluated course–wise with a maximum of 100 marks for theory course and 50 marks for practical course. For theory courses the distribution shall be 30 marks for Internal Evaluation and 70 marks for the Semester End Examinations.

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

(v) Continuous Internal Theory Evaluation:

(a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (ii) one descriptive examination and (iii) one as- signment. The online examination (objective) shall be 10 marks and descriptive examination shall be for 15 marks with a total duration of 1 hour 50 minutes (20 minutes for objective and 90 minutes for descriptive paper).

(b) The first online examination (objective) is set with 20 multiple choice questions for 10 marks (20 questions x $\frac{1}{2}$ marks) from first two and half units (50% of the syllabus). The descriptive examination is set with 3 full questions for 5 marks each from first two and half units (50% of the syllabus), the student has to answer all questions. In the similar lines, the second online and descriptive examinations shall be conducted on the rest of the syllabus.

(c) The assignment is given by the concerned class teacher for five marks from first two and half units (50% of the syllabus). The second as- signment shall be given from rest of the syllabus. The first assign- ment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. However, There shall be no assignment with viva voce and class room tests for Ap- plied/Engineering physics course. Finalized internal marks for Ap- plied/Engineering physics course can be calculated with 80% weigh- tage for the better of the two mid-term examinations and 20% for the other shall be considered for marks of 25 and is added to virtual lab

- assignments 5 marks for awarding total 30 marks.

(d) The total marks secured by the student in each mid-term examina-tion are evaluated for 30 marks. The first mid marks (Mid-1) consist- ing of marks of online objective examination, descriptive examination and assignment shall be submitted to the college examination section within one week after completion of first mid examination.

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

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

(g) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to College examination section within one week after com- pletion of second mid examination and it shall be displayed in the no- tice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of college examination section within one week from the submission.

(h) Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for another mid exam.

(i) Example:

Mid-1 marks =Marks secured in (online examination-1+descriptive examination-1 +one assignment-1)

Mid-2 marks=Marks secured in (online examination-2+ descriptive examination-2 +one assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

(j) With the above criteria, college examination section will send mid marks of all courses in consolidated form to all the concerned de- partments and same shall be displayed in the concerned department notice boards. If any discrepancy found, it shall be brought to the notice of college examination section through proper channel within

one week with all proofs. Discrepancies brought after the given dead- line will not be entertained under any circumstances.

(k) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks .The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test.

(vi) Semester End Theory Examinations Evaluation:

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

(b) For practical subjects the end examination shall be conducted by the teacher concerned and external examiner appointed by Chief Con- troller of Examinations for 35 marks.
Note: Laboratory marks and the internal marks awarded by the de- partment are not final. The marks are subject to scrutiny and scaling by the Chief Controller of Examinations wherever felt desirable. The internal and laboratory marks awarded by the department will be referred to a Committee. The Committee shall arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. All the laboratory records and internal test papers shall be preserved in re- spective departments as per college norms and shall be produced to the Committees of University as and when they ask for.

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

(d) Evaluation of the summer internships: It shall be completed in col- laboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG pro- gramme. Students shall pursue this internship during summer va- cation just before its offering as per course structure. The minimum duration of this course shall be at least 6 weeks. The student shall register for the internship as per course structure after commence-

ment of academic year. A supervisor/mentor/advisor has to be allot- ted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the College. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental com- mittee consists of an external examiner appointed by the Chief Con- troller of Examinations; Head of the Department, supervisor of the internship and a senior faculty member of the department. A cer- tificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College.

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

(f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environ- mental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the department internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (SA)/Not-completed (US) will be speci- fied.

(g) Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online

with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assign- ment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

(h) Major Project (Project - Project work, seminar and internship in industry): In the final semester, the student should mandatorily reg- ister and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Chief Controller of Examinations and is evaluated for 140 marks.

10. Recounting of Marks in the Semester End Examination:

A student can request for recounting of his/her answer book on payment of a prescribed fee as per college norms.

11. Re-evaluation of the End Semester Examination:

A student can request for Revaluation of his/her answer book on payment of a prescribed fee as per college norms.

12. Supplementary Examinations:

A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the college.

13. Malpractices in Examinations:

Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the college.

14. Promotion Rules:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.8 for promotion to higher classes

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

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

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

15. Course Pattern:

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

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

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

16. Earning of Credit:

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

17. Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

(a) SGPA(S_k) of kth semester (1 to 8) is 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 total number of credits of all the courses undergone/registered by a student, i.e.,

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	O	10
$\geq 80 \leq 89$	$\geq 40 \leq 44$	Excellent	S	9
$\geq 70 \leq 79$	$\geq 35 \leq 39$	Very Good	A	8
$\geq 60 \leq 69$	$\geq 30 \leq 34$	Good	B	7
$\geq 50 \leq 59$	$\geq 25 \leq 29$	Fair	C	6
$\geq 40 \leq 49$	$\geq 20 \leq 24$	Pass	P	5
< 40	< 20	Fail	F	0
-	-	Absent	AB	0

$$SGPA(S_k) = \frac{\sum_{i-1}^{n}(C_i \times G_i)}{\sum_{i-1}^{n} C_i}$$

(b) CGPA: The CGPA is calculated in the same manner taking into account all the 'm' courses/subjects registered by student over all the semesters of a Programme i.e., in all eight semesters

$$CGPA = \frac{\sum_{i-1}^{n}(C_i \times S_i)}{\sum_{i-1}^{n} C_i}$$

(c) SGPA and CGPA shall be rounded off to 2 decimal points and reported in transcripts.

(d) While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

(e) Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

(f) Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, S, A, B, C, P, F and AB.

(g) As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

$$Equivalent Percentage = (CGPA – 0.75) \times 10$$

(h) Illustration of Computation of SGPA and CGPA

(i) Illustration for SGPA:

Let us assume there are 6 subjects in a semester. The grades obtained as follows:

Course	Credit	Grade Obtained	Grade point	Si= Credit Point (Credit x Grade)
Subject 1	3	A	8	3 X 8 = 24
Subject 2	4	B	7	4 X 7 = 28
Subject 3	3	C	6	3 X 6 = 18
Subject 4	3	O	10	3 X 10 = 30
Subject 5	3	P	5	3 X 5 = 15
Subject 6	4	C	6	4 X 6 = 24
	20			139

Thus, SGPA =139/20 =6.95=6.9 (approx.)

(ii) **Illustration for CGPA:**

Semester 1	Semester 2	Semester 3	Semester 4
Credits: 19.5 SGPA: 6.9	Credits: 19.5 SGPA: 7.8	Credits: 21.5 SGPA: 5.6	Credits: 21.5 SGPA: 6.0
Semester 5	Semester 6	Semester 7	Semester 8
Credits: 21.5 SGPA: 6.3	Credits: 21.5 SGPA: 8.0	Credits: 23 SGPA: 6.4	Credits: 12 SGPA: 7.5

Thus,

$$CGPA = \frac{19.5 \times 6.9 + 19.5 \times 7.8 + 21.5 \times 5.6 + 21.5 \times 6.0 + 21.5 \times 6.3 + 21.5 \times 8.0 + 23 \times 6.4 + 12 \times 7.5}{160} = 6.75$$

18. Award of Class

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

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

19. Minimum Instruction Days

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

20. Withholding of Results

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

21. Transitory Regulations

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

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

(a) In case of transferred students from other Universities, credits shall be transferred to PACE as per the academic regulations and course structure of College.

(b) The students seeking transfer to PACE from various other Universi-ties / Institutions have to obtain the credits of any equivalent sub- jects as prescribed by PACE. In addition, the transferred candidates

have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by PACE.

22. Gap - Year

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

23. General

(i) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

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

(iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the competent authority of the college is final.

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

ACADEMIC REGULATIONS (R21) FOR B. TECH. (LATERAL ENTRY SCHEME)

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

1. Award of B. Tech. Degree

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

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

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

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

3. Promotion Rule

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

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

4. Award of Class

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (without any supplementary appearance)	From the CGPA secured from 121 credits
First Class	≥ 6.75	
Second Class	$\geq 5.75 < 6.75$	
Pass Class	$\geq 5.00 < 5.75$	

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

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

COMMUNITY SERVICE PROJECT

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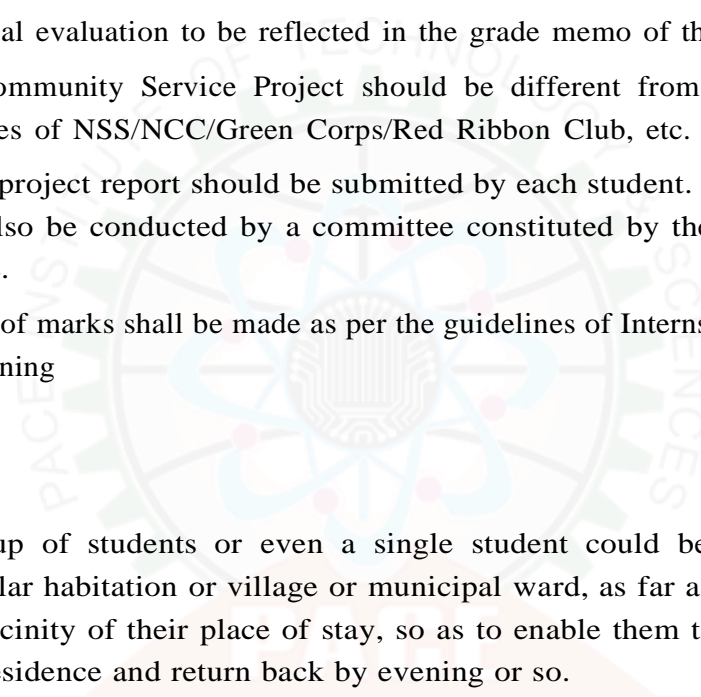
(1) Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development

(2) Community Service Project involves students in community development and service activities and applies the experience to personal and aca- demic development.

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

II. Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

(i) To sensitize the students to the living conditions of the people who are around them

(ii) To help students to realize the stark realities of the society.

(iii) To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and account- ability

(iv) To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.

(v) To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.

(vi) To help students to initiate developmental activities in the community in coordination with public and government authorities.

(vii) To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

III. Implementation of Community Service Project

(i) Every student should put in a minimum of 180 hours for the Community Service Project during the summer vacation.

(ii) Each class/section should be assigned with a mentor.

(iii) Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc

(iv) A log book has to be maintained by each of the student, where the activ- ities undertaken/involved to be recorded.

(v) The log book has to be countersigned by the concerned mentor/faculty in charge.

(vi) Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

(vii) The final evaluation to be reflected in the grade memo of the student.

(viii) The Community Service Project should be different from the regular pro-grammes of NSS/NCC/Green Corps/Red Ribbon Club, etc.

(ix) Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

(x) Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

IV. Procedure

(1) A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

(2) The Community Service Project is a twofold one –

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

  (b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
  - Agriculture
  - Health
  - Marketing and Cooperation
  - Animal Husbandry

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

(V) Expected Outcomes

(1) Benefits of Community Service Project to Students
Learning Outcomes

(a) Positive impact on students' academic learning

(b) Improves students' ability to apply what they have learned in "the real world"

(c) Positive impact on academic outcomes such as demonstrated com-plexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development

(d) Improved ability to understand complexity and ambiguity

Personal Outcomes

(a) Greater sense of personal efficacy, personal identity, spiritual growth, and moral development

(b) Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

(a) Reduced stereotypes and greater inter-cultural understanding

(b) Improved social responsibility and citizenship skills

(c) Greater involvement in community service after graduation

Career Development

(a) Connections with professionals and community members for learn-ing and career opportunities

(b) Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

(a) Stronger relationships with faculty

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(b) Greater satisfaction with college

(c) Improved graduation rates

(2) Benefits of Community Service Project to Faculty Members

  (a) Satisfaction with the quality of student learning

  (b) New avenues for research and publication via new relationships between faculty and community

  (c) Providing networking opportunities with engaged faculty in other disciplines or institutions

  (d) A stronger commitment to one's research

(3) Benefits of Community Service Project to Colleges and Universities

  (a) Improved institutional commitment

  (b) Improved student retention

  (c) Enhanced community relations

(4) Benefits of Community Service Project to Community

  (a) Satisfaction with student participation

  (b) Valuable human resources needed to achieve community goals

  (c) New energy, enthusiasm and perspectives applied to community work

  (d) Enhanced community-university relations.

VI. Suggestive List of Programmes Under Community Service Project

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

(b) For Engineering Students

- Water facilities and drinking water availability
- Health and hygiene
- Stress levels and coping mechanisms
- Health intervention programmes
- Horticulture
- Herbal plants
- Botanical survey
- Zoological survey
- Marine products

- Aqua culture
- Inland fisheries
- Animals and species
- Nutrition
- Traditional health care methods
- Food habits
- Air pollution
- Water pollution
- Plantation
- Soil protection
- Renewable energy
- Plant diseases
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Use of chemicals on fruits and vegetables
- Organic farming
- Crop rotation
- Floury culture
- Access to safe drinking water
- Geographical survey
- Geological survey
- Sericulture
- Study of species
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Human genetics
- Blood groups and blood levels
- Internet Usage in Villages
- Android Phone usage by different people
- Utilization of free electricity to farmers and related issues
- Gender ration in schooling level- observation.

Complimenting the community service project, the students may be in- volved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

(c) Programmes for School Children

- Reading Skill Programme (Reading Competition)
- Preparation of Study Materials for the next class.
- Personality / Leadership Development
- Career Guidance for X class students
- Screening Documentary and other educational films

- Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
- Awareness Programme on Socially relevant themes.

(d) Programmes for Women Empowerment

- Government Guidelines and Policy Guidelines
- Womens' Rights
- Domestic Violence
- Prevention and Control of Cancer
- Promotion of Social Entrepreneurship

(e) General Camps

- General Medical camps
- Eye Camps
- Dental Camps
- Importance of protected drinking water
- ODF awareness camp
- Swatch Bharat
- AIDS awareness camp
- Anti Plastic Awareness
- Programmes on Environment
- Health and Hygiene
- Hand wash programmes
- Commemoration and Celebration of important days

(f) Programmes for Youth Empowerment

- Leadership
- Anti-alcoholism and Drug addiction
- Anti-tobacco
- Awareness on Competitive Examinations
- Personality Development

(g) Common Programmes

- Awareness on RTI
- Health intervention programmes
- Yoga
- Tree plantation
- Programmes in consonance with the Govt. Departments like –
  - Agriculture
  - Health
  - Marketing and Cooperation
  - Animal Husbandry
  - Horticulture
  - Fisheries

- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy

VII. Role of Students:

(a) Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.

(b) For conducting special camps like Health related, they will be coordinat- ing with the Governmental agencies.

(c) As and when required the College faculty themselves act as Resource Persons.

(d) Students can work in close association with Non-Governmental Orga- nizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.

(e) And also, with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the suc- cessful deployment of the programme.

(f) An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

1. Duration: 8 weeks

(a) Preliminary Survey (One Week)

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

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

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

(b) Community Awareness Campaigns (Two Weeks)
Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread

over two weeks of time. The list of activities suggested could be taken into consideration.

(c) Community Immersion Programme (Four Weeks)

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

(d) Community Exit Report (One Week)

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

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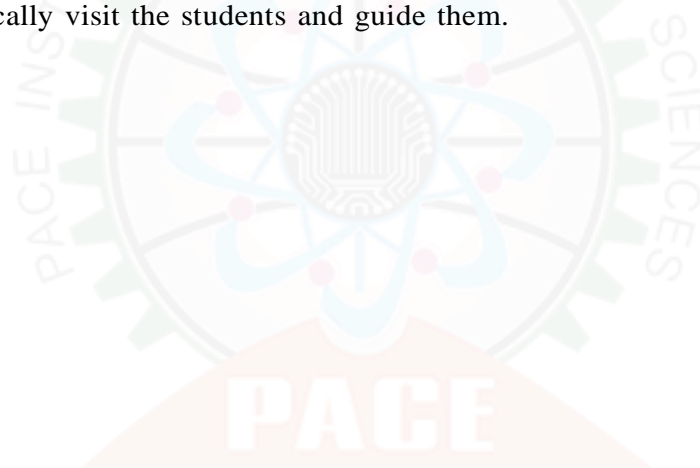
Annexure-II

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

Sl. No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. a.	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall in- clude any marks on the body of the can- didate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1. b.	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates in- volved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calcula- tors, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the can- didate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the sub- jects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in con- nection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and for- feits the seat. The performance of the original candidate, who has been imper- sonated, shall be cancelled in all the sub-jects of the examination (including prac- ticals and project work) already appeared and shall not be allowed to appear for ex- aminations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4	Smuggles in the Answer book or addi- tional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that sub- ject and all the other subjects the can- didate has already appeared including practical examinations and project work and shall not be permitted for the re- maining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the exam- iner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/Assistant – Superinten- dent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his per-son or to any of his relations whether by words, either spoken or written or by signs or by visible representation, as- saults the officer-in-charge, or any per- son on duty in or outside the examina- tion hall or any of his relations, or in- dulges in any other act of misconduct or mischief which result in damage to or de-struction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the sub- jects of that semester/year. The candi- dates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

7	Leaves the exam hall taking away answer script or intentionally tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examina- tions and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to po- lice and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11shall be reported to the Chief Controllerof Examinations for further action and impose suitable punishment.	

Annexure-III

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/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

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
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

DEPARTMENT OF CIVIL ENGINEERING
R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	C
		I Year - I Semester				
1	P21HST01	Communicative English	3	0	0	3
2	P21BST01	Linear Algebra & Differential Equations	3	0	0	3
3	P21BST03	Engineering Physics	3	0	0	3
4	P21EST01	Engineering Graphics	3	0	0	3
5	P21EST02	Engineering Geology (Integrated: Theory & Lab)	2	0	2	3
6	P21HSL01	English Language Communication Skills Lab	0	0	3	1.5
7	P21BSL02	Engineering Physics Lab	0	0	3	1.5
8	P21ESL01	Basics of Civil Engineering Workshop Lab	0	0	3	1.5
9	P21MCT01	Induction program	2	0	0	0
		TOTAL				19.5

S.No	Course Code	Course Title	L	T	P	C
		I Year - II Semester				
1	P21BST05	Engineering Chemistry	3	0	0	3
2	P21BST06	Numerical Methods & Vector calculus	3	0	0	3
3	P21EST03	C-Programming for Problem Solving	3	0	0	3
4	P21EST05	Building Material and Concrete Technology	3	0	0	3
5	P21EST09	Engineering Mechanics	3	0	0	3
6	P21BSL04	Engineering Chemistry Lab	0	0	3	1.5
7	P21ESL02	C-Programming for Problem Solving Lab	0	0	3	1.5
8	P21ESL03	Building planning and Computer aided engineering drawing	0	0	3	1.5
9	P21MCT02	Biology for Engineering	2	0	0	0
		TOTAL				19.5

DEPARTMENT OF CIVIL ENGINEERING
R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	C
		II Year - I Semester				
1	P21BST07	Probability and Statistics	3	0	0	3
2	P21CET01	Solid Mechanics	3	0	0	3
3	P21CET02	Fluid Mechanics	3	0	0	3
4	P21CET03	Highway Engineering	3	0	0	3
5	P21CET04	Surveying and Geometrics	3	0	0	3
6	P21CEL01	Concrete Technology Lab	0	0	3	1.5
7	P21CEL02	Surveying Field Work Lab	0	0	3	1.5
8	P21CEL03	Transportation Engineering Lab	0	0	3	1.5
9	P21CES01	Skill Oriented Course-I	1	0	2	2
10	P21MCT03	Environmental Science	2	0	0	0
		Total Credits				21.5

S.No	Course Code	Course Title	L	T	P	C
		II Year - II Semester				
1	P21CET05	Structural Analysis	3	0	0	3
2	P21CET06	Mechanics of Materials	3	0	0	3
3	P21CET07	Environmental Engineering	3	0	0	3
4	P21EST15	Hydraulic and Hydraulic Machinery	3	0	0	3
5	P21MBT01	Managerial Economics and Financial Analysis	3	0	0	3
6	P21ESL08	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	P21CEL04	Strength of Materials Lab	0	0	3	1.5
8	P21CEL05	Environmental Engineering Lab	0	0	3	1.5
9	P21CES02	Skill Oriented Course-II	1	0	2	2
		Total Credits				21.5
		Internship (Mandatory) 2 Months during Summer vacation				

DEPARTMENT OF CIVIL ENGINEERING
R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

		III Year - I Semester				
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P21CET08	Advanced Structural Analysis	3	0	0	3
2	P21CET09	Design and Drawing of Reinforced Concrete Structures	3	0	0	3
3	P21CET10	Geotechnical Engineering	3	0	0	3
4	P21OE01	Open Elective - I	3	0	0	3
5	P21PE01	Professional Elective - I	3	0	0	3
6	P21CEL06	Geotechnical Engineering Lab	0	0	3	1.5
7	P21CEL07	Advanced Concrete Technology Lab	0	0	3	1.5
8	P21MCT04	Design Thinking	0	0	0	0
9	P21CES03	Skill Oriented Course-III	1	0	2	2
10	P21XXXX	Internship 2 Months after II Year (to be evaluated during III Year I Semester)	0	0	0	1.5
					Total Credits	21.5

		III Year - II Semester				
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P21CET11	Design and Drawing of Steel Structures	3	0	0	3
2	P21CET12	Water Resources Engineering	3	0	0	3
3	P21CET13	Foundation Engineering	3	0	0	3
4	P21OE02	Open Elective - II	3	0	0	3
5	P21PE02	Professional Elective - II	3	0	0	3
6	P21CEL08	Estimation, Specification and Contracts Lab	0	0	3	1.5
7	P21CEL09	Structural Analysis and Design Programming Lab	0	0	3	1.5
8	P21CEL10	Structural Engineering Lab	0	0	3	1.5
8	P21MCT05	Employability Skills	0	0	0	0
9	P21CES04	Skill Oriented Course-IV	1	0	2	2
					Total Credits	21.5
		Industry Internship (Mandatory) for 2 months				

DEPARTMENT OF CIVIL ENGINEERING
R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	C
		IV Year - I Semester				
1	P21PE03	Professional Elective-III	3	1	0	3
2	P21PE04	Professional Elective-IV	3	0	0	3
3	P21PE05	Professional Elective-V	3	0	0	3
4	P21OE03	Open Elective-III	3	0	0	3
5	P21OE04	Open Elective-IV	3	0	0	3
6	P21HSE01	Universal Human Values-II	3	0	0	3
7	P21CES05	Skill Advanced Oriented /Soft Skill Course	1	0	2	2
8	P21CEXX	Summer Internship (Mandatory) 2 Months after III Year (to be evaluated during IV Year I Semester)	0	0	0	3
		Total Credits				23

S.No	Course Code	Course Title	L	T	P	C
		IV Year - II Semester				
1	P21CEXX	Project Work, Seminar and Internship in Industry	0	0	24	12
		Internship (6 Months)				
		Total Credits				12

Course Code	Course Name	Course Structure			
		L	T	P	C
P21HST01	Communicative English	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: The students should have basic knowledge of English grammar and LSRW skills.

Course Objectives: The student will be able

1. To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
2. To equip the students with appropriate oral and written communication skills.
3. To inculcate the skills of listening, reading and critical thinking.
4. To integrate English Language learning with employability skills and training.
5. To enhance the students' proficiency in reading skills enabling them to meet the academic demands of their course.

Course Outcomes: After going through this course the student will be able to

1. Use English Language effectively in spoken and written forms
2. Interpret the contextual meaning of words
3. Comprehend the given texts and respond appropriately
4. Recall and reproduce the theme in a given context
5. Communicate confidently in formal and informal contexts

UNIT–I   **(9 Lectures)**

a. Reading Skills: Leela's Friend – R.K. Narayan
b. Vocabulary: Synonyms, Antonyms and Word formation, Root Words
c. Grammar: Parts of Speech, Sentence structure and Types of sentences
d. Writing: Letter Writing, Note Making and Note Taking

UNIT–II   **(10 Lectures)**

a. Reading Skills: Dr. A.P.J. Abdul Kalam's Biography
b. Vocabulary: Prefixes, Suffixes and Affixes
c. Grammar: Prepositions and Articles
d. Writing: Paragraph Writing and Precis Writing

UNIT–III   **(9 Lectures)**

a. Reading Skills: Three Days to See – Helen Keller
b. Vocabulary: Collocations, One word substitutes & Idioms
c. Grammar: Tenses, Active voice & Passive voice
d. Writing: Technical Report Writing

UNIT–IV   **(9 Lectures)**

a. Reading Skills: Satya Nadella's Email to His Employees on His First Day as CEO of Microsoft

b. Vocabulary: Phrasal verbs and Commonly confused words

c. Grammar: Subject–Verb Agreement (Concord) and Question tags

d. Writing: Curriculum vitae, Cover Letter and Resume Writing. (Functional, Chronological and standard Resumes)

UNIT–V   **(9 Lectures)**

a. Reading Skills: Mokshagundam Visveswaraya

b. Vocabulary: Homonyms, Homophones and Homographs

c. Grammar: Modal Auxiliaries, Degrees of Comparison and Direct speech & Indirect Speech

d. Writing: E- mail Writing and Essay Writing

Text Books:

1. New Horizons – Pearson Publishers

2. Fluency in English", A Course Book for Engg. Students, Published by Orient Black Swan, Hyderabad, 2016 print.

3. "Technical Communication- Principles and Practice", Third Edition.   New Delhi: Oxford University press.

4. Epitome of Wisdom – Maruthi Publications

Reference Books:

1. Meenakshi raman, Sangeetha, Sharma Fundamentals of technical communication, Pg: 119-153 Oxford University press, 2015

2. Rutherford, Andhrea. J, Communication skills for technology. Pearson, New Delhi.2001

3. Raymond Murphy, Murphy's English Grammar, Cambridge University Press 2004

4. Meenakshi raman, Sangeetha, Sharma,Technical communication: English Skills for Engineers, Oxford University press, 2009

5. Michael Swan, Practical English Usage, Oxford University press, 1996

Web Resources:

1. www.englishhints.com

2. www.enchantedlearning.com

3. www.learnenglish.de/grammar/prefixtext.html

4. http://www.magickeys.com/books/riddles/words.html

5. http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf

6. http://www.yourdictionary.com

7. http://www.learnenglish.com

8. http://www.cambridge.org

9. http://www.eslcafe.com

10. http://www.eslgames.com

11. http://www.penguin.co.uk

12. http://www.edufind.com/english/practice

13. www.englishhints.com,www.enchantedlearning.com,

14. www.learnenglish.de/grammar/prefixtext.html

15. http://www.magickeys.com/books/riddles/words.html

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BST01	Linear Algebra & Differential Equations	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Basics of Matrix Algebra, Differentiation, Integration

Course Objectives: The student will be able to

1. The concept of rank of a matrix which is used to know the consistency of system of linear equations and find the solution by using various analytical and numerical methods.
2. Eigen values and eigenvectors of a given matrix. Cayley-Hamilton theorem to find the inverse and power of a matrix and determine the nature of the quadratic form,
3. Recognize and model differential equations, apply analytical techniques to compute solutions for engineering problems.
4. The general solution to the higher order linear differential equations and ap- plies to calculate the current in electrical circuits.
5. Explore the use of Laplace transform method to solve with initial value prob- lems of ordinary differential equations.

Course Outcomes: After going through this course the student will be able to

1. Demonstrate the understanding of rank of a matrix. Analyze the solution of the system of linear equations.
2. Find the Eigen values and Eigenvectors of a matrix, apply Cayley-Hamilton theorem to determine inverse and power of a matrix and identify the nature of the quadratic form.
3. Solve the differential equations of first order and first degree related to various engineering fields.
4. Find the complete solution to the higher order linear differential equations and apply these methods to find the current in complex electrical circuits.
5. Apply the technique of Laplace transform and solve differential equations for analytical solutions with the initial conditions.

UNIT–I: Solving System of Linear Equations   (8 Lectures)
Rank of a matrix by Echelon form-Normal form- Normal form through PAQ method
– Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination – Gauss Jordon methods.

UNIT–II: Eigen values – Eigenvectors, Cayley-Hamilton Theorem and Quadratic forms   (10 Lectures)
Eigen values - Eigenvectors– Properties – Cayley-Hamilton theorem (without proof)- Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form. Quadratic forms: Rank, index, signature and nature of the

quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

UNIT–III: Differential Equations of First Order and First Degree (10 Lectures)

Linear differential equation - Bernoulli's differential equation–Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling-Law of natural growth and decay-Orthogonal trajectories-Electrical circuits.

UNIT–IV: Linear Differential Equations of Higher order   (8 Lectures)

Non-homogeneous equations of higher order with constant coefficients-with RHS term of the type e^{ax}, $sinax$, $cosax$, polynomials in x, $e^{ax}V(x)$, $x^nV(x)$ and general method - Method of Variation of parameters.

Applications: LCR circuit

UNIT–V: Laplace Transforms   (9 Lectures)

Laplace transforms of standard functions– First shifting Theorem-Change of scale property multiplication by t^n−division by t, transforms of derivatives and integrals – Second shifting theorem– Laplace transform of Periodic functions.

Inverse Laplace transforms – Convolution theorem (without proof) **Applications:** Evaluation of integrals using Laplace transforms - Solving ordinarydifferential equations (Initial value problems) using Laplace transforms.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publish-ers

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

Reference Books:

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

2. H. K. Das, Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.

3. David Poole, Linear Algebra- A modern introduction, 4th edition, Cengage.

4. Peter O' Neil, Advanced Engineering Mathematics, Cengage

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

Web Resources:

1. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx

2. http://mathworld.wolfram.com/topics

3. http://www.nptel.ac.in/course.php

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BST03	Engineering Physics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: The basics of analytical and conceptual understanding of physics.

Course Objectives:

1. To impart the concepts of wave optics.
2. Learn the concepts of Polarization and Lasers.
3. To study the solid state physics through Crystallography and X-ray diffraction.
4. To explore the knowledge of Oscillations and vibrations in engineering fields.
5. To learn the basic concepts in Acoustics, Magnetism and Dielectrics.

Course Outcomes:

1. Understand the basic concepts in optics and apply for engineering applications.
2. Gain knowledge of Lasers and enable the students to develop Laser devicesto apply the knowledge various systems like Industries and medicine.
3. Enable to apply the concept of crystal structure and x-ray diffraction for new materials.
4. Understand the basic concepts oscillations and vibrations to apply in Engineering fields
5. Acquire the knowledge of Acoustics, Magnetism and Dielectrics.

UNIT–I:WAVE OPTICS **(9 Lectures)**
Interference: Introduction, Principle of Superposition of waves, colors in thin films, interference in thin films, Newton's rings: Determination of wavelength and refractive index.
Diffraction: Introduction, differences between interference and diffraction, differ- ence between Fraunhoffer and Fresnel diffraction, Fraunhoffer diffraction at single slit, Fraunhoffer diffraction due to double slit, Diffraction grating (N-slits qualita- tive), resolving power of grating
UNIT–II: POLARIZATION AND LASERS **(9 Lectures)**
Polarization: Introduction, types of polarization, Double refraction, methods of production, Half wave plate and quarter wave plate
Lasers: Introduction, Characteristics of laser, absorption, spontaneous emission, stimulated emission, Einstein's coefficients, population inversion, pumping, pump- ing mechanisms, types of lasers: Ruby laser, He-Ne laser, diode laser, applications of lasers.

UNIT–III: CRYSTALLOGRAPHY AND X-RAY DIFFRACTION   (8 Lectures)

Crystallography: Introduction, Space lattice, Basis, Crystal structure, Lattice parameters, Unit cell, crystal systems and Bravais lattices, structures and packing fraction of SC, BCC, and FCC, Lattice constant.

X-ray diffraction: Introduction, Miller Indices, Important features of Miller in- dices, separation between successive crystal planes, Bragg's law..

UNIT–IV: OSCILLATIONS AND VIBRATIONS   (9 Lectures)

Harmonic oscillations: Introduction, simple harmonic motion, the simple oscil- lator, equation of motion of a simple oscillator, characteristics, energy of simple harmonic oscillator, damped harmonic oscillator, heavy, critical and light damp- ing, waves (longitudinal, transverse and standing waves)

Transverse vibrations of stretched strings: Velocity of transverse wave along stretched string, Frequency of vibrating string, Harmonics and overtones.

UNIT–V: ACOUSTICS MAGNETISM AND DIELECTRICS   (10 Lectures)

Acoustics: Introduction, sound absorption coefficient, reverberation, reverbera- tion time, Sabine's formula for reverberation time, conditions for good auditorium.

Magnetism and Dielectrics: Classification of magnetic materials: dia, para, and ferromagnetic materilas, Ferromagnetism, Hysterisis, Types of polarization: Elec- tronic polarization, ionic polarization, orientation polarization, Internal field, Clau - sius Mossoti equation.

Text Books:

1. Engineering physics by M. N. Avadhanulu and P.G.Kshirsagar, S.Chand, NewDelhi.

2. Optics by Ajoy Ghatak, McGraw Hill Education.

3. Principle of Lasers by O. Svelto

4. Solid state physics by AJ Dekker.

5. Vibrations and waves in physics by Ian G. Main, 3rd Edn, Cambridge Univer- sity Press

6. Engineering physics by D. K. Bhattacharya and Poonam Tandon, OxfordPress

Reference Books:

1. Optics by E.Hecht.

2. The physics of vibrations and waves by H.J. Pain, John Wiley & Sons, Ltd

3. Engineering physics by Palanisamy (scitech publications).

4. Engineering physics by Palanisamy (scitech publications).

5. EngineeringPhysics by RKGAUR&SLGUPTA,DhanpatRaiPublication

6. Physics by Halliday and Resnick.

7. Physics for Engineers by M. R. Srinasan, New age International publishers

Web Resources:

1. https://ocw.mit.edu/courses/physics/8-03sc-physics-iii-vibrations-and-waves-fall-2016/part-iii-optics/

2. https://ncert.nic.in/textbook/pdf/leph202.pdf

3. https://ncert.nic.in/textbook/pdf/keph206.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST01	Engineering Graphics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Nill

Course Objectives: The student will be able

1. To introduce the students to use drawing instruments and to draw poly- gons, Engineering Curves and Scales, orthographic projections, projections of points.
2. To introduce the students to use projections of lines.
3. To make the students draw the projections of the planes and the varioustypes of solids.
4. To enable the students to gain the ability to convert the Isometric views in to Orthographic views vice versa and development of surfaces of regular solids.
5. To introduce the students to use the Fusion 360 for creating basic geometric figures.

Course Outcomes: After going through this course the student will be able to

1. Construct polygons, scales and engineering curves and Identify the positionof points with use of orthographic projections.
2. Identify the position of points and lines with use of orthographic projections.
3. Analyze the location and position of plane figures and solids through ortho- graphic projections.
4. Develop 2D and 3D objects by converting their view.
5. Construct basic geometric figures using Fusion 360.

UNIT–I   **(9 Lectures)**
Introduction To Engineering Graphics: Introduction to Drawing instruments and their uses, construction of regular polygons, Conic sections- ellipse, parabola, hyperbola using general method, Scales- Diagonal scale, Vernier scale.
Projections of Points: Principle of orthographic projection-Method of Projection – First and third angle projection methods- Projections of Points.
UNIT–II   **(9 Lectures)**
Projections Of Lines: projection of straight lines- parallel to one plane and in- clined to the other plane, projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces.
UNIT–III   **(9 Lectures)**
Projections Of Planes: projections of plane figures- triangle, square, rectangle, pentagon and hexagon, circle with surfaces inclined to both the reference planes. **Projections Of Solids:** projections of solids: projections of regular solids with the axis inclined to only one reference plane.

UNIT–IV **(9 Lectures)**

Surface Development: development of surfaces for basic solids- prisms, pyra-mids, cylinder and cone.

Projections of Pictorial Views: Conversion of isometric views into orthographic views and conversion of orthographic views in to isometric views.

UNIT–V **(7 Lectures)**

Introduction To Autodesk Fusion 360: fusion 360 fundamentals-Getting Started -The Fusion 360 Interface Design Navigation & Display-Design Units and Origin -Quick Shape Creation.

Creating Sketched Geometry: Introduction to the sketching workflow - sketchentities - dimensioning sketch constraint.

Text Books:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal, Charotar Publications, 2014.

2. Engineering Drawing by Basant Agrawal and C.M. Agrawal, McGraw Hill Education Pvt. Limited, 2013.

3. Engineering Drawing by Prof. K.L. Narayana & Prof. R.K.Kannaiah, Scitech Publications, 2010.

4. Parametric Modeling with Autodesk Fusion 360 By Randy H. Shih SDC publications April 23, 2021

Reference Books:

1. Engineering Graphics with AutoCAD 2002 by James D. Bethune, PHI, 2011.

2. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd,2010.

3. Engineering drawing – P.J. Shah .S.Chand Publishers,2010.

4. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers, 2010.

5. Autodesk Fusion 360: A Tutorial Approach Kindle Edition by Prof. ShamTickoo Purdue Univ. and CADCIM Technologies.

Web Resources:

1. https://lecturenotes.in/subject/436/engineering-drawing-ed.

2. web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf.

3. https://www.smartzworld.com/notes/engineering-drawing-pdf-1st -year-notes-ppts

4. https://www.researchgate.net/305754529_A_Textbook_of_Engineering_Drawing

5. www.academia.edu/32510080/N_d_bhatt_engineering_drawing_pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST02	Engineering Geology	2	0	2	3

Internal Marks: 15   External Marks: 35

Course Objectives: The objective of this course is:

1. To identify the Megascopic types of Ore minerals & Rock forming minerals.
2. Identify Megascopic rocks& their properties.
3. To identify the topography of the site & material selection.

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

1. Identify Megascopic minerals & their properties.
2. Identify Megascopic rocks & their properties.
3. Identify the site parameters such as contour, slope & aspect for topography.
4. Know the occurrence of materials using the strike & dip problems.

LIST OF EXPERIMENTS: (any eight of the following to be done)

1. Physical properties of minerals: Mega-scopic identification of

    (a) Rock forming minerals–Quartz group, Feld spar group ,Garnet group ,Micagroup &Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelealcite, Gypsum ,etc. . .

    (b) Ore forming minerals–Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite,etc. . .

2. Megascopic description and identification of rocks.

    (a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.

    (b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.

    (c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Bi-otiteschist, Marble, Khondalite, etc.

3. Interpretation and drawing of sections for geological maps showing tiltedbeds, faults, unconformities etc.

4. Simple Structural Geology problems.

5. Bore hole data.

6. Strength of the rock using laboratory tests.

7. Field work–To identify Minerals, Rocks, Geomorphology & Structural Geology.

LABEXAMINATIONPATTERN:

1. Description and identification of FOUR minerals.

2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)

3. ONE Question on Interpretation of a Geological map along with a geological section.

4. TWO Questions on Simple strike and Dip problems.

5. Bore hole problems.

6. Project report on geology.

REFERENCES:

1. 'Applied Engineering Geology Practicals' by M.T.Mauthesha Reddy, New Age International Publishers,2nd Edition.

2. 'Foundations of Engineering Geology' by Tony Waltham, SponPress,3rd edition,2009.
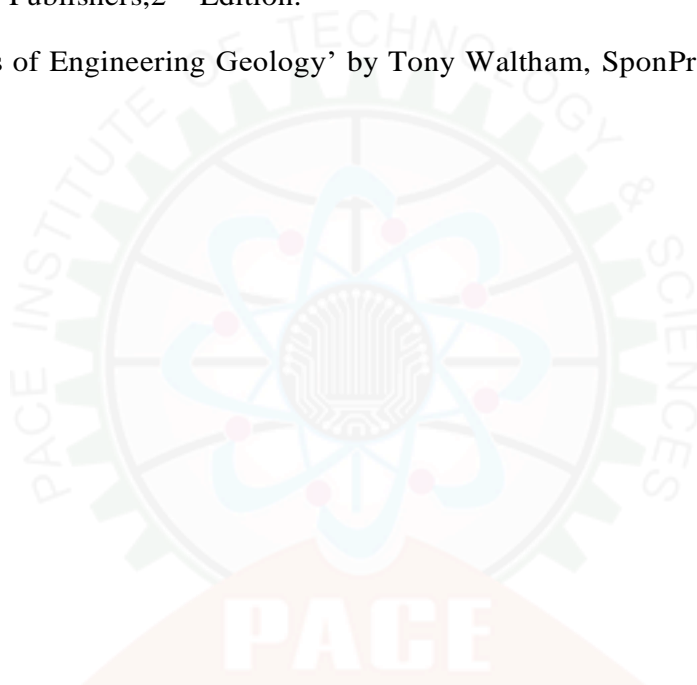
Course Code	Course Name	Course Structure			
		L	T	P	C
P21HSL01	English Language Communication Skills Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Basic knowledge of English grammar, Basic understanding of English vocabulary, Ability to speak simple sentences, Have interest to learn the language.

Course Objectives: The student will be able

1. To facilitate computer assisted multimedia instructions enabling individual-ized and independent language learning.
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
3. To bring about a consistence accent and intelligibility in students' pronunci-ation of English by providing an opportunity for practice in speaking.
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence.
5. To train students to use language appropriately for public speaking, group discussion and interviews.

Course Outcomes: After going through this course the student will be able to

1. Better understanding of nuances of English language through audio visual experience and group activities.
2. Neutralization of accent for intelligibility.
3. Speaking skills with clarity and confidence which in turn enhances their employability skills.
4. Better understanding of the production of sounds of language.
5. Suitable body language for employability.

EXERCISE–I   **(3 Sessions)**

A. Introduction to Phonetics
   Consonant sounds
   Vowel sounds – Pure Vowels & Diphthongs

B. Greeting, Introducing & taking leave and Ice – Breaking Activity

EXERCISE–II   **(2 Sessions)**

A. Structure of Syllables - Plural markers & Past tense Markers

B. JAM Session & Situational Dialogues

EXERCISE–III   **(2 Sessions)**

A. Word Stress & Rules of 'r' pronunciation

B. Role play, Giving Directions & Story Narration

EXERCISE–IV   (2 Sessions)

A. Consonant Cluster, Neutralization of Mother Tongue Influence and Listening Comprehension – Listening for General Details

B. Describing objects, events, places etc. & Presentation Skills – Extempore, Public Speaking.

EXERCISE–V   (3 Sessions)

A. Intonation & Listening Comprehension – Listening for Specific Details

B. Interview Skills & Group Discussion

Text Books:

1. Strengthen your Communication Skills - Maruthi Publication, Hyderabad 2013

2. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

Reference Books:

1. INFOTECH English (Maruthi Publications).

2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

3. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation

4. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.

5. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill

6. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

7. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad

8. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP

9. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP

10. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi : Foundation

11. Soundararaj, Francis.   2012.   Basics of Communication in English.   New Delhi: Macmillan

12. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

13. English Pronouncing Dictionary Daniel Jones Current Edition with CD.

Web Resources:

1. http://www.cambridge.org

2. http://www.edufind.com/english/practice

3. http://www.learnenglish.com

4. http://www.penguin.co.uk

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BSL02	Engineering Physics Lab	0	0	3	1.5

Internal Marks: 15 External Marks: 35

Course Prerequisite: The basics of analytical and conceptual understanding of physics.

Course Objectives:

1. Deploy scientific method of experiments in the laboratory.
2. Develop the procedures and observational skills for appropriate use of simple and complex apparatus.
3. Enable analytical techniques, statistical analysis and graphical analysis.
4. Reinforce ideas and concepts covered in lecture host of experiments.
5. Train to find the radius of curvature of a Plano-convex lens forming Newton's rings.

Course Outcomes:

1. Apply the phenomenon of interference and diffraction of light waves.
2. HImplement the concept of resonance in LCR circuit and sonometer.
3. HM toAnalyze the S determine its dependent properties.
4. Evaluate the behavior of electronic components and its characteristics.

LIST OF EXPERIMENTS: (any eight of the following to be done)

1. Determination of Radius of Curvature of Plano-Convex lens by forming Newton's Rings.
2. Determination of Wavelengths of various spectral lines using diffraction grat-ing with the normal incidence method.
3. Study of magnetic field along the axis of a current carrying coil and to verify Stewart-Gee's method.
4. Determination of energy gap of PN junction Diode.
5. Determination of hall coefficient and carrier concentration using Hall effect
6. Study of V-I characteristics of Zener diode.
7. Determination of frequency of a vibrating bar or electrical tuning fork using Melde's apparatus.
8. Determination of acceleration due to gravity using compound pendulum
9. Verification of laws of transverse waves by Sonometer.
10. Determination of Velocity of sound by volume resonator.
11. Determination of rigidity modulus by Torsional Pendulum.

Course Code	Course Name	Course Structure			
		L	T	P	C
P21ESL01	Basics of Civil Engineering Work Shop Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

SYLLABUS:
LIST OF EXPERIMENTS

1. emonstration on usage of chain

2. Ranging – offsets – chain-age

3. To find the area of an irregular polygon using chain by using horizontal measurements

4. Determination of bearings and included angles with prismatic compass.

5. Demonstration and Estimation of quantity of bricks, concrete, wood, paintfor the given single room building.

6. Masonry work hands – on practice work deferent types of bonds in brickmasonry

7. Identification of quality of brick through physical tests.

8. Identification of soil based on their physical properties.

9. Setting out of building: The student is required to set out a building (Single room only) as per the given building plan using tape and cross staff.

10. Demonstration on Installation of simple sanitary fittings and fixtures like Tap,T-joint, Elbow, bend, threading etc.

11. Demonstration of Welding (arc welding and gas welding).

12. Carpentry (Demonstration).

13. Identify deferent types of roads in the campus and write the physical characteristics of layers.

14. Demonstration on making of cement mortar/concrete for the given nominalmix

15. Study of given Topo-sheet.

REFERENCE BOOKS

1. Laboratory Manual for Basic Civil Engineering workshops .

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BST05	Engineering Chemistry	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Basic Chemistry at Intermediate or equivalent level.
Course Objectives:

1. To analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.
2. To utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corro- sion and study methods to control corrosion.
3. To understand various synthetic methods of nanomaterials for modern ad- vances of engineering technology. Summarize the techniques that detect and measure changes of state of reaction. Illustrate the commonly used industrial materials.
4. Differentiate petroleum, petrol, synthetic petrol and have knowledge how they are produced Study alternate fuels and analyze flue gases.
5. To analyze the suitable methods for purification and treatment of hard water and brackish water.

Course Outcomes: At the end of this unit, the students will be able to

1. Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.
2. Utilize the theory of construction of electrodes, batteries and fuel cells in re- designing new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
3. To understand various synthetic methods of nanomaterials for modern ad- vances of engineering technology. Summarize the techniques that detect and measure changes of state of reaction. Illustrate the commonly used industrial materials.
4. Differentiate petroleum, petrol, synthetic petrol and have knowledge how they are produced Study alternate fuels and analyze flue gases.
5. To analyze the suitable methods for purification and treatment of hard water and brackish water.

UNIT–I: Polymer Technology   (9   Lectures)
Polymerization: Introduction, classification, methods of polymerization (Emul- sion and Suspension), mechanical properties.
Plastics: Compounding, fabrication (compression, injection, blown film and extru- sion), preparation, properties and applications (Poly ethylene, PVC, Polycarbonates and Bakelite).

Elastomers: Introduction, preparation, properties and applications (Buna S, Thiokol and Polyurethanes).

Composite materials: Fiber reinforced plastics, conducting polymers, biodegrad-able polymers,

UNIT–II: Electrochemical Cells and Corrosion   (10   Lectures)

Galvanic Cells, Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery, Lead Acid battery and Ni-Cd cells).

Corrosion: Definition, theories of corrosion (Chemical and Electrochemical), gal- vanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, corrosion control (Proper designing and cathodic protection), protective coatings (Surface preparation, Cathodic coatings, Anodic coatings, Electroplating and Elec- troless plating).

UNIT–III: Chemistry of Materials   (10   Lectures)

Nano materials: Introduction, sol-gel method, characterization by (Brunauer Em- met Teller (BET), and transmission electron microscopy (TEM) with example (TiO2), applications of fullerenes, carbon nanotubes (types, preparation and applications).

Refractories: Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: Definition, mechanism of lubricants, properties (definition and im- portance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

UNIT–IV: Fueltechnology   (8 Lectures)

Introduction, calorific value, higher calorific value, lower calorific values, prob- lems using Dulong's formula, proximate and ultimate analysis of coal sample and their significance, numerical problems, petroleum (refining-cracking), synthetic petrol (Bergius), petrol knocking, diesel knocking, octane and cetane ratings, anti- knocking agents, Introduction to alternative fuels (Natural gas, liquefied petroleum gas, compressed natural gas), Flue gas analysis by Orsat apparatus.

UNIT–V: WATER TECHNOLOGY   (8 Lectures)

Hardness of water, determination of hardness by complexometric method, boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrit- tlement), internal treatments, softening of hard water (zeolite process and related sums, ion exchange process), treatment of industrial waste water, potable water and its specifications, steps involved in purification of water, chlorination, break point chlorination-desalination (reverse osmosis and electro dialysis).

Text Books:

1. P.C. Jain and M. Jain "Engineering Chemistry", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).

2. Shikha Agarwal, "Engineering Chemistry", Cambridge University Press, NewDelhi, (2019).

3. S.S. Dara, "A Textbook of Engineering Chemistry", S.Chand & Co, (2010).

4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

Reference Books:

1. K. SeshaMaheshwaramma and MridulaChugh, "Engineering Chemistry", Pearson India Edition.

2. O.G. Palana, "Engineering Chemistry", Tata McGraw Hill Education Private Limited, (2009).

3. CNR Rao and JM Honig (Eds) "Preparation and characterization of materials" Academic press, New York (latest edition).

4. B. S. Murthy, P. Shankar, "Textbook of Nanoscience and Nanotechnology", University press (latest edition).

Web Resources:

1. http://jntuk-coeerd.in/

2. http://en.wikipedia.org/wiki/title

3. http://nptel.ac.in/coures/105106/.com

4. https://en.wikipedia.org/wiki/Electrochemistry

5. https://www.youtube.com/watch?v=WLyaZbT97EI&list=PLzW3l18TEXrpqo3jRarGr9ao-61tB2184

6. https://encyclopedia.che.engin.umich.edu/

7. http://encyclopedia.che.engin.umich.edu/Pages/ProcessParameters/Spectrometers/Spectrometers.html

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BST06	Numerical Methods & Vector Calculus	3	0	0	3

Internal Marks: 30　　　　　　　　　　　　　　　　　External Marks: 70

Course Prerequisite: Differentiation, Partial differentiation, Integration, Differential Equations

Course Objectives: The student will be able to

1. The different numerical techniques to solve algebraic and transcendental equations and evaluate the polynomials from the numerical data.
2. The approximate solutions using numerical methods in the absence of an- alytical solutions of various systems of ordinary differential equations and integrations.
3. Enhance the knowledge level to visualize integrals in higher dimensional co-ordinate systems, possible representation and evaluation of geometrical and physical quantities in terms of multiple integrals.
4. Interpret concepts of vector functions, vector fields, differential calculus of vector functions in Cartesian coordinates and apply them for various engi- neering problems.
5. Evaluate line, surface and volume integrals and construct relation between line, surface and volume integrals using vector integral theorems.

Course Outcomes: After going through this course the student will be able to

1. Evaluate approximate roots of the polynomial and transcendental equations by different algorithms and apply Newton's forward, backward interpolation and Lagrange's formulae for equal and unequal intervals.
2. Apply different algorithms for approximating the integrals of numerical data and solutions of ordinary differential equations to its analytical computations.
3. S Evaluate the multiple integrals by using change of variables and change of order of integration. Also apply double and triple integration techniques in evaluating areas and volumes bounded by regions and solids.
4. nterpret the physical meaning of different operators such as gradient, curl and divergence.
5. Determine line, surface and volume integrals. Apply Green's, Stoke's and Gauss divergence theorems to calculate line, surface and volume integrals.

UNIT–I: Iterative Methods, Finite differences and Interpolation (10 Lectures)
Introduction-Solution of algebraic and transcendental equations-Bisection method -Method of false position-Newton-Raphson method (Single variable only)
Interpolation: Introduction-Errors in polynomial interpolation-Finite differences – Forward differences-Backward differences-Relations between operators-Newton's forward and backward formulae for interpolation -Interpolation with unequal in- tervals - Lagrange's interpolation formula.

UNIT–II: Numerical integration, Solution of ordinary differential equations with initial   **(9 Lectures)**

Trapezoidal rule – Simpson's 1/3rd and 3/8th rule– Solution of ordinary differen- tial equations by Taylor's series – Picard's method of successive approximations – Euler's method – Modified Euler's method-Runge-Kutta method (second and fourth order).

UNIT–III:Multiple Integrals: **(9 Lectures)**

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar coordinates) –Triple integrals- Change of variables (Cartesian to Cylindrical and Spherical coordinates).

Applications: Areas by double integrals and Volumes by triple integrals. **UNIT–IV:**

Vector Differentiation: **(8 Lectures)**

Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives – Divergence – Curl – Laplacian second order operator- Vector identities- Applications: Scalar Potential function.

UNIT–V: Vector Integration: **(9 Lectures)**

Line integral – Work done – Circulation- Surface integral- Volume integral

Vector Integral Theorems (without proof): Application of Green's theorem in a plane- Stoke's theorem- Gauss Divergence theorem.

Text Books:

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

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

Reference Books:

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

2. H. K. Das, Advanced Engineering Mathematics, 22nd Edition,S. Chand & Company Ltd.

3. David Poole, Linear Algebra- A modern introduction, 4th edition, Cengage.

4. Peter O' Neil, Advanced Engineering Mathematics, Cengage

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

Web Resources:

1. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx

2. http://mathworld.wolfram.com/topics

3. http://www.nptel.ac.in/course.php

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST03	C - Programming for Problem Solving	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Nill

Course Objectives: The student will be able

1. To impart adequate knowledge on the need of programming languages and problem solving techniques.
2. To impart problem solving skills.
3. To enable student to write programs in C and to solve the problems.

Course Outcomes: After going through this course the student will be able to

1. Design algorithms and flowchart / Pseudo code for a given problem.
2. Design programs involving decision structures and loops.
3. Implement different operations on arrays and solve problems using functions.
4. Understand pointers and strings.
5. Implement structures, unions and file operations in C programming for agiven application problem.

UNIT–I   **(8 Lectures)**

Introduction to Programming: Computer hardware, Bits and Bytes, program- ming languages, application and system software, the software development pro- cess.

Idea of algorithm: steps to solve logical and numerical problems. Representation of algorithm: flowchart/pseudo code with examples, from algorithms to programs. **UNIT–II**

(9 Lectures)

Introduction to C: Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing Input and Output. Decision Making - Branching and Looping. Enumerated Data type, Renaming Data type with type def, Type Casting.

UNIT–III   **(10 Lectures)**

Arrays: Definition, Declaration, Initialization, Assignment, Processing array, Pass-ing array to a function, Two and multi dimensional array. **Functions:** Defining a function, Accessing a function, Passing argument to functions, Function proto- types, Nested function call, Storage classes.

UNIT–IV   **(9 Lectures)**

Pointers: Definition, initialization, operations on pointers, functions and pointers, arrays and pointers, pointers to pointers, dynamic memory allocation.

Strings: C Strings, String Input / Output functions, arrays of strings, string ma- nipulation functions.

UNIT–V   **(9 Lectures)**

Structures: Definition, declaration, initialization, accessing members, array of structures, arrays within structure, functions and structures, pointers to struc- tures, nested structures, unions.

File Handling: Types, operations on files, modes, file I/O functions, Random Ac- cess Functions.

Text Books:

1. Byron S Gottfried, ––Programming with C, Schaums Outlines, Second Edi- tion, Tata McGraw-Hill, 2006.

2. Problem Solving and Program Design in C, 4th edition, by jeri R. Hanly and Elli B.Koffman.

3. Balagurusamy. 2011. C Programming. Tata Mc Graw Hills, New Delhi, India.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

2. Yashavant P. Kanetkar. ––Let Us C, BPB Publications, 2011.

Web Resources:

1. https://www.studytonight.com/c/

2. https://www.cprogramming.com/tutorial/c-tutorial.html

3. https://www.javatpoint.com/c-programming-language-tutorial

4. https://www.tutorialspoint.com/cprogramming/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST05	Building Materials and Concrete Technology	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. To learn about uses of fly ash, tiles, UPVC and glass.
2. To introduce various building construction materials and to know the impor-tance role of aggregates, cement and admixtures.
3. To know the various proportions of ingredients in concrete using mix design.
4. To describe various properties of ingredients of concrete.
5. To explain various properties and tests of fresh and Hardened Concrete

Course Outcomes: At the end of this unit, the students will be able to

1. Know various engineering properties of building construction materials and suggest their suitability.
2. Identify the functional role of ingredients of concrete abo ut aggr egat es,cement and admixt ur es.
3. Acquire knowledge on mix design procedure using IS 10262:2019
4. Differentiate petroleum, petrol, synthetic petrol and have knowledge how theyare produced Study alternate fuels and analyze flue gases.
5. The Student must be able to perform various tests on hardened concrete

UNIT–I: **(9 Lectures)**
Bricks: Composition of good brick earth, various methods of manufacturing ofbricks.
Timber: Structure – Properties – Seasoning of timber – Classification of various types of woods used in buildings – Defects in timber.
Tiles: Characteristics of good tile–Manufacturing methods, Types of tiles.
UPVC: Origin and definition, UPVC for doors and windows.
Glass: Origin and definition, glass for doors and windows.
UNIT–II: Aggregates, Cement and Admixtures   **(10   Lectures)**
Aggregates: Classification of aggregate, Bond, Strength and other mechanical properties of aggregate, Physical properties of aggregate, bulking of sand, Dele- terious substance in aggregate, Soundness of aggregate, Alkali-Aggregate reaction
– Thermal properties, Sieve analysis – Fineness modulus – Grading curves – Grad-ing of fine and coarse aggregates as per relevant IS code, Maximum aggregate size. **Portland Cement:** Chemical Composition, Hydration, Structure of hydrated ce- ment–Setting of cement, Fineness of cement, Tests for physical properties – Differ- ent grades of cements
Supplementary cementitious materials: fly ash, GGBS, Silica fume, Rice husk ash , Calcinated ash (Basic properties and their contribution to concrete strength)

Admixtures: Mineral and Chemical admixtures, plasticizers

UNIT–III: Fresh Concrete (10 Lectures)

Manufacture of concrete–Mixing and vibration of concrete, Workability–Segregation and bleeding Factors affecting workability, Measurement of workability by differ- ent tests, Effect of time and temperature on workability–Quality of mixing water, Ready-mix concrete ,Concrete. Mix design as per BIS 10269:2019.

UNIT–IV: Hardened Concrete (9 Lectures)

Water / Cement ratio – Abram's law, Gel space ratio, Nature of strength of concrete – Maturity concept, Strength in tension and compression – Properties of Hardened Concrete (Elasticity, Creep,Shrinkage, Poisson's ratio, Water absorption, Perme- ability, etc.), Relating between compression and tensile strength, Curing.

UNIT–V: Testing of Hardened Concrete (10 Lectures)

Factors affecting properties of Hardened concrete, Compression tests, Tension tests, Flexure tests,modulus of elasticity tests, Non-destructive testing methods –Codal provisions for NDT–Rebound hammer and UPV method.

Text Books:

1. "ConcreteTechnology"byM.S.Shetty-S.Chand &Co.,eighth edition 2019.

2. "Engineering Materials" by Rangwala S C, (43th edition), Anand Charotar Pub- lishing House.2019.

3. "Concrete Technology" by Shantha Kumar–Oxford Publications,2018.

Reference Books:

1. "Building Materials" by S. K. Duggal, New Age International Publications fifth edition 2019.

2. "Building Materials" by P. C. Verghese , PHI learning (P) Ltd., 2009.

3. "Properties of Concrete" by A.M.Neville–Pearson– 5th edition,2013.

Web Resources:

1. https://nptel.ac.in/courses/105/102/105102088/

2. https://nptel.ac.in/courses/105/102/105102012/

3. https://www.sanfoundry.com/1000-concrete-technology-questions -answers/

4. https://www.sanfoundry.com/1000-construction-building-materia ls-questions-answers/

5. https://lecturenotes.in/subject/145/building-materials-and-bui lding-construction-BMBC

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST09	Engineering Mechanics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. The students are to be exposed to the concepts of force, direction and its application and concept of equilibrium conditions.
2. the students are to be exposed to concepts of analysis of frames and friction.
3. The students are to be exposed to concepts of centre of gravity
4. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
5. The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

Course Outcomes: At the end of this unit, the students will be able to

1. Determine the resultant force and moment for a given system of forces
2. Analyse planar determine the forces in members of trusses, frames and prob-lems related to friction
3. Determine the centroid and centre of gravity of composite figures second mo-ment of area
4. Determine the second moment of area and mass moment of composite bodies
5. Calculate the motion characteristics of a body subjected to a given force sys-tem

UNIT–I: **(10 Lectures)**

Introduction, system of units, laws of mechanics, force characterises of a force, system of forces, co-planar concurrent forces: composition of forces, resolution of forces. Coplanar parallel forces, varignon's principles, couple, resolution of a force into a force and a couple.

Conditions of equilibrium, free body diagram, equilibrium of coplanar concur- rent forces, lamis theorem, types of supports, types of loadings, simply supported beams.

UNIT–II: **(10 Lectures)**

Analysis of trusses: method of joints, method of sections.

Friction: types of frictions, laws of friction, angle of friction, angle of repose and cone of friction, block, wedges & ladder problems.

UNIT–III: **(8 Lectures)**

Centroid: Centroids of simple figures (from basic principles) – Centroids of Com- posite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), center of gravity of composite bodies, pappus theorem.

UNIT–IV: **(9 Lectures)**

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT–V: **(9 Lectures)**

Kinematics: Rectilinear and Curvelinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. Introduction – Rectilinear motion – Motion with uniform and variable acceleration–Curvilinear motion–Components of motion– Circular motion – Projectiles

Kinetics: Kinetics of a particle – D'Alembert's principle – Motion in a curved path – work, energy and power. Principle of conservation of energy – Kinetics of a rigid body in translation, rotation – work done – Principle of work-energy – Impulse- momentum

Text Books:

1. Engineering Mechanics - S.Timoshenko&D.H.Young., 5th Edn , Mc Graw Hill publications.2017

2. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 14th Edn – Pearson Publ.2019.

Reference Books:

1. Engineering Mechanics: Statics and Dynamics by Anil Kumar Dhiman and Poonam Dhiman and Durgesh Kulshreshtha, McGraw Hill,2015.

2. Engineering Mechanics: Statics Si Version by MERIAM KRAIGE BOLTON, WILEY INDIA, 2017.

3. A Textbook of Engineering Mechanics (As Per the Latest Syllabus OfJntu, Kakinada) by Dr. S SBhavikatti, New Age International (P) Ltd., Publish- ers,2020

4. Basic Civil Engineering And Engineering Mechanics (Rgpv) by Dr. S SB-havikatti , New Age International (P) Ltd., Publishers,2012.

Web Resources:

1. https://nptel.ac.in/courses/105/106/105106116/

2. https://lecturenotes.in/download/note/27822-note-for-engineeri ng-mechanics-em-by-amit-das

3. https://gita.edu.in/lectnote/mechanics.pdf

4. https://www.sanfoundry.com/1000-engineering-mechanics-questio ns-answers/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BSL04	Engineering Chemistry Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Basic Chemistry at Intermediate or equivalent level. **Course Objectives:** The purpose of this course to provide students with practi-cal knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

Course Outcomes: After going through this course the student will be able to

1. Carrying out different types of titrations for estimation of concerned in ma- terials using comparatively more quantities of materials involved for good results.

2. Handling different types of instruments for analysis of materials using small quantities of materials involved for quick and accurate results.

LIST OF EXPERIMENTS: Introduction to Chemistry laboratory – Molarity, nor-mality, primary, secondary standard solutions, volumetric titrations, quantitative analysis.

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of water sample containing Na_2CO_3 and NaOH.
3. Determination of Mn^{+2} using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Cu^{+2} using standard hypo solution.
6. Determination of temporary and permanent hardness of water using stan-dard EDTA solution.
7. Determination of Fe^{+3} by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide($p^H metry$ method).
9. Determination of isoelectric point of amino acids using $p^H metry$ method (or) conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conduc-tometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Estimation of Vitamin C.
13. Preparation of Nylon-6, 6 and Bakelite (demonstration only).

Reference Books:

1. Dr. Jyotsna Cherukuris (2012) Laboratory Manual of engineering chemistry-II,

2. VGS Techno Series

3. Chemistry Practical Manual, Lorven Publications

Web Resources:

1. https://vlab.amrita.edu/index.php?sub=2&brch=193.

Course Code	Course Name	Course Structure			
		L	T	P	C
P21ESL02	C - Programming for Problem Solving Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Nil

Course Objectives: The student will be able

1. To understand the various steps in program development.
2. To understand the basic concepts in C Programming Language.
3. To understand different modules that includes conditional and looping ex-pressions.
4. To understand how to write modular and readable C Programs.
5. To write programs in C to solve problems using arrays, structures and files.

Experiment Wise Programs

EXERCISE–I

a. Write a simple C program to Print "Hello World"

b. Write a simple C Program to Calculate Area and Circumference of Circle

c. Write a simple C program to implement basic arithmetic operations - sum, difference, product, quotient and remainder of given numbers.

EXERCISE–II: Write C programs to demonstrate the following operators

a. Assignment Operator.

b. Relational and Logical Operator.

c. Increment and decrement operator.

d. Bitwise operators.

e. Ternary operator.

EXERCISE–III

a. Write a C programs - to find the largest and smallest of 2 numbers(if – else), to find the largest and smallest of 3 numbers(Nested if – else), roots of quadratic equation(else – if ladder).

b. The total distance travelled by vehicle in't' seconds is given by distance=ut+1/2 at 2 where 'u' and 'a' are the initial velocity and acceleration.

   Write a c program to find the distance travelled at regular intervals of time given the Values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

c. Write a c program, which takes two integer operands and one operator from the user, performs the operation and the prints the result. (consider the operators $+$, $-$, $*$, $/$, % and use switch statement).

EXERCISE–IV

a. Write a C program to find the sum of individual digits of a positive integer

b. A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1.Subsequent terms are found by adding the preceding two terms in the sequence .Write a c program to generate the first n terms of the sequence.

c. Write a c program to generate all the prime numbers between 1 and n, wheren is a value supplied by the user.

EXERCISE–V

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1 + x + x^2 + x^3 + ... + x^n$

b. Write a C program to generate Pascal's triangle.

c. Write a C program to construct a pyramid of numbers

EXERCISE–VI

a. Write a c program to find both the largest and smallest number in a list of integers.

b. Write a c program that uses functions to perform the following:

    i. Addition of Two Matrices.

    ii. Multiplication of Two Matrices.

EXERCISE–VII

a. Write a programs that use both recursive and non-recursive functions

b. To find the factorial of a given integer.

c. To find the GCD of two given integers.

EXERCISE–VIII

a. Write a c program that uses functions to perform the following operations:

    i. To insert a sub-string in given main string from a given position.

    ii. To delete n Characters from a given position in a given string.

b. Write a C program to determine if the given string is a palindrome or not.

EXERCISE–IX

a. Write a C program that displays the position or index in the string S Wherethe string T begins, or - 1 if S doesn't contain T.

b. Write a C program to count the lines, words and characters in a given text .

EXERCISE–X

a. Write a program to print the details of a student like(Name, Rollno, marks) using nested structures.

b. Write a C Program to Calculate Difference Between Two Time Period.

EXERCISE–XI

a. Write a C program that uses functions to perform the following operations:

   i. Reading a complex number

   ii. Writing a complex number

   iii. Addition of two complex numbers

   iv. Multiplication of two complex numbers
       (Note: represent complex number using a structure.)

EXERCISE–XII

a. Write a C program which copies one file to another and display the contentsof a file

b. Write a C program to reverse the first n characters in a file.

c. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Course Code	Course Name	Course Structure			
		L	T	P	C
P21ESL03	Building Planning and Computer Aided Engineering Drawing	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Engineering Drawing

Course Objectives: To help the student to attain competency in preparation of engineering drawings as per principles of planning using a suitable CAD software through various teaching learning experiences.

Course Outcomes:

1. Perform basic commands of any suitable CAD software to draw 2D drawings.
2. Interpret the conventions, signs and symbols from a given drawing.
3. Prepare line plans of residential and public buildings using principles of planning.
4. Prepare submission and working drawing from the given requirement for Load Bearing and Framed structures.

Major Equipment/ Instruments / System required

1. Computer with specification suitable for relevant CAD software with any suitable CAD Software.

2. Laser Printer preferably for the output of A3size.

Week 1, 2 and 3

Introduction to CAD software: Basic commands of CAD to draw, modify 2D drawings

Building Byelaws and Regulations

Introduction- terminology- objectives of building byelaws- floor area ratio- floor space index- principles under laying building bye laws- classification of buildings- open space requirements – built up area limitations- height of buildings- wall thickness – lightening and ventilation requirements- Indian national building code

-2016 recommendations; Andhra Pradesh state building rules. Conventions, signs and symbols: Conventions as per IS 962-1989, signs and symbols for earthwork, brickwork, stonework, concrete, woodwork and glass used in civil engineering. Construction, Graphical symbols for door and window, Abbreviations, symbols for sanitary and electrical installations.

Exercise 0

Prepare a given line drawing in minimum three layers using CAD software.

Exercise 1

Reading and interpreting readymade Architectural building drawing (To be procured from Architect, Planning Consultants, Planning Engineering.

Week 4, 5 and 6

Residential Buildings: Minimum standards for various parts of buildings- require- ments of different rooms and their grouping- characteristics of various types of residential buildings. Public Buildings: Planning of educational institutions, hos- pitals, dispensaries, office buildings, banks, industrial buildings, hotels and mo- tels, buildings for recreation, Land scaping requirements.

Exercise 2

Line plans for residential building of minimum three rooms including w/c, bath and staircase as per principles of planning.

Exercise 3

Line plans for public building-school building, primary health centre, restaurant, bank, post office, hostel, Function Hall and Library.

Week 7, 8, 9 and 10

Drawing of Load Bearing Structure: Developed plan, elevation, section, site plan, schedule of openings construction notes with specifications, area statement. Plan-ning and design of staircase Rise and Tread for residential and public building (2 BHK Load bearing structure). Component parts of the given load bearing struc- ture.

Exercise 4

Draw developed plan, elevation, section, site plan from the given line plan for a load bearing residential building (2BHK) with stair case.

Exercise 5

Prepare submission drawing (including foundation plan) of the given load bearing residential building with stair case.

Week 11, 12, 13 and 14

Drawing of Framed Structure: Developed plan, elevation, section, site plan, schedule of openings construction notes with specifications, area statement. Plan-ning and design of staircase Rise and Tread for residential and public building(G+1, 2 BHK framed structure). Component parts of the given framed structure. **Exercise 7**

Draw developed plan, elevation, section, site plan from the given line plan for framed structure residential building including stair case (2BHK, G+1).

Exercise 8

Prepare submission drawing (including foundation plan) of the given framed struc-ture residential building with stair case

Note: It is mandatory that student performs all 9 Exercises (from 0 to 8).

SUGGESTED STUDENT ACTIVITIES

1. Prepare report on Provisions given in National Building Code2016.

2. Collect and study building Bye laws, rules and regulation for planning as per local competent authority.

3. Prepare list of the documents required for obtaining permission for construc- tion of residential building/apartment from competent authority and write report.

4. Prepare list of the documents required for obtaining permission for construc-tion of commercial building from competent authority and write report.

Prepare a model of a simple building using card board showing different

Course Code	Course Name	Course Structure			
		L	T	P	C
P21MCT02	Biology for Engineering	2	0	0	0

Internal Marks: 30   External Marks: 70

Course Prerequisite: Nill

Course Objectives:

1. Overall understanding of living organisms and their characteristics
2. Basic understating of the biological principles of cell biology
3. Awareness on basic organization of organisms
4. Understanding about the machinery of the cell functions
5. Basic knowledge on biological problems that requires engineering expertise

Course Outcomes: After going through this course the student will be able to

1. The overview ofbiological observations that lead to major discoveries.
2. The concept of the cell,various stages of cell cycle, ultrastructure of Eukary-otic cell, Glycolysis and Krebs cycle
3. Analysis of biomolecules, identification of DNA in the molecular basis
4. The concepts of recessiveness and dominance during the passage of genetic-material from parent to offspring
5. Chromosomal disorders, the concept of origin of life with detailed descriptionof Darwinian evolution and Lamarckism

UNIT–I: History of Biology   **(5 Lectures)**

Science and Engineering; Definition of Biology, Characteristics of living organisms, Diversity in the living world, Applications of biology; **Biological classification of organisms:**Nomenclature, History of biological classification, Systematic Hierar- chy, **Classification of the five kingdoms:** Monera, Protista, Fungi, Plantae and animalia.

Major contributions of prominent scientists: Aristotle,Antonie van Leeuwenhoek, Linnaeus, William Harvey, Louis Pasteur,Watson & Crick,Charles Darwin, Salim-Moizuddin Abdul Ali and YellapragadaSubbarao.

UNIT–II: Cell Biologyand Immunology   **(10   Lectures)**

Ultra structure of animal cell: Plasma membrane, Golgi complex, Endoplasmic reticulum, Mitochondria,Glycolysis, Kreb's cycle, Lysosomes, Ribosomes, chromo-somes, and Nucleus.Cell divisions: Cell cycle stages, Mitotic phase, meiosis.

Immunity: Innate immunity, Acquired immunity.Immunoglobulins: structureand biological properties of immunoglobulin classes, Immune disorder: AIDS. **UNIT–III: Biomolecules**   **(10 Lectures)**

Introduction, properties of biomolecules,Carbohydrates:structure, classifications andfunctions of carbohydrates.Proteins:structure, classification and functions of proteins. Lipids:characteristic features of lipids, important functions in biological systems, classification of lipids and vitamins.

Nucleic acids: structure and properties of DNA & RNA.Enzymes: Mode of action of enzymes, properties of enzymes, classification and nomenclature of enzymes, importance of enzymes.

UNIT–IV: Genetics and Evolution **(10 Lectures)**

Introduction, reasons for Mendel's success, characters selected by Mendel, Man- del's laws:1. Law of dominance 2.Law of segregation or Law of purity of ga- metes 3.Law of independent assortment. Monohybrid cross,Dihybrid cross, Test cross, back cross. Multiple alleles and Blood grouping, Sex determination in human.Chromosomal disorders in human- Klinefelter's syndrome, Turner's syn- drome and Down's syndrome.Protein synthesis: Transcription and Translation.

Evolution: Evolutionary concepts: Theory of special creation, Cosmozoic theory, Theory of spontaneous generation or abiogenesis, Biogenesis theory, Theory of catastrophism, Theory of organic evolution. Origin of life: Primitive atmosphere and molecules, Biological evolution, Experimental chemical origin of life.Theories of evolution: Lamarckism and Darwinism.

UNIT–V: Human Health & Diseases And Applied Biology **(10 Lectures)**

Common diseases in humans: Health, Disease, Pathogens, Transmission, Bacte- rial diseases: Typhoid, Pneumonia, Diphtheria, Tetanus, Plague, Cholera, Tuber- culosis, Syphilis, Gonorrhoea,Leprosy, Peptic ulcers;Viral diseases:Common cold, Measles, Rubella, Rabies, Chickenpox, Flu,Smallpox, Chikungunya, Poliomyelitis, AIDS;Fungal diseases: Ringworm;Protozoan diseases:Malaria, Amoebic dysentery and Helminth diseases: Filariasis, Ascariasis.

Applied Biology:rDNA technology; Industrial use of microorganisms- alcohols, acids and vitamins; enzymes, pollution control, vaccines, hormones.Monoclonal antibodies and stem cells.

Reference Books:

1. Biology: A global approach: Campbell, N.A.; Reece, J.B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P.V.; Jackson, R. B. Pearson Education Ltd

2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons

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

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

5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Web Resources:

1. Human health and diseases:https://www.emedicalprep.com/study-mat erial/biology/biology-in-human-lefare/human-health-and-disease

2. Aristotle's biology: https://en.wikipedia.org/wiki/Aristotle%27s_biology.

3. Sir Ronald Ross:https://en.wikipedia.org/wiki/Ronald_Ross.

4. Recombinant DNA Technology:https://microbenotes.com/recombinant
   -dna-/technology-steps-applications-and-limitations/

5. Nucleic acids:https://www.khanacademy.org/science/ap-biology/gen   e-/expression-and-
   regulation/dna-and-rna-structure/a/nucleic-a cids.

Course Code	Course Name	Course Structure			
		L	T	P	C
P21BST07	Probability and Statistics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Principle of counting, Permutations and Combinations.

Course Objectives:

1. To introduce pupils to the fundamentals of probability and statistical approaches.
2. To teach probability ideas and statistical methodologies in diverse engineering applications.

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

1. Explain the basic terms of Statistical Inference.
2. Interpret the relationship between attributes using correlation and regression methods.
3. Make advantage of probability ideas and their applications. In addition, use discrete and continuous probability distributions to tackle a variety of engineering challenges.
4. Recognize the various distributions and sampling methods, as well as the estimate mistakes in sampling distributions.
5. Using Tests of Hypothesis, apply the appropriate test statistics to examine the hypothetical data.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	2	-	-	2	-	-	-	-	-	-	-	-	3	2	

UNIT–I: Descriptive Statistics   (9 Lectures)

Introduction - Measures of Central tendency - Measures of Variability (Spread or variance) - Moments – Skewness - Kurtosis.

UNIT–II: Curve Fitting and Correlation and Regression   (9 Lectures)

Method of least squares - Straight line - Parabola-Exponential curve - Power curve – Correlation - Correlation coefficient - Rank correlation - Regression and Regression lines.

UNIT–III: Probability Theory and Random Variable: (14 Lectures)

Probability Theory: (14 Lectures)Probability - Axioms of Probability - Elementary theorems - Conditional probability - Baye's theorem (Without Proofs).

Random Variables: Discrete random variable - Distribution function of a discrete random variable - Probability mass function: Properties - Mean and Variance - Continuous random variable - Distribution function - Density function: Properties- Mean and variance.

Probability Distributions: Binomial distribution - Poisson distribution and their fitting to data - Normal distribution - Mean and Variance (Without proof).

UNIT–IV: Sampling theory and Theory of estimation **(9 Lectures)**

Sampling Theory: Introduction - Population and Samples - Sampling distribution of means (σ known)-Central limit theorem (without proof).

Theory of estimation: Point estimation- Interval estimation - Estimation of one mean and two means - Estimation of one proportion and two proportions.

UNIT–V: Tests of Hypothesis: **(9 Lectures)**

Introduction – Hypothesis - Null and Alternative Hypothesis - Type I and Type II errors - Level of significance - One tail and two-tail tests -Tests concerning one mean and two means (Large and Small samples) -Tests on proportions.

Text Books:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e (Reprint) 2019, Sultan Chand & Sons Publications.

2. Miller and Freund's,Probability and Statistics for Engineers, 7/e, Pearson, 2008.

Reference Books:

1. T. K. V. Iyenger, Probability and Statistics, S. Chand & Company Ltd, 2015

2. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.

Web References:

1. https://leanpub.com/LittleInferenceBook

2. https://www.coursera.org/learn/statistical-inference

3. https://www.datacamp.com/community/open-courses/statistical-i nference-and-data-analysis

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET01	Solid Mechanics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. To teach introductory notions of material strength and the principles of elasticity and plasticity stress situations, as well as to create diagrams of the change of various stresses over the length.

2. The ideas presented above will be used to calculate shear force and BM in beams under various loading and support situations.

3. To provide principles of stresses created in cross sections and bending equations for section modulus computation of sections with diverse cross sections.

4. Understanding shear stress ideas for various cross sections.

5. The ideas presented above will be used to measure deflections in beams under varied loading and support circumstances.

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

1. To comprehend the fundamental behavior of materials under the impact of various external loading situations and support conditions.

2. To create graphs illustrating the fluctuation of critical performance characteristics such as bending moment and shear forces.

3. To comprehend and analyze flexural stresses in a part.

4. Able to assess shear stresses across sections.

5. To understanding of bending principles and section modulus computation, as well as the estimation of stresses created in beams and deflections owing to varied loading situations.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	2	-	-	2	-	-	-	-	-	-	-	-	3	2	

UNIT–I: **(10 Lectures)**

Simple Stresses And Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them.

UNIT–II: **(10 Lectures)**

Shear Force And Bending Moment: Definition of beam – Types of beams – Types of loads - Concept of shear force and bending moment – S.F and B.M diagrams for

cantilever, simply supported subjected to point loads, u.d.l., and combination of these loads.

UNIT–III:					**(08 Lectures)**

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid).

UNIT–IV:					**(9 Lectures)**

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I sections.Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I sections.

UNIT–V:					**(9 Lectures)**

Deflection of Beams: Bending into a circular arc – slope , deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads – UDL.

Text Books:

1. Introduction to text book of Strength of Materials , R.K.Bansal, 4th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

2. Strength of Materials , S. Ramamrutham and R.Narayanan , 11th Edition, Dhanpat Rai publications, 2009.

3. Mechanics of Materials , Timoshenko & Gere, 4th Edition, Mc Grawhill, 2003.

4. Strength of materials, R.K. Raj put, S.Chand& Co, New Delhi, 2012.

Reference Books:

1. Mechanics of Solids , Ferdinand Beer and Johnston, 6th Edition, Tata Mc Graw hill Publications, 2000.

2. Strength of Materials , R. Subramanian, 1st Edition, Oxford university press, New Delhi, 2011.

3. Strength of Materials, Bhavi Katti, 7th Edition, 2010.

4. Strength of Materials, Timoshenko & Young, 4th Edition, Tata Mc Graw hill.

5. Strength of Materials, Sadhu Singh, 2nd Edition, Khanna Publications, 2001.

Web References:

1. www.r-k-bansalstrength-of-materials-com.pdf

2. www.Engineering/SM/Strength_Of_Materials-Timoshenko.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET02	Fluid Mechanics	3	0	0	3

Internal Marks: 30   **External Marks: 70**

Course Objectives:

1. To understanding fluid characteristics and fluid statics.
2. To address kinematic issues such as particle path and streamline detection.
3. To apply essential principles like as the continuity equation, Bernoulli's equation, and turbulence to situations.
4. To investigate laminar and turbulent flows.
5. To comprehend the various flow measurement equipment and to learn more about boundary layers theory.

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

1. Understand fluid characteristics and their effects on fluid motion, as well as analyze a range of fluid statics and dynamics issues.
2. Determine the forces acting on submerged planes and curves.
3. Capability to analyze different sorts of fluid fluxes.
4. To forecast appropriate pressures, velocities, and forces, apply the integral forms of the three fundamental principles of fluid mechanics to turbulent and laminar flow via pipes and ducts.
5. Capable of measuring the volume of fluid moving through pipes, tanks, and channels.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-

UNIT–I: **(10 Lectures)**

Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law. Pressure gauges, Manometers: Differential and Micro Manometers.

Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, in- clined and curved surfaces – Center of pressure.

UNIT–II: **(10 Lectures)**

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, flow net analysis.

Fluid Dynamics: Euler's and Bernoulli's equations for flow along a stream line

UNIT–III: **(08 Lectures)**

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes.

Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-Williams formula, Hard-Cross Method.

UNIT–IV: **(9 Lectures)**

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trape- zoidal and Stepped notches, Broad crested weirs and Ogee weirs.

UNIT–V: **(9 Lectures)**

Boundary Layer Theory: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

Text Books:

1. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi, 2004.

2. Fluid mechanics and hydraulic machines, R. K. Bansal - Laxmi Publications (P) ltd., New Delhi, 2006.

Reference Books:

1. Hydraulics and Fluid mechanics , R.S Kurmi,S.chand & co ,New Delhi,2008.

2. Fluid Mechanics and hydraulic Machinery, R.K. Rajput, published chand.s, India, 2011.

Web References:

1. www.nptel.ac.in

2. www.easyengineering.net

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET03	Highway Engineering	3	0	0	3

Internal Marks: 30   **External Marks: 70**

Course Objectives:

1. To teach many ideas in the subject of highway engineering.
2. To learn the fundamentals of highway geometry and pavement design.
3. To Obtaining Intersection Design Principles.
4. To investigate different materials in roadway cross-sections.
5. To create multiple pavement kinds.

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

1. Plan a roadway network for a certain area.
2. Design highway geometrics and determine highway alignment.
3. Create intersections and traffic management schemes.
4. Assess the appropriateness of paving materials.
5. Create both flexible and stiff pavements.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	2	-	-	2	-	-	-	-	-	-	-	-	3	2	

UNIT–I: **(10 Lectures)**

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 road development plans, road develop- ment vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT–II: **(10 Lectures)**

Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical alignment- Gradients- Vertical curves.

UNIT–III: **(08 Lectures)**

Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; RoadAccidents-Causes and Preventive measures - Condition Di- agram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Af- fecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersec- tions; Design of Traffic Signals – Webster Method –IRC Method.

UNIT–IV: **(9 Lectures)**

Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength - California Bearing Ratio – Modulus of Subgrade Reaction. Stone ag- gregates: Desirable properties –Tests for RoadAggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Re- quirements – Marshall Method of Mix Design.

UNIT–V: **(9 Lectures)**

Design Of Pavements: Types of pavements; Functions and requirements of dif- ferent components of pavements; Design Factors

Flexible Pavements: Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses –Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

Text Books:

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.

2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Pub- lishers, NewDelhi.

Reference Books:

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi

2. Principles of Transportation Engineering, Partha Chakroborthy and AnimeshDas, PHI Learning Private Limited, Delhi

Web References:

1. www.nptel.ac.in

2. www.easyengineering.net

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET04	Surveying and Geometrics	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives: The object of the course student should have the capability to:

1. Understand surveying principles and methodologies.
2. Distances and angles are measured horizontally and vertically.
3. Accurately recording observations, doing calculations based on observations.
4. Methods for identifying the cause of mistakes and correcting them.
5. Use surveying concepts to establish areas and volumes, as well as to lay out curves.

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

1. Use your knowledge to compute angles, distances, and levels.
2. Determine data gathering procedures and make field notes.
3. Understand the concepts of survey instrument operation, measurement errors, and correction measures.
4. Creating a Curve and Using Different Surveying Methods
5. Interpret survey data and compute areas, volumes, and levels using various types of equipment, and apply knowledge to contemporary equipment and procedures.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	2	-	-	2	-	-	-	-	-	-	-	-	3	2	

UNIT–I: **(10 Lectures)**

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, surveying accessories.

Measurement of Distances and Directions Linear distances-Approximate meth- ods, Direct Methods- Chains- Tapes, ranging, Tape corrections.

Measurement of directions – Introduct ion of compass - Bearings, included an- gles, Local Attraction, Magnetic Declination, and dip –W.C.B systems and Q.B. system of locating bearings.

UNIT–II: **(10 Lectures)**

Leveling- Types of levels, temporary and permanent adjustments, methods of lev- eling, booking and Determination of levels by using rise and fall method.

Areas - Determination of areas consisting of irregular boundary and regular bound-ary by using Simpsons formula.

Volumes -Determination of volume of earth work in cutting and embankments for level section, volume of borrow pits.

UNIT–III: **(08 Lectures)**

Theodolite Surveying: Types of Theodolites, temporary adjustments, measure- ment of horizontal angle by repetition method and reiteration method, measure- ment of vertical Angle, Trigonometric leveling when base is accessible and inacces- sible, Introduction of traversing

UNIT–IV: **(9 Lectures)**

Curves: Types of curves and their necessity, elements of simple, compound, re-verse curves.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Introduction to Global Positioning System.**UNIT–V:**   **(9 Lectures)**

Photogrammetric Surveying: Introduction, Basic concepts, perspective geome- try of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- map- ping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

Text Books:

1. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

2. Chandra A M, "Plane Surveying and highersurveying", New Age International Pvt. Ltd., Publishers, New Delhi.

3. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd.New Delhi.

References:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.

2. Surveying and levelling by R. Subramanian, Oxford university press, NewDelhi

3. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi.

Web References:

1. www.easyengineering.net

2. www.nptel.ac.in

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL01	Concrete Technology Lab	0	0	3	1.5

Internal Marks: 15   **External Marks: 35**

Course Objectives :
1. Providing pupils with sufficient understanding on the principles of tangible material production, its elements, and behaviors.
2. Controlling the quality of fresh and hardened concrete in both the lab and the field.
3. Teaching pupils about the need of considering the sustainability elements of concrete production.

Course Outcomes: At the end of the course, student will be able to
1. Assess the physical and mechanical qualities of cement.
2. Examine the characteristics of coarse and fine aggregates.
3. Concrete workability is determined by the compaction factor and slump cone.
4. Determine the hardened concrete's compressive and split tensile strengths.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	-	-	-	-	2	3	-	3	2	3	-
CO2	3	2	3	3	-	-	-	-	3	3	-	3	3	3	-
CO3	3	3	2	2	-	-	-	-	3	3	-	3	2	2	-
CO4	2	3	3	3	-	-	-	-	2	3	-	3	3	2	-

LIST OF EXPERIMENTS
I. Tests on road aggregate:

1. Determination of normal Consistency and fineness of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Determination of grading and fineness modulus of coarse aggregate bysieve analysis.
6. Determination of specific gravity of coarse aggregate
7. Determination of grading and fineness modulus of fine aggregate (sand) by sieveanalysis.
8. Determination of bulking of sand.
9. Determination of workability of concrete by compaction factor method.
10. Determination of workability of concrete by slump test
11. Determination of compressive strength of cement concrete and its young'smodulus.
12. Determination of split tensile strength of concrete.

Note: Any 10 Experiments must be completed.

Web References:
1. https://nptel.ac.in/courses/105102012
2. https://cs-iitd.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL02	Surveying Field Work Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Objectives :
1. To teach practical information in the field such as measuring distances, directions, and angles.
2. To calculate R.L.'s areas and volumes.
3. Curves and points must be established.
4. To explore the region and create maps.

Course Outcomes: At the end of the course, student will be able to
1. Close circuit surveying and chain surveying are used to correct offsets.
2. Show how to use a compass to measure the distance between two inaccessible places and to do closed traversing.
3. Determine the area of the border using various plane table surveying methods.
4. Determine the lowered level using fly leveling.
5. Using fly leveling, calculate the longitudinal and cross sections.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	2	3	-	3	3	2	-
CO2	2	2	2	3	-	-	-	-	3	2	-	2	2	2	-
CO3	3	2	2	2	-	-	-	-	2	2	-	3	2	3	-
CO4	2	3	3	3	-	-	-	-	3	3	-	2	3	3	-
CO5	3	3	3	3	-	-	-	-	3	3	-	3	3	3	-

LIST OF EXPERIMENTS

1. Plane table survey; finding the area of given boundary by method of radiation and intersection.
2. Two point problem by the plane table survey
3. Fly levelling: Height of instrument method (differential levelling).
4. Fly levelling: rise and fall method
5. Fly levelling: closed circuit/ open circuit
6. Fly levelling: Longitudinal Section and Cross sections of a given road profile.
7. Fly levelling and Fly chaining
8. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition.
9. Theodolite Survey: Finding the distance between two inaccessible points.
10. Theodolite Survey: Finding the height of far object.
11. Tacheomatric Survey: Heights and distance problems using tacheomatric principles.
12. One Exercise on Curve setting.
13. One Exercise on Road volumes.
14. Total Station: Introduction to total station and practicing setting up, levelling up and elimination of parallax error.

Note: Any 10 Experiments must be completed.

Web References:
https://nptel.ac.in/courses/105105106
https://mg-nitk.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL03	Transportation Engineering Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Objectives :
1. To organize traffic surveys and collect a wide range of traffic data for analysis and interpretation.
2. To carry out several routine soil, aggregate, and bitumen tests.

Course Outcomes: At the end of the course, student will be able to
1. Examine the crushing strength, impact value, and moisture content of the aggregate.
2. Abrasion is used to calculate the dellotious material % and frictional value.
3. Learn about bitumen penetration and ductility.
4. Estimate the bitumen binding characteristics in pavement construction.
5. Marshal stability test to assess bitumen flow characteristics

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-		-	-	-	-	-	-	2	2	-
CO2	2	2	2	2	-		-	-	-	-	-	-	2	3	-
CO3	2	2	2	3	-	-	-	-	-	-	-	-	3	2	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	3	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-	3	-	-

LIST OF EXPERIMENTS
I. Tests on road aggregate:
1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. Tests on Bituminous materials:
1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test

III. Tests on Bituminous mix:
1. Marshall Stability test.

Note: Any 10 Experiments must be completed.

Web References:
https://ts-nitk.vlabs.ac.in/
https://www.youtube.com/watch?v=lE7LFOuGKyI&list=PL4_tNnCBDtMwbjUgBmY2I2woie7RAQByZ

Course Code	Course Name	Course Structure			
		L	T	P	C
P21MCT03	Environmental Science	2	0	0	0

Internal Marks: 100

Course Prerequisite: Basic knowledge about sciences up to intermediate or equivalent level.

Course Objectives: The student will be able to

1. Overall knowledge of natural resources
2. Basic knowledge of the ecology and its variety
3. familiarity with numerous environmental difficulties caused by unexpected human activity
4. Understanding the environmental consequences of development operations
5. Public awareness of social concerns, environmental regulations, and international treaties

Course Outcomes: After going through this course the student will be able to acquire

1. The ecosystem idea and its role in the environment. The importance of preserving producers and consumers in diverse ecosystems, as well as their roles in the food web.
2. The natural resources and their relevance for life sustenance, as well as the necessity to protect natural resources.
3. Pollution characteristics, repercussions, and strategies to prevent or regulate pollution, as well as waste management techniques.
4. India's biodiversity, biodiversity risks, and conservation efforts to conserve biodiversity.
5. Social difficulties in both rural and urban environments, as well as potential solutions to obstacles and environmental assessment phases included in EIA and environmental audit.

UNIT–I: **(9 Lectures)**
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: Definition, Scope
and Importance– Need for Public Awareness. Renewable energy Resources, Solar energy-solar cells, solar batteries, wind energy, wind mills, ocean energy, tidal en- ergy and nonrenewable energy resources: LPG, water gas, producer gas. World food problems, degradation and Soil erosion - overgrazing, effects of modern agri- culture, fertilizer-pesticide problems, water logging and salinity.

UNIT–II: **(8 Lectures)**
ECOSYSTEMS: Concept of an ecosystem. – Structure, Components and func- tion of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Ecological pyramids - Food chains, food webs and Introduction, types, characteristic features, structure and function of

the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem d. Aquatic – River and Lake Ecosystems.

UNIT–III: **(8 Lectures)**

BIODIVERSITY AND ITS CONSERVATION: Introduction, Definition: genetic, speciesand ecosystem diversity – Bio-geographical classification of India –Value of biodiversity: consumptive use, Productive use, social, ethical and aesthetic values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT–IV: **(9 Lectures)**

ENVIRONMENTAL POLLUTION: Definition, Cause, Effects and Control measures of : a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes

Disaster management: floods, earthquake, cyclone and landslides.

UNIT–V: **(8 Lectures)**

SOCIAL ISSUES AND THE ENVIRONMENT: From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management –Environmental ethics: Issues and possi- ble solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Population growth – Impacts on society, variation among nations. Environmental Impact Assessment (EIA) and Environmental Protection Acts.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by ErachB- harucha for University Grants Commission, Universities Press, 2005.

2. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi, 2008.

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Pub- lishing Company Pvt. Ltd. 2013.

2. Perspectives in Environmental Studies, Second edition, AnubhaKoushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

Online References:

1. Environmental Science - Oxford Research Encyclopedia

2. Environmental Science - Museum of Science and Industry

3. Collegesat.du.ac.in/UG/Envinromental%20Studies ebook.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET05	Structural Analysis	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:
1. To provide basic principles for calculating bending moment and shear force in propped cantilevers, fixed beams, and continuous beams under various loading conditions.
2. To teach Bending Moment and Shear Force principles for beams with varying boundary and loading circumstances.
3. To comprehend the functioning principles of distinct types and the technique for developing and solving slope deflection equations. application to continuous beams with and without support settlement.
4. To provide strain energy analysis for diverse systems based on theorems.

Course Outcomes: Upon successful completion of this course the student willbe able to

1. Differentiate between determinate and indeterminate structures.
2. Determine the behavior of structures as a result of predicted loads, including shifting loads, operating on the structure.
3. Calculate the bending moment and shear forces in beams under various fixity criteria.
4. Analyze continuous beams using various approaches, such as the three moment method and the slope deflection method.
5. Capable of analyzing strain energy as a result of various situations utilizing energy theorems.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	2	3	-
CO3	2	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	2	-	-	-	-	-	-	-	-	3	2	-
CO5	3	2	-	3	-	-	-	-	-	-	-	-	2	3	-

UNIT–I: **(10 Lectures)**

Propped Cantilevers: Analysis of propped cantilevers- shear force and bending moment diagrams-Deflection of propped cantilevers.

UNIT–II: **(10 Lectures)**

Fixed Beams – Introduction to statically indeterminate beams with U. D. load, cen- tral point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams- De- flection of fixed beam sincluding effect of sinking ofs upport,effect of rotation of a support.

UNIT–III: **(12 Lectures)**

Continuous Beams: Introduction-Clapeyron's theorem of three moments- Analy- sis of continuous beams with constant moment of inertia with one or both ends fixed-Continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bend- ing moment diagrams.

UNIT–IV: (14 Lectures)

Slope- DeflectionMethod: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

UNIT–V: (14 Lectures)

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams.

Text Books:

1. Basic Structural Analysis ,C.S. Reddy Tata Mc. Graw-Hill, NewDelhi.

2. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi

3. Analysis of Structures-Vol.I and II,V. N.Vazirani and M.M.Ratwani, Khanna Publishers, NewDelhi.

References

1. Theory of Structures, B.CPunmia, A.KJain & ArunK. Jain, Lakshmi Publications

2. Theory of Structures, R.S.Khurmi, S.Chand Publishers.

3. Structural analysis by R.C.Hibbeler, Pearson, NewDelhi.

4. Structural Analysis-I, Hemanth Patel,YogeshPatel,Synergy Knowledge ware, Mumbai

5. Structural Analysis I Analysis of Statically Determinate Structures, P. N. Chandramouli, Yesdee Publishing Pvt Limited, Chennai

Web References:

1. www.nptel.ac.in

2. www.easyengineering.net

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET06	Mechanics of Materials	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. To transmit failure principles in the content while examining various hypotheses.
2. Torsion ideas and the governing torsion equation will be presented.
3. To comprehend the principles of helical and leaf springs under stress.
4. To identify columns and calculate load bearing capacity, as well as to measure stresses owing to axial and lateral loads at various edge conditions.
5. Teach ideas for calculating forces in members of plane pin-jointed ideal trusses.

Course Outcomes: Upon successful completion of this course
1. Evaluate the members' failing state under various scenarios.
2. To comprehend the notions of tormented members.
3. Understands the uses of springs under load.
4. To evaluate the columns under various end circumstances.
5. To evaluate forces in various types of building trusses.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	2	3	-
CO3	2	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	2	-	-	-	-	-	-	-	-	3	2	-
CO5	3	2	-	3	-	-	-	-	-	-	-	-	2	3	-

UNIT–I: **(10 Lectures)**
Theories Of Failures: Introduction – Various Theories of failures like Maximum Principal Stress theory – Maximum Principal Strain theory – Maximum shear stress theory– Maximum strain energy theory–Maximum shear strain energy the- ory.

UNIT–II: **(9 Lectures)**
Torsion of Shafts: Theory of pure torsion – Derivation of shear stress produced in a circular shaft subjected to torsion– Assumptions made in the derivation of shear stress produced in a circular shaft subjected to torsion-Power transmitted by shafts.

UNIT–III: **(10 Lectures)**
Springs: Introduction – Types of springs – Laminated or Leaf spring- Derivation for maximum bending stress and deflection of the leaf spring- Close coiled helical springs- Derivation for maximum shear stress, deflection and stiffness of closely coiled helical springs.

UNIT–IV: **(8 Lectures)**
Columns: Introduction – Types of columns- Failure of a column- Assumptions made in the Euler's column theory- End conditions for long columns-Expression

for crippling load when both ends of the column are hinged- Expression for crip- pling load when one end of the column is fixed and the other end is free- Expres- sion for crippling load when both the ends of the column are fixed-Expression for crippling load when one end of the column is fixed and other end is hinged- Limi- tations of Euler's formula.

UNIT–V: **(9 Lectures)**

Analysis of Pin-Jointed Plane Frames: Introduction- Types of Frames – Assump- tions made in finding out the forces in a frame- Reactions of supports of a frame – Analysis of a frame- Determination of Forces in members of simply supported plane pin-jointed perfect trusses by method of joints.

Text Books:

1. Introduction to text book of Strength of Materials, R.K.Bansal, 4 th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

2. Strength of Materials, S. Ramamrutham and R.Narayanan , 11th Edition, Dhanpat Rai publications, 2009.

References

1. Mechanics of Solids, Ferdinand Beer and Johnston, 6th Edition, Tata Mc Graw hill Publications, 2000.

2. Strength of Materials , R. Subramanian, 1st Edition, Oxford university press, New Delhi, 2011

Web References:

1. www.r-k-bansalstrength-of-materials-com.pdf

2. www.Engineering/SM/Strength_Of_Materials-Timoshenko.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET07	Environmental Engineering	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. Outline the planning and design of a community's/town's/city's water delivery systems.
2. Provide information on the water quality requirements for household use.
3. Instill knowledge of the significance of water source quality protection.
4. Describes the work required to turn raw water into clean drinkable water.
5. Provide information about the design of a water distribution network. Water distribution system valve and fixture selection.

Course Outcomes: Upon successful completion of this course

1. Plan and design the water distribution and sewage systems.
2. Determine the water supply and the appropriate intake structure.
3. Characterisation of water.
4. Choosing an appropriate treatment flow for raw water treatment.
5. Choose the suitable water supply appurtenances.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	-	2	-	-	-	-	-	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	2	2	-	-	-	2	3	-	-	-	-	-	2	2	-
CO4	3	3	2	3	-	3	3	-	-	3	-	-	3	3	3
CO5	3	3	-	3	-	3	3	-	-	2	-	-	3	3	-

UNIT–I: **(10 Lectures)**

Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer.

Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it- factors affecting water demand, DesignPeriod, Population forecasting.

Collection and Conveyance of Water: Factors governing the selection of the in- take structure, Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, Design of economi-cal diameter of pumping main, HP of pump and monthly expenditure for an apart- ment and a village. Laying and testing of pipe lines- Capacity of storage reservoirs, Mass curve analysis.

UNIT–II: **(10 Lectures)**

Analysisofwater: Physical,Chemical and Biological characteristics and WHO guide lines for drinking water -IS105002012-Water quality standards forAgriculture, In- dustries and Construction.

Treatment of water: Treatment methods: Theory and Design of Sedimentation, Coagulation, Filtration. Theory of disinfection-Chlorination and other Disinfection

methods.

UNIT–III: (8 Lectures)

Miscellaneous treatments: Removal of color and odors- Removal of Iron and Manganese - Adsorption- Fluoridation and de fluoridation–Reverse Osmosis-Solar stills-Freezing

Distribution of Water: Methods of Distribution system, Layouts of Distribution networks, Water main appurtenances - Sluice valves, Pressure relief valves, air valves, check valves, hydrants,and water meters–Ideal water supply system. Case studies

UNIT–IV: (9 Lectures)

Introduction to sanitation: Sewerage systems - Estimation of sewage flow and storm water drainage, fluctuations, types of sewers, design of sewers. Sewer ap- purtenances, Cleaning and ventilation of sewers, Sewage pumps.

House Plumbing: Systems of plumbing– Design of drainage in Gated communi-ties, Apartments and Hotels. Septic Tank - Working Principles and Design **UNIT–V:**

                                                                      (10 Lectures)

Sewage characteristics–Characteristics of sewage- BOD equations. ThOD, COD and BOD.

Treatment of Sewage: Primary treatment. Secondary treatment: Activated Sludge Process, principles, designs, and operational problems. Oxidation ponds, Trick- ling Filters classification –design, operation and maintenance problems. RBCs. Fluidized bed reactors –Anaerobic digestion of sludge, Sludge Drying Beds.

Ultimate Disposal of sewage: Methods of disposal – disposal into water bodies- Oxygen Sag Curve- Disposal into sea, disposal on land, Crown corrosion, Sewage sickness. Effluent standards.

Text Books:

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

2. Rural Municipal and Industrial water management, KVSG MuraliKarishna, Environmental Protection Society, Kakinada, 2021.

3. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna, Paramount Publications, Visakhapatnam, 2018.

4. Elements of Environmental Engineering – K. N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

References

1. WaterSupplyEngineering –P.N.Modi.

2. WaterSupplyEngineering –B.C.Punmia

3. WaterSupplyandSanitaryEngineering–G.S. BirdieandJ. S. Birdie

4. EnvironmentalEngineering, D.Srinivasan, PHILearningPrivateLimited,NewDelhi, 2011.

Web References:

1. https://nptel.ac.in/courses/105/104/105104102/

2. https://lecturenotes.in/notes/18698-note-for-environmental-engineering-ee-by-garikapati-rambabu?reading=true

Course Code	Course Name	Course Structure			
		L	T	P	C
P21EST15	Hydrualic and Hydraulic Machinery	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Objectives:

1. Learn about uniform and non-uniform flows in open channels, as well as the features of hydraulic jumps.
2. To introduce dimensional analysis in the context of fluid flow issues.
3. To comprehend the principles of operation of numerous types of hydraulic machines and pumps.

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

1. Solve issues with uniform and non-uniform open channel flow.
2. In hydraulic model testing, use the principles of dimensional analysis and similitude.
3. Understand the principles of operation of various hydraulic machines and pumps.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	-
CO2	2	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	3	-
CO5	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

UNIT–I: (10 Lectures)

UNIFORMFLOWINOPENCHANNEL: 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, Criticalflow : Specificenergy

- criticaldepth–computationofcriticaldepth

UNIT–II: (10 Lectures)

NON-UNIFORM FLOW IN OPEN CHANNELS: Steady Gradually Varied flow-Dynamicequation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT–III: (08 Lectures)

HYDRAULICS IMILITUDE: Dimensional analysis-Rayleigh's method and Buckingham's pi theorem- study of Hydraulic models - Geometric, kinematic and dynamic similarities-dimension less numbers– model and prototype relations.

UNIT–IV: (9 Lectures)

BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.

UNIT–V: (9 Lectures)

HYDRAULICTURBINES–I: Heads and efficiencies - classification of turbines.

Pel- ton wheel - Francis turbine - Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube –theory and efficiency. Governing of turbines-surge tanks-unit and specific quantities, selec- tion of turbines, performance characteristics – cavitation – Introduction to pumpsand types.

Text Books:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers

2. Fluid mechanics and hydraulic machines, Rajput,A.K(2018),Schand, NewDelhi

3. Fluid Mechanics, Modi and Seth, Standard book house.

References

1. Fluid Flow in Pipes and Channels, G.L.Asawa, CBS

2. PFluid Mechanics and Machinery, C.S.P. OJHA, R. BERNDTSSON and P. N.Chandramouli, Oxford Higher Education.

3. Fluid Mechanics and Machinery, Md.Kaleem Khan, Oxford Higher ducation.

4. Fluid mechanics and Hydraulic machines, R.K.Bansal, Laxmi publications, NewDelhi.

Web References:

1. www.nptel.ac.in

2. www.easyengineering.net
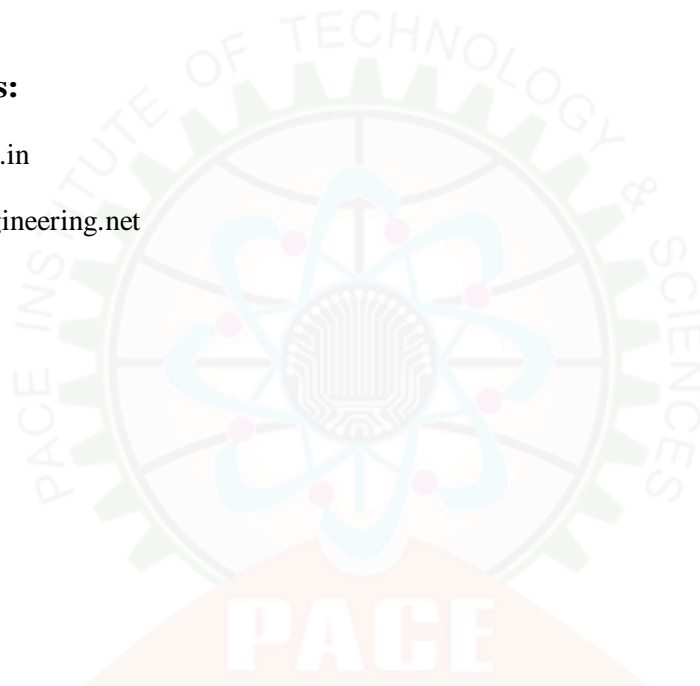
Course Code	Course Name	Course Structure			
		L	T	P	C
P21MBT01	Managerial Economics and Financial Analysis	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Nill

Course Objectives: The student will be able to

1. This unit's learning purpose is to comprehend the idea and nature of managerial economics, as well as its link to other disciplines, as well as the notion of demand and demand forecasting.

2. This unit's learning purpose is to comprehend the concepts of production function, input-output connection, various cost concepts, and cost-volume-profit analysis.

3. The Learning Objective of this Unit is to comprehend the Nature of Competition, Pricing Characteristics in Different Market Structures, and the Significance of Different Pricing Methods, as well as the Different Forms of Business Organization.

4. The Learning Objective of this Unit is to comprehend the various Accounting Systems, the creation of Financial Statements, and the application of various techniques for performance evaluation.

5. This Unit's Learning Objective is to grasp the concepts of capital, capitalization, and capital budgeting, as well as the strategies used to evaluate capital budgeting proposals using various methodologies.

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

1. The Learner understands how to estimate a product's demand and the link between price and demand.

2. For decision making and estimating the lowest cost combination of inputs, one needs comprehend the Cost Concepts.

3. One must comprehend the characteristics of numerous marketplaces as well as price output determination under varied market situations and with knowledge of various Business Units.

4. The learner may produce financial statements as well as use numerous accounting tools for analysis.

5. The Learner is able to analyze various investment project ideas for decision making using capital budgeting approaches.

UNIT–I: (8 Lectures)

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics-Scope of Managerial Economics and its relationship with other subjects-Concept of Demand, Types of Demand, Determinants of Demand-Demand Schedule, Demand Curve, Law ofDemand and its limitations-Elasticity

of Demand-Types of Elasticity of Demand and Measurement-Demand forecastingand its Methods.

UNIT–II: (10 Lectures)

Production and Cost Analyses: Concept of Production function-Cobb-Douglas Production Function – Law of one Variable proportions-Isoquants and Isocosts and choice of Least cost factor combination-Concepts of Returns to Scale and Economics of Scale-Different Cost Concepts: Opportunity Costs, Explicit Costs and Implicit Costs - Fixed Costs, Variable Costs and Total Costs - Cost Volume Profit analysis - Determination of Break-Even Point (Simple Problem) Managerial Significance and limitations of Breakeven point.

UNIT–III: (8 Lectures)

Introduction to Markets and Types of Business Organization: Market Struc- tures: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price and Output Determination– Other Methods of Pricing: Average Cost Pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company –Private Public Partnership - State/Public Enterprises and their forms – Business Cycles – Mean-ing and Features – Phases of Business Cycle.

UNIT–IV: (10 Lectures)

Introduction to Accounting & Financing Analysis: Introduction to Double En- try Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements (Simple Problems) GST basic concepts and Slab rates.

UNIT–V: (10 Lectures)

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Meaning of Capital Budgeting-Time value of Money-Methods of appraising Project profitabil- ity: Traditional methods (pay back period, accounting rate of return) and Modern Methods (Discounted cash flow method, Net present value method, internal rate of return method and profitability index).

Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.

2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011.

3. Prof. J.V.Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

4. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.

Reference Books:

1. V. Maheswari : Managerial Economics, Sultan Chand.

2. Suma Damodaran : Managerial Economics, Oxford 2011.

3. Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.

4. Sanjay Dhameja : Financial Accounting for Managers, Pearson.

5. Maheswari : Financial Accounting, Vikas Publications.

6. S. A. Siddiqui & A. S. Siddiqui : Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

Web References:

1. https://lecturenotes.in/subject/566/managerial-economics-and-f inancial-analysis-mefa

2. https://nptel.ac.in/courses/110101005/

3. https://www.crectirupati.com/sites/default/files/.../MEFA%20lecture%20notes.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P21ESL08	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Objectives :
1. To compare the behavior of analytical models taught in class to the behavior of real fluid flows.
2. To describe the typical fluid mechanics measuring techniques and their applications..
3. To show pupils the components and operating principles of hydraulic machines such as turbines, pumps, and other miscellaneous hydraulic equipment.
4. Analyze laboratory measurements and document the results in a suitable way.

Course Outcomes: At the end of the course, student will be able to
1. Examine the discharge coefficients for the venturimeter, orifice, tiny orifice, and external mouthpiece.
2. Assess head loss due to abrupt contraction and friction.
3. Verify Bernoulli's equation.
4. Find out how efficient turbines and pumps are.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	3	2	-	-	3	3	-
CO2	2	3	3	-	-	-	-	-	2	3	-	-	3	3	-
CO3	2	3	-	-	-	-	-	-	3	2	-	-	3	3	-
CO4	2	2	-	-	-	-	-	-	2	3	-	-	3	3	-

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 a constanthead method.
4. Determination of Coefficient of discharge for an external mouth piece byvariable head method.
5. Determination of Coefficient of loss of head in a sudden contraction and
6. Determination of friction factor of head loss due to 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.Efficiency test on reciprocating pump.

Note: Any 10 Experiments must be completed.

Web References:
1. https://archive.nptel.ac.in/courses/112/106/112106311/
2. https://fmc-nitk.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL04	Strength of Materials Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Objectives :
1. Universal testing machines and torsion equipment are used to determine experimental results.
2. To get experimental data for a spring testing machine, a compression testing machine, an impact tester, and a hardness tester.
3. Using various approaches, determine stress analysis and design of beams subjected to bending and shearing loads.
4. To calculate the flexural strength of a beam.
5. Fatigue and compression tests are used to measure experimental stress.

Course Outcomes: At the end of the course, student will be able to
1. Determine the shear strength of the material and the tensile strength of the steel specimen.
2. Material hardness and impact qualities must be determined.
3. Verify the beam-related hypotheses.
4. Determine the material's shear strength.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	3	2	-	-	3	2	-
CO2	3	2	2	2	-	-	-	-	2	3	-	-	3	3	-
CO3	2	3	3	3	-	-	-	-	3	3	-	-	3	3	-
CO4	3	2	2	2	-	-	-	-	2	3	-	-	2	3	-

LIST OF EXPERIMENTS

1. Tension test on Steel bar
2. Bending test on simple support beam.
3. Torsion test
4. Hardness test by Rockwell Apparatus
5. Brinell hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Continuous beam–deflection test.
12. Charpy impact test
13. Izod impact test

Note: Any 10 Experiments must be completed.

Web References:
https://www.vlab.co.in/ba-nptel-labs-civil-engineering
https://civil.iitr.ac.in/GEG/Strengthofmaterialslab

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL05	Environmental Engineerirng Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Objectives :
1. Carry out the experiments to determine the quality of the water and waste water.
2. Understand the sampling of water and waste water, as well as their quality criteria.
3. Calculate the quality of water, waste water, and industrial water.

Course Outcomes: At the end of the course, student will be able to
1. Learn about the equipment required to carry out the test procedures.
2. Experiment in the laboratory.
3. Compare the water and air quality criteria to those established by municipal governments.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	3	-	3	2	-	-	-	-	3	2	-	-
CO2	-	3	2	2	-	2	3	-	-	-	-	2	3	3	-
CO3	-	2	2	3	-	3	2	-	-	-	-	3	2	2	-
CO4	2	2	3	2	-	-	3	-	-	-	-	2	3	3	-

LIST OF EXPERIMENTS

1. Determination of pH of Water.
2. Determination of Electrical Conductivity (Salinity) of Water.
3. Determination and estimation of Total Hardness–Calcium &Magnesium.
4. Determination of Alkalinity
5. Determination of Acidity
6. Determination of Chlorides in water
7. Determination and Estimation of total solids, organic solids and in organicsolids and settle-able solids.
8. Determination of Iron.
9. Determination of Dissolved Oxygen with D.O. Meteor Wrinklers Method and B.O.D.
10. Determination of Dissolved Oxygen with D.O. Meteor Wrinklers Method and B.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Determination of C.O.D.
14. Determination of N,P,K values in solid waste

Note: Any 10 Experiments must be completed.

Web References:
1. https://www.digimat.in/nptel/courses/video/105107176/L01.html
2 https://ee1-nitk.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET08	Advanced Structural Analysis	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Structural Analysis, Mechanics Of Materials,
Course Objectives:

1. 1. Introduce students to various sorts of structures
2. 2. Provide information on arches to the student
3. 3. Comprehend the ideas behind lateral load analysis
4. 4. Become familiar with suspension bridges and cables
5. Recognize analysis techniques Kani's Method, Moment Distribution

Course Outcomes: After completing this program, the student will be capable of

1. Differentiate between fixed and movable structures
2. Structures' lateral load analyses carried out
3. Examine the designs of Cable and Suspension Bridges
4. Use the Moment Distribution to analyze structures
5. Use Kani's approach to structure analysis

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	-	-	-	-	-	-	-		2	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-		3	3	-
CO3	2	2	2	2	-	-	-	-	-	-	-		2	3	-
CO4	2	3	3	3	-	-	-	-	-	-	-		2	2	-
CO5	3	2	2	2	-	-	-	-	-	-	-		3	2	-

UNIT–I: **(14 Lectures)**
Three Hinged Arches: Introduction and Types of arches-Elastic theory of arches
– Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust
and radial shear – effect of temperature. Hinges with supports at different levels.
Cable Structures and Suspension Bridges: Introduction, characteristics of ca- ble,
analysis of cables subjected to concentrated and uniformly distributed loads, analysis
of simple suspension bridge, three hinged and two hinged stiffening girder suspension
bridges.
UNIT–II: **(10 Lectures)**
Lateral Load Analysis Using Approximate Methods: application to building frames.
(i) Portal Method
(ii) Cantilever Method.
UNIT–III: **(9 Lectures)**
Moment Distribution Method: Stiffness and carry over factors – Distribution factors –
Analysis of continuous beams with and without sinking of supports – Portal frames –
including Sway-Substitute frame analysis by two cycle.
UNIT–IV: **(9 Lectures)**
Kani's Method: Analysis of continuous beams – including settlement of supports and

single bay portal frames with and without side sway.

FLEXIBILITY METHOD: Flexibility matrix analysis of continuous beams and rigid jointed plane frames (Single Bay, single storey with vertical legs only) by flexibility method with matrix approach.

STIFFNESS METHOD: Stiffness matrix, Relationship between flexibility matrix and stiffness matrix, Analysis of continuous beams, Rigid jointed plane frames (Single Bay, single storey with vertical legs only) by stiffness method with matrix approach.

Text Books:

1. Structural Analysis, T. S. Thandavamoorthy, Oxford university press, India.

2. Structural Analysis, R.C. Hibbeler, Pearson Education, India

3. Theory of Structures – II, B. C. Punmia, Jain & Jain, Laxmi Publications, India.

4. Structural Analysis, C.S. Reddy, Tata Mc-Graw hill, New Delhi.

References

1. Intermediate Structural Analysis, C. K. Wang, Tata McGraw Hill, India

2. Theory of structures, Ramamuratam, Dhanpatrai Publications.

3. Analysis of structures, Vazrani & Ratwani – Khanna Publications.

4. Comprehensive Structural Analysis-Vol. I & 2, R. Vaidyanathan & P. Perumal-Laxmi Publications Pvt. Ltd., New Delhi

5. Structural Analysis I, P.N. Chandramouli. Yesdee Publishing Pvt Limited

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ce26/preview

2. https://unacademy.com/course/complete-course-of-structural-analysis-for-gate-ese-98/JCUTKKS8

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET09	Design And Drawing of Reinforced Concrete Structures	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Building Materials & Concrete Technology, Structural analysis,

Course Objectives:

1. To learn the fundamentals of limit state design, including its ideas, loads, strain curves for mild steel and cold wrought deformed bars, assumptions in limit state design, and design of singly reinforced beams.

2. To learn design principles for flexure, shear, torsion, and bond, including limit state analysis, design examples in simple-supported and continuous beams, and details.

3. To learn about slabs, including how to classify them, design one-way, two-way, and continuous slabs using conventional IS coefficients.

4. To learn about compression members, such as the effective length of a column, the design of short and long columns, and the effects of uniaxial and biaxial bending under axial loads.

5. To learn about footings, including different footing types and their distribution

Course Outcomes: At the end of this course, the student will be able to
1. Describe the limit state method's concepts and the beams' detailed design.

2. Using the limit state method, design of the flexure, shear, torsion, and bond of beams is included.

3. Use the limit state method to design various slab kinds.

4. Use the limit state approach to design compression members.

5. Use the limit state method to design several footing types.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	2		2	2	-	-	-	-	-	-	-	-	2	3	-

UNIT–I: **(10 Lectures)**

Introduction : Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads - Design philosophies - Concepts of limit state design - Ba- sic statistical principles - Types of sections - Characteristic loads - Characteristic strength - Partial load and safety factors - representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design - stress - block parameters - limiting moment of Resistance - limit state analysis and design of singly reinforced Beams (Rectangular and flanged beams).

UNIT–II: **(10 Lectures)**

Design for Flexure, Shear, Torsion and Bond: Limit state analysis and design of doubly reinforced sections (Rectangular and T-beams).- effective depth- Moment of Resistance – Minimum depth for a given capacity – Limiting Percentage of Steel – Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.

UNIT–III: **(8 Lectures)**

Design of Slabs: Classification of slabs, design of one - way slabs, one way con- tinuous slab using IS Coefficients (Conventional)-Design of two way slabs - simply supported and various edge conditions using IS Code .

UNIT–IV: **(9 Lectures)**

Design of Compression members: Effective length of a column, Design of short and long columns –under axial loads, uniaxial bending and biaxial bending – I S Code provisions.

UNIT–V: **(10 Lectures)**

Footings: Different types of footings – Distribution of base pressure – General Design considerationsfor footings – Design of isolated footings – rectangular and square footings.

Text Books:

1. Limit State Design, A. K.Jain

2. Design of Reinforced concrete Structures, N.Subrahmanyian

3. Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, New age International Publishers, NewDelhi

4. Reinforced Concrete Structures, S. Unnikrishna Pillai & Devdas Menon, Tata Mc.Graw Hill,NewDelhi.

References

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. LakshmiPublications

2. Reinforced Concrete Structures by Park and Pauley, John Wiley and Sons.

3. Design of concrete structures – Arthus H.Nilson, David Darwin, and Chorles W. Dolar,Tata Mc.GrawHill,3rd Edition, 2005.

4. Reinforced concrete structures – I.C. Syal & A.K.Goel, S.Chand Publishers.

5. Limit state designed of reinforced concrete – P.C.Varghese, Printice Hall ofIndia, NewDelhi.

Web Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105105/

2. https://unacademy.com/course/design-of-reinforced-concrete-structures/IRIHWE1J

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET10	Geotechnical Engineering	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Engineering Geology

Course Objectives:

1. To enable the student to identify the soil's index properties and categorize it.

2. To explain the idea of water seeping through soils and calculate the water discharge through soils.

3. To explain the fundamentals of soil consolidation and compaction while estimating the size and rate of consolidation settlement.

4. Identify the shear parameters of sands and clays and the areas of their application in order to help the student understand the idea of soil shear strength.

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

1. 1. Describe distinct soil characteristics and establish relationships between them.
2. 2. Describe soil permeability and seepage.
3. 3. Examine and clarify the distribution of soil stress.
4. 4. Describe the phenomenon of soil consolidation and compaction.
5. 5. Describe soil shear stress and theories of failure.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-		-	-	-	-	-	-	2	2	-
CO2	2	2	2	2	-		-	-	-	-	-	-	2	3	-
CO3	2	2	2	3	-	-	-	-	-	-	-	-	3	2	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	3	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-	3	-	-

UNIT–I: (10 Lectures)

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density

Index Properties of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT–II: (10 Lectures)

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy'sLaw- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems.

Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Char- acteristics and Uses.

UNIT–III: (8 Lectures)

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq and Westergaard'stheories for point loads and areas of different shapes– Newark's influence chart – 2:1 stress distribution method.

UNIT–IV: **(9 Lectures)**

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determi- nation of coefficient of consolidation (cv) – Over consolidated and normally consol- idated clays.

UNIT–V: **(10 Lectures)**

Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories Stress-Strain behavior of Sands - Critical Void Ratio – Stress- Strain behavior of clays – Shear Strength determination- various drainage condi- tions.

Text Books:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International Publishers 2005

2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers 2001

Reference BOOKS

1. D.W.Taylor, "Fundamentals of Soil Mechanics", Wiley.

2. Holtz and Kovacs, "An introduction to Geotechnical Engineering" Prentice Hall

3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.

Web Resources:

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

2. https://unacademy.com/course/geotechnical-engineering-soil-mec hanics-gate-ce/PJA6Y7UYV

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL06	Geotechnical Engineering Lab	0	0	3	1.5

Internal Marks: 15 External Marks: 35

Course Prerequisite: Engineering Geology, Geotechnical Engineering
Course Objectives:

1. To teach students how to determine the index qualities needed for soil classification.

2. To instruct students on how to use pertinent lab experiments to estimate the permeability of soils by determining the compaction characteristics and consolidation behavior.

3. To demonstrate how to use various laboratory procedures to evaluate the shear characteristics of soil.

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

1. Identify and categorize the soil's index qualities.

2. Ascertain the soils' permeability.

3. Establish the properties of shear strength, consolidation, and compaction.
Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	-	-	-	-	2	3	-	-	3	3	-
CO2	2	2	2	2	-	-	-	-	3	3	-	-	3	3	-
CO3	2	3	3	3	-	-	-	-	3	2	-	-	2	3	-
CO4	2	3	2	3	-	-	-	-	2	3	-	-	3	2	-

List of Experiments: (At least TEN experiments must be completed.)

1. Determination of Moisture Content of given soil sample
2. Determination of specific gravity of the given soil sample
3. Determine the in-situ density of natural or compacted soils using sand pour-ing cylinders
4. Grain size analysis of soils using sieve analysis and using hydrometer analy-sis test
5. Determination of consistency limits
6. To determine the relative density of given course grained material
7. To determine the coefficient of permeability of a soil using constant headmethod
8. To determine the moist density and dry density of soil sample using proctor compaction test
9. To find shear strength of a given soil specimen using vane shear apparatus
10. To determine the shearing strength of the soil specimen using the direct shear apparatus
11. Determine shear parameters of cohesive soil using unconfined compression apparatus

12. To find the shear of the soil by undrained triaxle test
13. To determine the settlements due to primary consolidation of soil by conduct-ing one-dimensional Test.
14. To determine the C.B.R value of given soil sample

References:

1. https://onlinecourses.nptel.ac.in/noc22_ce60/preview

2. https://smfe-iiith.vlabs.ac.in/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL07	Advanced Concrete Technology Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Concrete Technology

Course Objectives:

1. To give the pupils the tools they need to carry out all basic experiments.

2. To adequately teach diverse design principles through experimentation.

3. To give the pupils the chance to look at how structural components perform.

4. To encourage students to research the materials for environmentally friendly constructions.

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

1. Describe the evolution of experimental skills and knowledge of design.

2. Perform numerous laboratory studies on aggregates and cement

3. Understand how to assess strain

4. Testing without destruction

5. Concrete, aggregate, and sand chemical analysis

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	-	-	-	-	2	3	-	3	2	3	-
CO2	3	2	3	3	-	-	-	-	3	3	-	3	3	3	-
CO3	3	3	2	2	-	-	-	-	3	3	-	3	2	2	-
CO4	2	3	3	3	-	-	-	-	2	3	-	3	3	2	-

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non-destructive testing - Impact Hammer test
7. TNon-destructive testing - UPV test
8. Mix design and placement of Self compacting concrete
9. Qualifications tests on Self compaction concrete- L Box , J Box , U box
10. Slump Flow test on Self-compacting concrete

References:

1. https://archive.nptel.ac.in/courses/105/102/105102012/

2. https://archive.nptel.ac.in/courses/105/104/105104030/

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET11	Design and Drawing of Steel Structures	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Structural Analysis, DDRCS

Course Objectives:

1. Introduce students to various Connection kinds and pertinent IS codes.
2. Provide concepts for designing flexural members to the learner.
3. Recognize how tension and compression members are designed in trusses.
4. Introduce several types of columns, their bases, and their designs to the class.
5. Introduce plate girders and gantry girders to the class, along with their designs.

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

1. Utilize pertinent IS codes
2. Complete the analysis, design, and detailing of flexural members.
3. Create several forms of compression members with connection detailing
4. Plate Girder and Gantry Girder Design with Connection Details
5. Create the drawings for the various steel construction components.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	3	-	-	-	-	-	-	2	-	-
CO2	3	3	3	3	-	3	-	-	-	3	-	-	3	3	-
CO3	3	3	3	2	-	2	-	-	-	3	-	-	3	3	-
CO4	2	3	2	2	-	3	-	-	-	2	-	-	3	2	-
CO5	3	2	3	3	-	3	-	-	-	3	-	-	3	3	-

UNIT–I: **(10 Lectures)**

Types of structural steel – Mechanical properties of steel – Concepts of plasticity – yield strength - Loads and Stresses – Local buckling behaviour of steel. Concepts of limit State Design – Different Limit States – Load combinations for different Limit states - Design Strengths- deflection limits – serviceability – stability check; Connections: Design of Connections– Different types of connections –.

UNIT–II: **(10 Lectures)**

Plastic Analysis: Plastic moment – Plastic section modulus - Plastic analysis of continuous beams Beams: Allowable stresses, design requirements as per IS Code- Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, lat- erally unsupported beams.

UNIT–III: **(8 Lectures)**

Effective length - Slenderness ratio – permissible stresses. Design of compression members, and struts. Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns. Roof Truss Element: Different types of trusses – Design loads – Load combinations as per IS Codes –Design of simple roof trusses involving design of purlins, rafters and joints – tubular trusses.

UNIT–IV: **(9 Lectures)**

Design of slab base and gusseted base. Column bases subjected moment. Bolted connections –Design strength – efficiency of joint Welded connections: Advantages and disadvantages - Strength of welds-Butt and fillet welds: Permissible stresses

– IS Code requirements. Design of fillet weld subjected to in-plane moment acting in the plane and at right angles to the plane of the joints

UNIT–V: **(10 Lectures)**

Design of Plate Girder: Design consideration – I S Code recommendations Design of plate girder - Welded – Curtailment of flange plates, stiffeners – splicing and connections. Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders.

Text Books:

1. Steel Structures Design and Practice, N. Subramanian, Oxford University Press.
2. Limit State Design of steel structures, S. K. Duggal, Tata Mc Graw Hill, New Delhi

Reference Books

1. Structural Design in Steel, SarwarAlamRaz, New Age International Publishers, New Delhi
2. Structural Design and Drawing by N.Krishna Raju, Universities Press
3. Design of Steel Structures by K.S.Sai Ram, Person India Education Services and Other Developing Countries, Oxford & IBH Publishing Company, 1993

Web Resources:

1. https://nptel.ac.in/courses/105105162

2. https://unacademy.com/course/design-of-steel-structures-for-g atece/F3K6O6MM

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET12	Water Resources Engineering	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: DDRCS

Course Objectives:

1. Calculate the water needed for irrigation.
2. Create canals for irrigation
3. Recognize the hydrologic cycle's significance to civil engineering.
4. Become familiar with physical processes and how they interact in hydrology.
5. Acquire measurement and estimate skills for the hydrologic cycle's constituents.
6. Be familiar with and comprehend hydrographs

Course Outcomes: At the end of this course, the student will be able to
1. Calculate the amount of water that crops need.
2. Organize and create canals and diversion systems to transport water to irrigation fields.
3. Describe a region's rainfall projections and hydrological principles.
4. Describe abstractions in runoff and precipitation in a catchment region.
5. Create a synthetic hydrograph and a unit hydrograph.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	-	-	3	-	-	-	-	-	2	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	3	-	-	-	-	-	-	-	-	3	3	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	-	-	-	-	2	-	-	-	-	-	2	2	-

UNIT–I: (**10 Lectures**)

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil water-plant relationship, soil moisture constants, con- sumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficien- cies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT–II: (**10 Lectures**)

Canals: Classification, design of non-erodible canals - methods of economic sec- tion and maximum permissible velocity, economics of canal lining, design of erodi- ble canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting. Diversion Head Works: Types of diversion head works, weirs and bar- rages, layout of diversion head works, components. Causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of imper- vious floors for subsurface flow, exit gradient.

UNIT–III: (**8 Lectures**)

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hy- drological data-sources of data. Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation

of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT–IV: (9 Lectures)

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measure- ment, infiltration indices. Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

UNIT–V: (10 Lectures)

Hydrograph analysis: Components of hydrograph, separation of base flow, effec- tive rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assump- tions, derivation of unit hydrograph, unit hydrographs of different durations, prin- ciple of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, in- troduction to IUH.

Text Books:

1. 1. Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi

2. Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard BookHouse, New Delhi

3. 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), NewDelhi.

4. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), NewDelhi

Reference Books

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt.

2. .'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers. Design of Steel Structures by K.S.Sai Ram, Person India Education Services

Web Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105110/

2. https://unacademy.com/course/water-resources-engineering-and-i   rrigation-gate-ce/X9CKKUTM

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CET13	Foundation Engineering	3	0	0	3

Internal Marks: 30   External Marks: 70

Course Prerequisite: Geotechnical Engineering, SA

Course Objectives:

1. To teach the student about various shallow foundation types and the tools needed to assess their bearing capacity.

2. To make it possible for the learner to calculate the consolidation and quick settlements of shallow foundations.

3. To teach the fundamentals of crucial field tests including the SPT and the Plate Bearing Test.

4. To help the learner understand pile foundations and calculate their load-bearing capacity.

Course Outcomes: At the end of this course, the student will be able to
1. Calculate the amount of water that crops need.
2. Organize and create canals and diversion systems to transport water to irrigation fields.
3. Describe a region's rainfall projections and hydrological principles.
4. Describe abstractions in runoff and precipitation in a catchment region.
5. Create a synthetic hydrograph and a unit hydrograph.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	3	-	-	2	3	-
CO2	2	3	3	3	-	-	-	-	-	2	-	-	3	2	-
CO3	3	2	3	2	-	-	-	-	-	3	-	-	2	3	-
CO4	2	3	2	-	-	2	-	-	-	-	-	-	3	3	-
CO5	3	2	3	3	-	3	-	-	-	-	-	-	3	-	-

UNIT–I: **(10 Lectures)**

Soil Exploration: Need – Methods of soil exploration – Boring and Sampling meth- ods – Field tests – Penetration Tests – Pressure meter – planning of Program and preparation of soil investigation report.

UNIT–II: **(10 Lectures)**

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- Stability of slopes of dams and embankments - different conditions. Rankine's & Coulomb's theory of earth pressure – Cullman's graphical method - earth pres- sures in layered soils.

UNIT–III: **(8 Lectures)**

Shallow Foundations – Bearing Capacity Criteria: Types of foundations and fac- tors to be considered in their location - Bearing capacity – criteria for determina- tion of bearing capacity Factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory - IS Methods.

UNIT–IV: **(9 Lectures)**

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 of structures.

UNIT–V: **(10 Lectures)**

Deep Foundations:

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests - Load carrying capacity of pile groups in sands and clays.

Well Foundations: Types – Different shapes of well – Types of cassions – Com- ponents of well - functions – forces acting on well foundations - Design Criteria – Determination of staining thickness and plug - construction and Sinking of wells – Tilt and shift.

Text Books:
1. 'Principles of Foundation Engineering' by Das, B.M., - (2011) –6th edition(Indian edition) Cengage learning.
2. 'Basic and Applied Soil Mechanics' by Gopal Ranjan& ASR Rao, New Age International Pvt. Ltd, (2004).
3. Soil mechanics & foundation engineering by Arora

Reference Books
1. Foundation Analysis and Design' by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, New York.
2. 'Theory and Practice of Foundation Design' by N.N.SOM & S.C.DAS PHI Learn-ing Private limited.

Web Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105176/

2. https://unacademy.com/course/complete-course-on-foundation-engineering/3DM0RTBQ

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL08	Estimation, Specification and Contracts Lab	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:
1. Be familiar with the quantity calculations for the various building components.
2. Have a thorough understanding of the rate analysis of the various building components.
3. Get to know the various building details and parts.

Course Outcomes: At the end of this course, the student will be able to
1. List the various standards and contracts available.
2. Identify building components and quantify quantity estimation techniques.
3. Create a schedule for building bar bending.
4. Calculate the price of construction using the individual wall technique.
5. Use the centre line method to project the cost of construction.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	-	-	-	-	-	-	-	-	-	2	-	3

UNIT–I:

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–II:

General items of work in Building – Standard Units Principles of working out quan- tities for detailed and abstract estimates –Approximate method of Estimating.

UNIT–III:

Rate Analysis – Working out data for various items of work over head and contin- gent charges. Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT–IV:

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

UNIT–V:

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Text Books:

1. 'Estimating and Costing' by B.N. Dutta, UBS publishers, 2000.

2. 'Civil Engineering Contracts and Estimates' by B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.

References:

1. 'Standard Schedule of rates and standard data book' by public works department.

2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works – B.I.S.).

Web Resources:

1. https://onlinecourses.swayam2.ac.in/nou20_cs11/preview

2. https://unacademy.com/course/estimation-costing-valuation-12/ HMHRZZRR

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL09	Structural Analysis and Design Programming Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Structural Analysis

Course Objectives:

1. To become familiar with structural engineering software applications.
2. To gain knowledge of the analysis of plane, space truss, and frames under various forms of loading.
3. To learn the estimations and to detail the RCC members.
4. To research the design ideas for steel structural components such trusses, beams, and columns.
5. To research the specifications for RCC retaining walls.

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

1. Determine the software applications and create structural drawings for structural members.
2. Create and evaluate plane frames and trusses that are subject to various types of loads.
3. Beam, column, slab, and footing RC structural member design, details, and calculations
4. Bridge deck slab design and analysis for various loading scenarios
5. Retaining wall design and analysis for various loading scenarios

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	-	-	-	-	-	2	3	-
CO2	2	3	3	2	3	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	3	2	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	2	3	-	-	-	-	-	-	-	3	2	-
CO5	3	2	2	3	2	-	-	-	-	-	-	-	2	3	-

List of Experiments: (At least TEN experiments must be completed.)

1. Introduction to staad pro
2. Analysis and design of simply supported beam
3. Analysis and design of continuous beam
4. Analysis design of fixed and cantilever beam
5. 2-D Frame Analysis and Design
6. 3-D Frame Analysis and Design
7. Steel Tabular Truss Analysis and Design
8. Analysis and design of single-storey building
9. Analysis and Design of multi-storey building
10. Analysis and Design of Electrical tower.
11. Analysis and Design of Retaining wall.

Course Code	Course Name	Course Structure			
		L	T	P	C
P21CEL10	Structural Engineering Lab	0	0	3	1.5

Internal Marks: 15   External Marks: 35

Course Prerequisite: Structural Analysis, Design & Drawing of Reinforced Concrete Structures

Course Objectives:

1. To give the students the tools they need to carry out all essential beam experiments.
2. They provide sufficient information on different deflections and cracks.
3. To give the students the opportunity to look at how RCC Beams that are intended for bending behave when they fail in shear.
4. Provide enough information about RCC Beams that are designed for shear but fail in bending.
5. Encourage the investigation of RCC One- and Two-Way Slabs by the pupils.

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

1. Describe your understanding of deflection and cracks on under- and over- reinforced and balanced sections.
2. Put RCC Beams intended for bending and failing in shear through tests.
3. Run tests to see how well RCC One-way and Two-Way slabs function.
4. To determine the Young's modulus of elasticity for concrete, do numerous laboratory procedures.
5. Be able to take concrete core samples from paving stones.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	-	-	-	-	-	2	3	-
CO2	2	3	3	2	3	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	3	2	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	2	3	-	-	-	-	-	-	-	3	2	-
CO5	3	2	2	3	2	-	-	-	-	-	-	-	2	3	-

List of Experiments: (At least TEN experiments must be completed.)

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections.
2. Study on Performance of RCC Beams designed for Bending and failing inShear.
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.