VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

for

B. TechCivil Engineering

(Applicable for batches admitted from 2020-2021)

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

(Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUK,

NAAC Accredited with ‘A’ Grade, ISO 9001:2015 Certified

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

About Institute

VasireddyVenkatadri Institute of Technology (VVIT) was established in the year 2007, with an intake of 240 students in four B. Tech programs under Social Educational Trust in Nambur village, Guntur, AP, by Er. VasireddyVidyaSagar. It is located strategically between Guntur and Vijayawada in the capital region of Amravati, AP. In a short span of ten years, with an annual intake capacity of 1260 and 81 students into B.Tech (CE, EEE, ME, ECE, CSE, IT, CSM, CSO, CIC and AID) and M. Tech (CSE, VLSI&ES, PEED, MD, SE) programs respectively, today almost 4000 students, 345 teaching staff and 225 non-teaching staff strive to fulfill the vision of VVIT.

VVIT has emerged as one of the top ten Engineering Colleges from the 200 engineering colleges affiliated to JNTU Kakinada. The Institute signedMoUs with Industry and Training & Placement Companies like Infosys, Tech Mahindra, Social Agro, Efftronics, AMCAT and Cocubes. Centre of Excellence (CoE) by Siemens India was established in the year 2016 by APSSDCto promote Industry Institute interface and strengthen employability skills in students, Google Inc. USA for establishing Google Code labs, University Innovative Fellowship (UIF) program by Stanford University USA and VDC established by Northeastern University

On achieving permanent affiliation to JNTUK, Kakinada, NAAC 'A" grade certification (CGPA 3.09) and B. Tech programs (CE, EEE, ME, ECE, CSE, IT) accredited by NBA, VVIT has set its sight on centrally funded research projects with 10 completed and 6 running DST projects and consultancy service from other departments. VVIT as part of its commitment to research, has published 13 patents, 16 books and nearly 690 journal papers and also has a 'Research Centre affiliated to JNTUK'.

Institute Vision

To impart quality education through exploration and experimentation and generate socially conscious engineers, embedding ethics and values, for the advancement in science and technology.

Institute Mission

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve over all development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

Department Vision

To provide globally competitive and socially responsible Civil Engineering professionals, who can contribute to the organization and nation-building through their innovative ideas and to create knowledge pool of Civil Engineering through quality research.

Department Mission

- To develop and implement qualitative teaching and learning practices to impart quality education to the students to dovetail them to industry needs
- To develop engineers with good scientific and engineering knowledge so as to comprehend, analyze, design and apply knowledge to the fast changing needs in the field of Civil Engineering.
- To provide hands-on experience and knowledge to the students to make them engineers of excellence.
- To promote innovative and original thinking in the minds of budding engineers to face the Challenges of future by shaping the department into a center of academic and research excellence.
- To inculcate the value of discipline and encourage the student to become a responsible and worthy citizen of the nation.

Program Educational Objectives (PEOs)

PEO 1 : To produce the students who can excel in their professional career and/or in higher education by acquiring knowledge in mathematical, computing and engineering principles.

PEO 2 : To produce the students who can analyze any real life problem and design structures which are not only safe, eco-friendly and economical but also socially acceptable.

PEO 3 : To train the students to exhibit the ethical professionalism by imbibing right attitude and built teamwork.

PEO 4 : To produce the students who excel as an entrepreneur by adapting lifelong learning practices and facing the challenges with acquired knowledge through research and development and innovative thinking.

Program Outcomes (POs)

PO1 : **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 : The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1 : Graduates will be able to adapt creative thinking and problem-solving approach in planning, analysis, design and estimation of civil engineering structures and services.

PSO2 : Able to act as renowned consultant in all divisions of civil engineering for providing sustainable solutions to practical problems.

PSO3 : Graduates will be able to acquire updated knowledge to provide cost-effective solutions to societal engineering problems

ACADEMIC REGULATIONS (R20) FOR B. TECH (REGULAR)

Applicable for the students of B.Techfrom the Academic Year 2020 – 21 onwards

1.Award of B. Tech. Degree

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

- Pursues a course of study in not less than four and not more than eight academic years.
- After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.
- Registers for 160 credits and must secure all the 160 credits.
- A student shall be eligible for the award of **B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.**

2. **Courses of Study:** The following courses of study are offered at present as specializations for the B. Tech. Courses

S. No.	Branch	Branch Short Form	Branch Code
1	Civil Engineering	CIV	01
2	Electrical and Electronics Engineering	EEE	02
3	Mechanical Engineering	MEC	03
4	Electronics and Communication Engineering	ECE	04
5	Computer Science and Engineering	CSE	05
6	Information Technology	INF	12
7	CSE (Artificial Intelligence and Machine Learning)	CSM	42
8	CSE (Internet of Things and Cyber Security with Block Chain Technology)	CIC	47
9	CSE (Internet of Things)	CSO	49
10	Artificial Intelligence and Data Science	AID	54

3. **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.

4. **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

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.

5. **Structure of the Undergraduate Engineering program:** Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

S.No.	Category	Breakup of Credits
1	Humanities and social science including Management courses	10.5 - 12
2	Basic Science courses	21 - 25
3	Engineering science courses	24
4	Professional core Courses	48 - 51
5	Open Elective Courses	12 - 18
6	Professional Elective Courses	15 - 18
7	Internship, seminar, project wok	15 – 16.5
8	Mandatory courses	NC
9	Skill Oriented Courses	----
	Total Credits	160

** Breakup of Credits based on AICTE /APSCHE

Assigning of Credits

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

6. **Programme Pattern**

i. Total duration of the of B. Tech (Regular) Programme is four (three for lateral entry) 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 (Physical by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc.,) 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 concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

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 make engineering graduates to connect with the needs of the industry and society at large.

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

xiv. Courses like Environmental Sciences, 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.

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

xvi. Departments may swap some of the courses between first and second semesters to balance the work load.

xvii. The concerned Board of studies can assign tutorial hours to such courses wherever it is necessary, but without change in the total number of credits already assigned for semester.

8. Registration for Courses

i. The college 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 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 format to the college examination section and University without fail.

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. The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

iii. A student shall be permitted to pursue up to a maximum of 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 SWAY/NPTE through online with the approved by the BoS 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 University examination center as well as college examination center. The Head of the Department shall appoint a mentor for each of the MOOC subjects registered by the students to monitor the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

iv. Two summer internships 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 agencies, Industries, Hydel and thermal power projects and also in software MNCs. After completing the summer internship, the students shall register in the immediate respective odd semester and it will be evaluated at the end of the semester as per norms of the autonomy. The student has to produce the summer internship satisfactory report and certificate taken from the organization to be considered for evaluation. The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

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

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.

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 3 skill courses, one shall be necessarily be a soft skill course and the remaining two 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 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 all the calculations of mandatory attendance requirements upon producing 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 certificate issued by external agency is marked with unsatisfactory condition, 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 examination conducted at college as per BoS norms at the end of the semester.

9. Attendance Requirements:

i. A student is eligible to write the semester-end examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

ii. Shortage of Attendance below 65% in aggregate shall in NO case be condoned. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end semester examination of that class and their registration shall stand cancelled.

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

iv. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

v. A student will be promoted to the next semester if he satisfies the(a) attendance requirement of the present semester and (b) minimum required credits (from Vth Semester onwards).

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

vii. For induction programme attendance shall be maintained as per AICTE norms.

viii. For non-credit mandatory courses the students shall maintain the attendance similar to

10. Evaluation-Distribution and Weightage of marks

Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council of the institute from time to time.

i. A student is deemed to have satisfied the minimum academic requirements if he/she has earned the credits allotted to each theory/practical design/drawing subject/ project etc. by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the total of the internal marks and end semester examination marks together.

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

iii. **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 Examination (SEE). The performance of a student in each semester shall be evaluated subject–wise with a maximum of 100 marks for theory subject, 50 marks for practical subject/Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project, and 200 marks for end Project Work.

iv. Guide lines for Continuous Internal Evaluation (CIE)

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 (iii) one assignment and (iv) one Subject Seminar. The online examination (objective) shall be 10 marks with duration of 20 minutes, descriptive examination shall be for 10 marks with a duration of 1 hour 30 minutes, assignment test shall be 5 marks with duration of 50 minutes (Open book system with questions of L4 standard on Bloom's scale) and 90 minutes for descriptive paper) and Subject Seminar 5 marks.

b. The first online examination (objective) is set with 20 multiple choice questions for 10 marks (20 questions x 1/2 marks) from first two and half units (50% of the syllabus).

c. The descriptive examination is set with 3 full questions for 10 marks each from first two and half units (50% of the syllabus), the student has to answer all questions.

d. The Assignment Test from first two and half units conducted for 20 Marks and will be scaled down to 5 Marks. The test is open book system and the duration of the exam is 50 minutes. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.

e. For the subject seminar 5 marks, each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.

f. For the subject having design and / or drawing ((such as Engineering Graphics / Drawing, Design & Drawing of Reinforced Concrete Structures, Design & Drawing of and 15 marks for internal tests).

In the similar lines, the mid-2 examinations shall be conducted on the rest of the syllabus.

f. For practical subjects there shall be continuous evaluation during the semester for 25 marks. The internal 25 marks shall be awarded as follows: day to day work 5 marks, record 5 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.

g. The mid marks submitted to the examination section shall be displayed in the concerned department notice boards for the benefit of the students. If any discrepancy found in the displayed Mid marks, it shall be brought to the notice of examination section within two working days from the date of display.

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

Example:

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

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

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

v. **Semester End Examinations Evaluation:**

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

b. For practical subjects shall be conducted for 35 marks by the teacher concerned and external examiner appointed by Chief superintendent/ Controller of Examinations (CoE), VVIT. All the laboratory records and internal test papers shall be preserved in respective departments as per autonomous norms and shall be produced to the Committees as and when they ask for.

c. Evaluation of the summer internships: It shall be completed in collaboration 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 programme. Students shall pursue this internship during summer vacation 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 commencement of academic year. A supervisor/mentor/advisor has to be allotted 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 appear for an oral presentation before the departmental committee consists of an external examiner appointed by Chief superintendent/ CoE; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate 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 examination section.

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

e. Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc. non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the 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 (Y)/Not-completed (N) will be specified.

f. Procedure for Conduct and Evaluation of MOOC: There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL/etc., through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student’s assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

g. Major Project (Project - Project work, seminar and internship in industry): In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the 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 superintendent/ CoE and is evaluated for 140 marks.

vi. Recounting/ Revaluation/ Revaluation by Challenge in the End Semester Examination: A student can request for recounting/ revaluation/ revaluation by challenge of his/her answer book on payment of a prescribed fee as per autonomous norms.

vii. 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 examination section.

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

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

11. Promotion Rules:

i. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

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

iii. 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.

12. **Course Pattern**

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

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

iii. 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.

13.Grading:

The grade points and letter grade will be awarded to each course based on students' performance as per the grading system shown in the following Table.

% of Marks	Letter Grade	Level	Grade Points
≥ 90	**A+**	Outstanding	10
80 to 89	**A**	Excellent	9
70 to 79	**B**	Very Good	8
60 to 69	**C**	Good	7
50 to 59	**D**	Fair	6
40 to 49	**E**	Satisfactory	5
<40	**F**	Fail	0
ABSENT	**Ab**	Absent	0

14. Computation of SGPA and CGPA

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

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

   where, C_i is the number of credits of the ith subject and G_i is the grade point scored by the student in the ith course

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

   $CGPA = \Sigma (C_i \times Si)/ \Sigma Ci$

   where 'S_i' is the SGPA of the ith semester and C_i is the total number of credits in that semester

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

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

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

vi. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E and F.

vii. As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

   Equivalent Percentage = (CGPA – 0.75) x 10

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

Course	Credit	Grade Obtained	Grade point	Credit x Grade Point
Subject 1	3	B	8	3 X 8 = 24
Subject 2	4	C	7	4 X 7 = 28
Subject 3	3	D	6	3 X 6 = 18
Subject 4	3	A^+	10	3 X 10 = 30
Subject 5	3	E	5	3 X 5 = 15
Subject 6	4	D	6	4 X 6 = 24
	20			139

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

Illustration for CGPA:

	Sem-1	Sem-2	Sem-3	Sem-4	Sem-5	Sem-6	Sem-7	Sem-8
Credits	20	22	25	26	26	25	21	23
SGPA	6.9	7.8	5.6	6.0	6.3	8.0	6.4	7.5

$$\boldsymbol{CGPA = \frac{20\,X6.9 + 22X7.8 + 25X5.6 + 26X6.0 + 26X6.3 + 25X8.0 + 21X6.4 + 23X7.5}{188}}$$

$$\boldsymbol{= \frac{1276.3}{188} = 6.78}$$

15. Award of Class:

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

Class Awarded	CGPA to be secured
First Class with distinction*	≥7.5
First Class	≥6.5 &<7.5
Second Class	≥5.5 &<6.5
Pass Class	≥4 &<5.5
Fail	<4

* Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates

The students who are approved for break in study for entrepreneurships / startups will also be considered for award of first class with distinction

For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall been considered

16.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 year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

17. Transitory Regulations

A candidate, who is detained or discontinued a semester, on re-admission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by Board of Studies and ratified by Academic Council.

18.Curricular Framework for Honors Programme

i. Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

ii. A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

v. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

vi. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii. The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

viii. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

ix. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

x. The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

19. Curricular Framework for Minor Programme

i. Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

ii. Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

iii. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc., or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iv. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

v. There shall be no limit on the number of programs offered under Minor. The college can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

vi. The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vii. A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2^{nd} semester without any history of backlogs. It is expected that the 3^{rd} semester results may program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

viii. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

ix. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

x. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the University/academic council.

xi. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xii. A committee should be formed at the level of College / department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xiii. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript or None of the courses done under the dropped Minor will be shown in the transcript.

xiv. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xv. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor’s degree.

Institution-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Institutions are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Institutions shall also explore the possibilities of collaborations with major industries in the core sectors and professional bodies to create specialized domain skills.

21. **Amendments to Regulations:** The college may from time-to-time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies with the approval of Academic Council and Governing Body of the college.

22. **Transferred Students:**The students seeking transfer to VVIT from various Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by the Academic Council. Only the internal marks obtained in the previous institution will be considered for evaluation of failed subjects.

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ACADEMIC REGULATIONS (R20) FOR B. TECH.

(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II-year B. Tech. from the Academic Year 2021-22 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 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.
   - The candidate shall register for 121 credits and secure all the 121 credits.
   - A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 121 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech Lateral Entry Students.

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
First Class with distinction*	≥ 7.5
First Class	≥ 6.5 &<7.5
Second Class	≥ 5.5 &<6.5
Pass Class	≥ 4 &<5.5
Fail	<4

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

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	Nature of Malpractices/Improper conduct	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not

		candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the

		semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

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 hurt	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 any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

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.

In case any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

COURSE STRUCTURE

Definition of Credit (C)

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

Structure of B. Tech program Regulation R20

S.No.	Category	Code	Suggested Breakup of Credits by AICTE	Suggested Breakup of Credits by APSCHE	Breakup of Credits
1	Humanities and Social Sciences including Management courses	HS	12	10.5	10.5
2	Basic Science courses	BS	25	21	18
3	Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc	ES	24	24	24
4	Professional core courses	PC	48	51	57
5	Professional Elective courses relevant to chosen specialization/ branch	PE	18	15	15
6	Open subjects – Electives from other technical and /or emerging subjects	OE	18	12	12
7	Project work, seminar and internship in industry or elsewhere	PR	15	16.5	13.5
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	MC	Non-Credit	Non-Credit	Non-Credit
9	Skill Oriented Courses	SC	--	10	10
Total			**160**	**160**	**160**

SEMESTER-WISE STRUCTURE OF CURRICULUM

Course structure for eight semesters during four years of study is as follows

I Year I Semester (Semester-1)

S.No.	Course Code	Course Name	L	T	P	C
1	HS1101	Communicative English	3	1	0	3
2	BS1101	Mathematics-I	3	1	0	3
3	BS1102	Engineering Physics	3	1	0	3
4	ES1101	Engineering Graphics	1	0	4	3
5	ES1102	Problem Solving using C	3	1	0	3
6	HS1101L	Communicative English Lab	0	0	3	1.5
7	BS1102L	Engineering Physics Lab	0	0	3	1.5
8	ES1103L	Problem Solving using C Lab	0	0	3	1.5
					Total Credits	**19.5**

Category		Credits
BS	Basic Science Courses	3+3+1.5=7.5
ES	Engineering Science Courses	3+3+1.5=7.5
HS	Humanities and Social Sciences including Management courses	3+1.5=4.5
	Total Credits	**19.5**

I Year II Semester (Semester-2)

S.No.	Course Code	Course Name	L	T	P	C
1	BS1201	Mathematics – II	3	1	0	3
2	BS1202	Engineering Chemistry	3	1	0	3
3	ES1201	Basic Electrical & Electronics Engineering	3	1	0	3
4	ES1202	Building Materials and Construction	3	1	0	3
5	ES1203	Engineering Mechanics	3	1	0	3
6	BS1202L	Engineering Chemistry Lab	0	0	3	1.5
7	ES1201L	Civil Workshop Practice Lab	1	0	3	1.5
8	ES1203L	Basic Electrical & Electronics Lab	0	0	3	1.5
9	MC1201	Indian Constitution	2	0	0	0
					Total	**19.5**

Category		Credits
BS	Basic Science Courses	3+3+1.5=7.5
ES	Engineering Science Courses	3+3+3+1.5+1.5=12
	Total Credits	**19.5**

II Year I Semester (Semester-3)

S.No.	Course Code	Course Name	L	T	P	C
1	BS2101	Mathematics-III	3	1	0	3
2	PC2101	Strength of Materials	3	1	0	3
3	PC2102	Fluid Mechanics	3	1	0	3
4	PC2103	Surveying	3	1	0	3
5	PC2104	Concrete Technology	3	1	0	3
6	PC2101L	Strength of Material Laboratory	0	0	3	1.5
7	PC2102L	Surveying Field Work	0	0	3	1.5
8	PC2103L	Concrete Technology Laboratory	0	0	3	1.5
9	SOC2101	Skill Oriented Course 1	0	0	4	2
10	MC2101	Essence of Indian Knowledge and Tradition	2	0	0	0
					Total	**21.5**

Category		Credits
BS	Basic Science Courses	3
PC	Professional core courses	3+3+3+3+1.5+1.5+1.5=16.5
SOC	Skill Oriented Course	2
	Total Credits	**21.5**

II Year II Semester (Semester-4)

S.No.	Course Code	Course Name	L	T	P	C
1	ES2201	Scientific Computing Using Python	3	1	0	3
2	PC2201	Transportation Engineering	3	1	0	3
3	PC2202	Structural Analysis	3	1	0	3
4	PC2203	Hydraulics & Hydraulic Machinery	3	1	0	3
5	PC2204	Environmental Engineering	3	1	0	3
6	ES2201L	Scientific Computing Using Python Laboratory	0	0	3	1.5
7	PC2202L	Building Planning and Drawing Laboratory	0	0	3	1.5
8	PC2203L	FM & HM Lab	0	0	3	1.5
9	SOC2201	Skill Oriented Course 2	0	0	4	2
					Total	**21.5**
		Internship/Community Service Project 2 Months (Mandatory) during summer vacation				
		Honors/Minor courses	3	1	0	4

Category		Credits
ES	Engineering Science Courses	3+1.5=4.5
PC	Professional core courses	3+3+3+3+3+1.5+1.5=15
SOC	Skill Oriented Course	2
	Total Credits	**21.5**

III Year I Semester (Semester-5)

S.No.	Course Code	Course Name	L	T	P	C
1	HS3101	Engineering Economics And Management	3	1	0	3
2	PC3101	Soil Mechanics	3	1	0	3
3	PC3102	Design and Drawing of Concrete Structures	3	1	0	3
4	OE3101	Open Elective-I	3	1	0	3
5	PE3101	Professional Elective-I	3	1	0	3
6	PC3101L	Environmental Engineering Laboratory	0	0	3	1.5
7	PC3102L	Transportation Engineering Laboratory	0	0	3	1.5
8	PC3103L	Engineering Geology Laboratory	0	0	3	1.5
9	SAC3101	Skill Advanced Course 1	1	0	2	2
10	MC3101	Environmental Studies	2	0	0	0
11	PR	Summer Internship 2 Months (Mandatory) after Second Year (to be evaluated during V semester)	0	0	3	1.5
					Total	**23**
		Honors/Minor courses	3	1	0	4

Category		Credits
HS	Humanities and Social Science Courses	3
PC	Professional Core Courses	3+3+1.5+1.5+1.5=10.5
PE	Professional Elective Courses	3
OE	Open Elective Courses/Job Oriented Elective Courses	3
SAC	Skill Advanced Course/Soft Skills Course	2
PR	Summer Internship	1.5
MC	Mandatory course (AICTE)	0
	Total Credits	**23**

III Year II Semester (Semester-6)

S.No.	Course Code	Course Name	L	T	P	C
1	HS3201	Universal Human Values	3	1	0	3
2	PC3201	Design and Drawing of Steel Structures	3	1	0	3
3	PE3201	Professional Elective-II	3	1	0	3
4	PE3202	Professional Elective-III	3	1	0	3
5	OE3201	Open Elective-II	3	1	0	3
6	PC3201L	STAAD Laboratory	0	0	3	1.5
7	PC3202L	Geotechnical Engineering Laboratory	0	0	3	1.5
8	SAC3201	Skill Advanced Course 2	1	0	2	2
9	MC3201	Entrepreneurial Skills Development	2	0	0	0
					Total	**20**
		Industrial/Research Internship 2 Months (Mandatory) during summer vacation				
		Honors/Minor courses	3	0	2	4

Category		Credits
HS	Humanities and Social Science Courses	3
PC	Professional Core Courses	3+3+1.5+1.5=9
PE	Professional Elective Courses	3
OE	Open Elective Courses/Job Oriented Elective Courses	3
SAC	Skill Advanced Course/Soft Skills Course	2
	Total Credits	**20**

IV Year I Semester (Semester-7)

S.No.	Course Code	Course Name	L	T	P	C
1	PC4101	Estimation Specification and Contracts	3	1	0	3
2	PC4102	Water Resources Engineering	3	1	0	3
3	PE4102	Professional Elective-IV	3	1	0	3
4	PE4103	Professional Elective-V	3	1	0	3
5	OE4101	Open Elective- III	3	1	0	3
6	OE4102	Open Elective- IV	3	1	0	3
7	SAC4101	Skill Advanced Course 3	1	0	2	2
8	PR	Industrial / Research Internship 2 Months (Mandatory) after Third Year (to be evaluated during VII semester)	0	0	3	3
					Total	**23**
		Honors/Minor courses	3	0	2	4

Category		Credits
PC	Professional Core Courses	3
PE	Professional Elective Courses	3+3+3=9
OE	Open Elective Courses/Job Oriented Elective Courses	3+3=6
SAC	Skill Advanced Course/Soft Skills Course	2
PR	Summer Internship	3
	Total Credits	**23**

IV Year II Semester (Semester-8)

S. No	Subject code	Course Name	L	T	P	C
1	PROJ4201	Major Project Project work, seminar, and internship in industry	0	0	0	12
		Internship (6 months)				
					Total Credits	**12**

Skill oriented course/Skill advanced courses

Subject code	Track-1 (Softwares)	Track-2 (Advanced Technologies)	Track-3 (Field Applications)
SOC2101	Advanced AutoCAD	Smart Contracts	Water & Waste Water Treatment Plant
SOC2201	Digital Land Surveying Laboratory	Machine Learning Applications in Civil Engineering	Foundation Design using Admixtures in Low bearing capacity Soils
SAC3101	Soft skills	Soft skills	Soft skills
SAC3201	Revit Architecture and Energy Analysis/Open Roads	ARVR Applications in Civil Engineering	Analysis & Assessment of New Building Materials Adoption
SAC4101	Bentley Pro-Structures/E-Tabs/IIT Pave/Tekla	BIM	Health Monitoring of Structures

Open Elective Courses

Open Elective- I	Open Elective- II	Open Elective- III	Open Elective- IV
Building Services	Green Technologies	Green Buildings	Safety Engineering
Disaster Management	Alternative Energy Sources	Low cost Housing	Remote Sensing & GIS
Traffic Safety	Element of Civil Engineering (Other than Civil Engineering)	Environmental Pollution and Control	Smart Cities
Project Management	Geo-Spatial Technologies	Forensic of Civil Engineering	Architecture and Town Planning

Professional Elective Courses

Professional Elective- I	Professional Elective- II	Professional Elective- III	Professional Elective- IV	Professional Elective- V
Advanced Strength of Materials	Earthquake Resistant Design of Structures	Swayam/ NPTEL / MOOCS Courses (12 Weeks Duration)	Prestressed Concrete Structures	Advanced Design of Steel Structures
Reinforced Soil Structures	Earth Retaining Structures		Special Geotechnical Construction	Ground Improvement Techniques
Air pollution and control	Industrial Waste and Waste water Engineering		Solid Waste Management	Environmental Impact Assessment
Airport Planning and Design	Road Safety Engineering		Pavement Analysis and Design	Transportation Economics
Water Shed Management	Ground Water Development and Management		Urban Hydrology	Irrigation and Hydraulic Structures

Courses for Honors degree

Pool-I (Structural Engineering)	Pool-II (Transportation Engineering)	Pool-III (Geotechnical Engineering)	Pool-IV (Environmental Engineering)
Advanced Concrete Technology	Advanced Traffic Engineering	Advanced Soil Mechanics	Advanced Water Supply Systems
Matrix Methods of Structural Analysis	Pavement Construction, Maintenance and Management	Soil Foundation Interaction	Environment and Ecology
Advanced Reinforced Concrete Design	Transport System and Management	Rock Mechanics	Ground Water Contamination & Remediation
Design of Prestressed Concrete Strucutres	GIS Applications In Transportation Engineering	Construction in Expansive Soils	Water Quality Modelling
MOOC-1*(NPTEL/SWAYAM)Duration: 12 Weeksminimum			
MOOC-2*(NPTEL/SWAYAM)Duration: 12 Weeksminimum			

*Course/subject titlecan't be repeated

Note:

1. **Students has to acquire 16 credits with minimum one subject from each pool**
2. **Compulsory MOOC/NPTEL course for 4 credits (2 course, each 2 credited)**

General Minor Tracks

Department of Civil Engineering

S.No.	Course Name	L	T	P	C
1	Building Materials and Construction	3	1	2	4
2	Surveying	3	1	2	4
3	Environmental Engineering	3	1	2	4
4	Quantity Surveying	3	1	2	4
5	Construction Technology and Management	3	1	2	4
6	Environmental Pollution and Control	3	1	2	4

Note:

1. Students can opt any 4 subjects from the pool
2. Compulsory MOOC/NPTEL course for 4 credits (2 course, each 2 credited)

VVIT Life skill courses

The following courses are admitted to be the **courses beyond curriculum** to improve individual life skills. These courses and will be demonstrated in the class room and will be having an internal assessment for satisfactory.

S. No	Year and Semester	Course Name
1	I Year I Semester (Semester-1)	Quantitative Aptitude
2	I Year II Semester (Semester-2)	Verbal Ability
3	II Year I Semester (Semester-3)	Understanding Self for Effectiveness
4	II Year II Semester (Semester-4)	Design Thinking
5	III Year I Semester (Semester-5)	Stress and Coping Strategies
6	III Year II Semester (Semester-6)	Research Skills

I-Year-I Semester	Communicative English	L	T	P	C
HS1101		3	1	0	3

Course objectives:

The main objectives are

1. Adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Unit – 1: **13 HOURS**

Detailed Study: A Proposal to Girdle the Earth (Excerpt) by Nellie Bly

Theme: Exploration

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

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Non-Detailed Study:

1. "How to Fashion Your Own Brand of Success" by Howard Whitman

2. "How to Recognize Your Failure Symptoms" by Dorothea Brande

Unit-2: **13 HOURS**

Detailed Study: An excerpt from The District School as It Was by One Who Went to It by Warren Burton

Theme: On Campus

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

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

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

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, signposts and transition signals; use of articles and zero article; prepositions.

Non-detailed Study:

3. "How to Conquer the Ten Most Common Causes of Failure" by Louis Binstock

4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz

Unit-3: **13 HOURS**

Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes. **Non-Detailed Study:** **5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand** **6. "How to Raise Your Self-Esteem and Develop Self-confidence" by James W Newman**
Unit-4: 13 HOURS **Detailed Study: H.G Wells and the Uncertainties of Progress by Peter J. Bowler** **Theme: Fabric of Change** **Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role-plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms **Non-Detailed Study** **7. "How to Win Your War against Negative Feelings" by Dr Maxwell Maltz** **8. "How to Find the Courage to Take Risks" by Drs. Tom Rusk and Randy Read**
Unit-5: 13 HOURS **Detailed Study: Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far** **Theme: Tools for Life** **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) **Non-Detailed Study** **9. "How to Become a Self-Motivator" by Charles T Jones** **10. "How to Eliminate Your Bad Habits" by OgMandino**

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

CO1	identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and formulate sentences using proper grammatical structures and correct word forms **(Describe, relate, tell, find L-3)**
CO2	speak clearly on a specific topic using suitable discourse markers in informal discussions **(Discuss, outline, explain, predict – L3)**
CO3	write summaries based on global comprehension of reading/listening texts **(Use, categorize, complete, solve L-3)**
CO4	produce a coherent paragraph interpreting a figure/graph/chart/table **(Identify, compare, explain, illustrate L4)**

Text books:
1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019 2. University of Success by OgMandino, Jaico, 2015.
Reference books:
1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014. 2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012. **AICTE Recommended Books** 5. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press, 2018. 6. Pushplata and Sanjay Kumar. Communication Skills, Oxford University Press, 2018. 7. Kulbushan Kumar. Effective Communication Skills. Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing

1-language.com
http://www.5minuteenglish.com/
https://www.englishpractice.com/

Grammar/Vocabulary

English Language Learning Online
http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/
http://www.nonstopenglish.com/
https://www.vocabulary.com/
BBC Vocabulary Games
Free Rice Vocabulary Game

Reading

https://www.usingenglish.com/comprehension/
https://www.englishclub.com/reading/short-stories.htm
https://www.english-online.at/

Listening

https://learningenglish.voanews.com/z/3613
http://www.englishmedialab.com/listening.html

Speaking

https://www.talkenglish.com/
BBC Learning English – Pronunciation tips
Merriam-Webster – Perfect pronunciation Exercises

All Skills

https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		1
CO2									2	3		1
CO3									2	3		1
CO4									2	3		1
CO5									2	3		1

BS1101		3	1	0	3

Preamble: This course illuminates the students in the concepts of calculus.

Course objectives:

The main objectives are

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Unit–1: **13 HOURS**
Differential equations of first order and first degree
Linear differential equations-Bernoulli's equations - Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

Unit–2: **13 HOURS**
Linear differential equations of higher order
Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type $e^{ax}, \sin ax, \cos ax,$ polynomials in x^n , $e^{ax}V(x)$ and $x^n V(x)$ - Method of Variation of Parameters.
Applications: LCR circuit – Simple harmonic motion

Unit–3: **12 HOURS**
Mean value theorems
Mean value theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

Unit–4: **14 HOURS**
Partial differentiation
Introduction – Homogeneous function – Euler's theorem **-** Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Unit–5: **13 HOURS**
Multiple integrals
Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.
Applications: Areas by double integrals and Volumes by triple integrals.

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

CO1	solve the differential equations related to various engineering fields.
CO2	utilize mean value theorems to real life problems.
CO3	familiarize with functions of several variables which is useful in optimization.

	dimensional and 3 – dimensional coordinate systems.

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. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd. 2. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Micro-Syllabus of MATHEMATICS – I (Calculus)

Unit-1: Differential equations of first order and first degree:
Linear differential equations-Bernoulli's equations - Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

Unit	**Module**	**Micro content**
1a. & 2a. Differential equations of first order and first degree	Linear differential equations	Solution of Linear differential equations in $'y'$
		Solution of Linear differential equations in $'x'$
		Initial value problem
	Non-Linear differential equations	Bernoulli's equations
		Equations reducible to Linear differential equations
	Exact differential equations	Solution of Exact differential equations
	Non-Exact differential equations	Equations reducible to Exact equations
		Integrating factor found by inspection
		Integrating factor of a Homogeneous equation
		Integrating factor for an equation of the type $f_1(xy)\,ydx + f_2(xy)\,xdy = 0$
		Integrating factor, if $\dfrac{\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}}{N}$ be a function of $'x'$
		Integrating factor, if $\dfrac{\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}}{M}$ be a function of 'y'
1b. & 2b. Applications	Application of differential equations of first order and first degree	Newton's Law of cooling
		Law of natural growth and decay
		Orthogonal trajectories
		Electrical circuits

Unit-2: Linear differential equations of higher order:
Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^n V(x)$ - Method of Variation of Parameters.
Applications: LCR circuit – Simple harmonic motion

Linear differential equations of higher order	higher order with constant coefficients	
	Non-homogeneous equations of higher order with constant coefficients	Particular integral of the type 'e^{ax}'
		Particular integral of the type 'sinax' (or) '$\cos ax$'
		Particular integral of the type x^n
		Particular integral of the type 'e^{ax} V(x)'
		Particular integral of the type '$x^n v(x)$'
3b. & 4b. Applications	Applications of Non-homogeneous equations of higher order with constant coefficients	Method of variation of parameters
		LCR circuit
		Basic problems on simple harmonic motion

Unit-3: Mean value theorems:
Mean value theorems (without proofs): Rolle's theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

Unit	Module	Micro content
5a. & 6a. Mean value theorems	Mean value theorems	Rolle's theorem
		Lagrange's mean value theorem
5b. & 6b. Mean value theorems	Mean value theorems	Cauchy's mean value theorem
		Taylor's expansions of $f(x)$
		Maclaurin's expansions of $f(x)$

Unit-4: Partial differentiation:
Introduction – Homogeneous function – Euler's theorem **-** Total derivative – Chain rule – Jacobians – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Unit	Module	Micro content
7a. & 8a. Partial differentiation	**Partial Differentiation**	Euler's theorem
		Total derivative
		Chain rule
		Jacobians
7b. & 8b. Applications	**Applications of Partial Differentiation**	Taylor's and Mc Laurent's series expansion of functions of two variables
		Maxima and Minima of functions of two variables
		Lagrange's method of undetermined multipliers

Unit-5: Multiple integrals:
Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.
Applications: Areas by double integrals and Volumes by triple integrals.

Unit	Module	Micro content
9a. & 10a. Multiple integrals	Evaluation of Double Integrals	Double integrals
		Change of order of integration
		Double integrals in Polar co-ordinates
		Change of variables

	Applications of Multiple Integrals	Areas by double integrals
		Volumes by triple integrals

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

I-Year-I Semester	ENGINEERING PHYSICS	L	T	P	C
BS1102		3	1	0	3

Course objectives:

Engineering Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by Vasireddy Venkatadri Institute of Technology, which serves as a transit to understand the branch specific advanced topics.

The course is designed to:

- Impart Knowledge of physicaloptics phenomena like Interference and Diffraction required to design instruments with higher resolution.
- Impart knowledge in basic concepts of LASERs and Holography along with their engineering applications
- Impart the knowledge of materials with characteristic utility in appliances.
- Impart the knowledge on acoustic quality of concert halls and concepts of flaw detection techniques using ultrasonic.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.

Unit-I: Wave Optics: 13 HOURS **Interference:**PrincipleofSuperposition-Interferenceoflight – ConditionsforsustainedInterference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry) **Diffraction:**Fraunhofer Diffraction: - Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).
Unit– II: LASERs and Holography 13 HOURS **LASERs:** Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications. **Holography:** Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms
Unit-III: Magnetism and Dielectrics 13 HOURS **Magnetism**: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr Magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material. **Dielectrics:** Introduction- Dielectricpolarization, Dielectric polarizability, Susceptibility and Dielectricconstant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.
Unit-IV: ACOUSTICS AND ULTRASONICS 15 HOURS **Acoustics**: Introduction – Reverberation - Reverberation time - Sabine's formula–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies. **Ultrasonics**: Properties –Production of ultrasonics by Magnetostriction & Piezoelectric methods – Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays–applications.
Unit-V: ELASTICITY 11 HOURS Stress & strain —stress &strain curve– generalized Hooke's law – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.

CO1	**Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.
CO2	**Learn** the basic concepts of LASER light Sources and Apply them to holography
CO3	**Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
CO4	**Analyze** acoustic properties of typically used materials in buildings
CO5	**Understand** the concepts of shearing force and moment of inertia

Text books:

1. "Engineering Physics" by B. K. Pandey, S. Chaturvedi - Cengage Publications, 2012
2. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand, 2017.
3. "Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
4. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

Reference books:

1. "Engineering Physics" by M.R.Srinivasan, New Age international publishers (2009).
2. "Optics" by AjoyGhatak, 6^{th} Edition McGraw Hill Education, 2017.
3. "Solid State Physics" by A.J.Dekker, Mc Millan Publishers (2011).

Micro-Syllabus of Engineering Physics

Unit-I: Wave Optics:
Interference: Principle of Superposition – Interference of light – Conditions for sustained Interference – Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry)
Diffraction: Fraunhofer Diffraction:- Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

Unit	Module	Micro content
Ia. Interference	Principle of Superposition & Interference of light	Introduction to interference
		Principle of superposition
		Coherence
		Conditions for sustained Interference
	Interference in thin films	Interference in thin films by reflection (cosine's law)
		Complementary nature
		Colours of thin film
	Newton's Rings	Newton's Rings(reflected geometry)
		Experimental arrangement & conditions for diameters
		Applications: determination of wavelength of monochromatic source and refractive index of the given transparent liquid.
Ib. Diffraction	Fraunhofer Diffraction - Diffraction due to single slit	Differences between Fresnel's and Fraunhofer's diffraction
		Differences between interference and diffraction
		Fraunhofer diffraction due to single slit(quantitative)
		Fraunhofer diffraction due to circular aperture (qualitative)
	double slit	Fraunhofer diffraction due to double slit (qualitative)

		Intensity distribution curves
	Diffraction grating& Resolving powers	Grating spectrum, missing orders and maximum number of orders possible with a grating
		Rayleigh's criterion for resolving power
		Resolving power of grating, Telescope and Microscope (qualitative)

Unit– II: LASERs and Holography

LASERs: Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

Holography: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

Unit	**Module**	**Micro content**
IIa. LASERs	Interaction of radiation with matter	Introduction to LASERS
		Spontaneous emission
		Stimulated emission
	Einstein's coefficients	Einstein's coefficients
		Population inversion
		Pumping mechanisms
	LASERS construction and working	Ruby laser
		Helium-Neon laser
		Applications of Lasers
IIb. Holography	Principle of holography	Introduction and Principle of holography
		Differences between photography and holography
	construction and reconstruction of hologram	Construction of hologram
		Reconstruction of hologram
		Applications of holography

Unit-III: Magnetism and Dielectrics

Magnetism: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

Dielectrics: Introduction- Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

Unit	**Module**	**Micro content**
IIIa. Magnetism	Introduction& Origin of permanent magnetic moment	Introduction to Magnetism, Definitions of Magnetic dipole moment, Magnetization, Magnetic susceptibility and Permeability
		Origin of magnetic moment
		Bohr magneton
	Classification of magnetic materials	Dia magnetic materials
		Para magnetic materials
		Ferro magnetic materials
	Domain concept of Ferromagnetism &	Domain concept of Ferromagnetism
		Hysteresis Curve
		Soft and hard magnetic materials classification based

<table>
<tr><td rowspan="10">IIIb. Dielectrics</td><td rowspan="3">Introduction& definitions</td><td>Introduction to dielectrics</td></tr>
<tr><td>Dielectric polarization, Dielectric polarizability, susceptibility</td></tr>
<tr><td>Dielectric constant</td></tr>
<tr><td rowspan="3">Types of polarizations</td><td>Electronic polarization (Quantitative)</td></tr>
<tr><td>Ionic polarization (Quantitative)</td></tr>
<tr><td>Orientational polarizations (Qualitative)</td></tr>
<tr><td rowspan="4">Internal field& Claussius –Mossotti's equation</td><td>Lorentz Internal fields in solids</td></tr>
<tr><td>Clausius-Mossotti's equation</td></tr>
<tr><td>Frequency dependence of polarization</td></tr>
<tr><td>Applications of Dielectrics</td></tr>
<tr><td colspan="3">Unit-IV: ACOUSTICS AND ULTRASONICS
Acoustics: Introduction – Reverberation - Reverberation time - Sabine's formula–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.
Ultrasonics: Properties –Production of ultrasonics by Magnetostriction & Piezoelectric methods – Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays–applications.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="8">IVa. Acoustics</td><td rowspan="3">Introduction & Reverberation</td><td>Introduction to acoustics</td></tr>
<tr><td>Definition of Reverberation</td></tr>
<tr><td>Definition of Reverberation time</td></tr>
<tr><td rowspan="3">Sabine's formula & absorption</td><td>Sabine's formula derivation</td></tr>
<tr><td>Absorption coefficient</td></tr>
<tr><td>Determination of Absorption coefficient</td></tr>
<tr><td rowspan="2">Factors affecting acoustics of buildings</td><td>Basic requirements for acoustically good halls</td></tr>
<tr><td>Factors affecting acoustics of buildings and their remedies</td></tr>
<tr><td rowspan="9">IVb. Ultrasonics</td><td rowspan="3">Properties &Production of ultrasonics</td><td>Introduction and Properties of Ultrasonics</td></tr>
<tr><td>Production of ultrasonics by Magnetostriction method</td></tr>
<tr><td>Production of ultrasonics by Piezoelectric method</td></tr>
<tr><td rowspan="2">Non-Destructive Testing</td><td>Non-Destructive Testing using Pulse echo system</td></tr>
<tr><td>Non-Destructive Testing through transmission and reflection modes</td></tr>
<tr><td rowspan="4">Different scanning techniques</td><td>A - Scan</td></tr>
<tr><td>B - Scan</td></tr>
<tr><td>C - Scan</td></tr>
<tr><td>Applications of Ultrasonics</td></tr>
<tr><td colspan="3">Unit-V: ELASTICITY: Stress & strain –stress &strain curve– generalized Hooke's law – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="5">V.ELASTICITY</td><td rowspan="3">Stress & strain</td><td>Introduction to Elasticity, Stress & Strain</td></tr>
<tr><td>Stress & Strain curve (Behavior of a wire under increasing load)</td></tr>
<tr><td>Generalized Hooke's law</td></tr>
<tr><td rowspan="2">Different types of moduli and their relations</td><td>Young's modulus, Bulk modulus, Rigidity modulus and Poisson's ratio</td></tr>
<tr><td>Relations among Young's, Bulk and Rigidity moduli</td></tr>
</table>

		Cantilever and depression of cantilever (Cantilever supported at its ends and loaded in the middle)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

I-Year-I Semester

L	T	P	C

Course objectives:

The main objectives are

1. Expose the students to use Drafting packages for generating Engineering curves and conventions followed in Preparation of engineering drawings.
2. Make the students to understand the concepts of orthographic projections of Lines and Plane Surfaces.
3. To understand the concepts of orthographic projections of Regular Solids.
4. Develop the ability of understanding sectional views and Development of Solid Surfaces.
5. Enable them to use computer aided drafting packages for Conversion of Isometric view to Orthographic Projection and vice versa.

UNIT-I: INTRODUCTION TO AUTOCAD: 15 HOURS Basic commands, Customization, ISO and ANSI standards for coordinate dimensioning, Annotations, layering, 2D drawings of various mechanical components, 2D drawings of various electrical and electronic circuits. Creation of engineering models- floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; (Experiments should be Planned According to respective Core Branch Applications)
UNIT-II: THEORY OF PROJECTION: 12 HOURS Principles of Orthographic Projections-Convention: Projections of Points, Projections of Lines inclined to both planes, Projections of planes inclined to one Plane & Projections of planes inclined to both Planes
UNIT III: PROJECTIONS OF REGULAR SOLIDS 12 HOURS Projections of Solids –with the axis perpendicular to one of the principal planes, with the axis Inclined to one of the principal planes, Projections of Solids –with the axis Inclined to Both the principal planes
UNIT IV: DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS 13 HOURS Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and, Cone. Draw the sectional orthographic views of geometrical solids
UNIT V: ISOMETRIC PROJECTIONS 13 HOURS Conversion of isometric views to orthographic views, drawing of isometric views - simple Solids, Conversion of orthographic views to isometric views of simple Drawings

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

CO1	Prepare engineering drawings as per BIS conventions Understand level, KL2}
CO2	Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software {Apply level, KL3}
CO3	Use the knowledge of orthographic projections of Solids to represent engineering information/concepts and present the same in the form of drawings {Apply level, KL3}

	Applications {Apply level, KL3}
CO5	Develop isometric drawings of simple objects reading the orthographic projections of those objects {Analyze level, KL4}

Text books:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Graphics with Autocad by Kulkarni D.M, PHI Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

Reference books:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan) ISBN: 9789386551870, 938655187X RUPAPUBLICATIONS

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	–	3	–	–	–	–	2	–	1
CO2	2	1	1	–	3	–	–	–	–	2	–	1
CO3	2	2	2	–	3	–	–	–	–	2	–	1
CO4	2	2	2	–	3	–	–	–	–	2	–	1
CO5	2	2	2	–	3	–	–	–	–	2	–	1

I-Year-I Semester	Problem Solving using C	L	T	P	C
ES1102		3	1	0	3

Course objectives:

The main objectives are

1. To familiarize to notion of an algorithm, editing and executing programs in Linux.
2. To Understanding branching, iteration.
3. To represent Data using arrays.
4. To use Modular programming and recursive solution formulation.
5. To familiarize pointers and dynamic memory allocation.
6. To handle data through files

UNIT-I: Introduction to C **13 HOURS**

Introduction to Computers: hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.

Programming Style - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements

Casting - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

UNIT-II: Control Flow & Modules **13 HOURS**

Selection: if-else Statement, nested if, examples, Multiway selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled andCondition-Controlled Loops, for, while and do while.

Branching: break & continue.

Modular Programming: Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument.

Recursion: Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.

UNIT-III Arrays & Strings **12 HOURS**

Arrays: Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments.

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.

Unit – IV Pointers & Structures **14 HOURS**

Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments, Passing by address, Dangling memory, Pointer Arithmetic, Character pointers, Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments.

Structures: Derived types, Structure's declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.

UNIT-V: Files **13 HOURS**

Writing to Text Files, File copy, merge, Writing and reading records, Random File Access.

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

CO1	**Understand** algorithms and basic terminology of C
CO2	**Solve** problems using control structures and modular approach
CO3	**Make** use of 1D and 2D arrays along with strings for linear data handling
CO4	**Determine** the use of pointers and structures
CO5	**Implement** various operations on data files.

Text books:

1. ANSI C Programming, E Balaguruswamy, Mc-GrawHill, 5th Edition
2. ANSI C Programming, Gary J. Bronson, Cengage Learning.
3. Programming in C, ReemaThareja, OXFORD Publications

Reference books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Let us C, YashwantKanetkar, BPB Publications
3. Mastering in C, KR Venu Gopal, TMH

Micro-Syllabus of Problem Solving and Programming in C

UNIT I: Introduction to Computers: Hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.
Programming Style - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements
Casting - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

Unit	Module	Micro content
Introduction to C	Introduction to Computers	Components of Computer: Hardware & Software
		Algorithm and its characteristics
		Program development steps
		Structure of a C Program
		Features of C
		The main () function and standard I/O functions
	Programming Style	Indentation, Comments, Identifiers, Data Types
		Operators, Precedence and Associativity. Variables and Declarations
		Format Modifiers, Escape Sequences
		Types of Statements
	Casting	Implicit Type Conversions
		Explicit Type Conversions
		Mathematical Library Functions

UNIT II: Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled andCondition-Controlled Loops, for, while and do while. **Branching**: break & continue. **Modular Programming:** Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument. **Recursion:** Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.		
Control Flow & Modular Programming	Selection Statements	if else, nested if examples
		Multi Way Selection: switch, else if examples
	Iterative Statements	Counter Controlled Loops
		Logic Controlled Loops
	Unconditional Branching	Break & Continue
	Modular Programming	Function and Parameter Declarations
		Returning a Value
		Types of parameters. Parameter – scalar data as argument.
	Recursion	Definition, Base condition for recursion
		Mathematical Recursion
		Recursion versus Iteration
UNIT III: Arrays: Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arraysas Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments. **Strings:** String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.		
Arrays & Strings	Arrays	Introduction to Arrays, Input and Output of Array Values, Array Initialization
		Arraysas Function Arguments
		Two-Dimensional Arrays, Larger Dimensional Arrays
		Matrices, 1D & 2D arrays as arguments
	Strings	String Fundamentals, String Input and Output
		String Processing, Library Functions
		Strings as arguments
UNIT IV: Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments,Passing by address, Dangling memory, Pointer Arithmetic, Character pointers, Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments. **Structures**: Derived types, Structures declaration, Initialization of structures, accessing structures,nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.		
Pointers and Structures	Pointers	Concept of a Pointer, Initialization of Pointer variables
		Pointers as function arguments,Passing by address
		Dangling memory, Pointer Arithmetic, Character pointers
		Pointers to Pointers
		Dynamic Memory Allocation
		Pointer to Arrays and Array of Pointers
	Command line Arguments	Command line Arguments
	Structures	Derived types, Structures declaration, Initialization of structures
		Accessing structures,nested structures, arrays of structures

		Unions, typedef, enum, bit-fields.
UNIT V: Storage classes – auto, static, extern, register. Preproessor statements **Data Files**: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and Writing to TextFiles, File copy, merge, Writing and reading records, Random File Access.		
Storage Classes and Files	Storage Classes	auto, static, extern and register
	Preprocessor Statements	Preprocessor Statements
	Data Files	Declaring, Opening, and Closing File Streams
		File handling functions, Reading from and Writing to TextFiles
		File copy, merge, Writing and reading records
		Random File Access

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	2	1	-	-	-	3	3	1	2	1	2
CO2	2	3	3	2	-	-	-	-	1	1	2	2	2	2
CO3	3	3	3	2	-	-	-	-	2	1	2	2	2	3
CO4	2	2	2	2	-	-	-	-	2	1	2	2	2	2
CO5	2	2	2	2	-	-	-	-	2	1	2	2	1	2

I-Year-I Semester	COMMUNICATIVE ENGLISH LAB	L	T	P	C
HS1101L		0	0	3	1.5

Course Objective:

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

CO2. take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3)

CO3. write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3)

Detailed Syllabus

Introduction to Sound system of English

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols.

Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.

Intonation - Stress and accent in connected speech. Types and functions of Intonation in English.

I. **A. Speaking**: Introducing Yourself and Others
B. Listening: Conversation between two and more people.

II. **A. Speaking:** Speak for a minute in response to a question about personal experience / wish.

III. **A. Speaking:Group discussion** – 5 minutes followed by a summary –1 or 2 minutes: Topics- 1. Features that make a place beautiful, 2. The most challenging job you can think of, 3. Some skills that everyone should learn, 4. The best criteria to measure success, 5. A recent news story that is interesting, 6. Impact of technology on the music industry, 7. An app that has helped society, 8. Pros and Cons of after school tutorials, 9. How to stay safe on Social Media, 10. The most common reasons why friendships fall apart, 11. Interactions with seniors on campus, 12. Coping with peer pressure, 13. Others’ opinion vs your belief, 14. Feeling that plants would express if they could, 15. Growing up alone vs Growing up with siblings, 16. Uniforms stifle individuality, 17. In India summer is the best and worst of times, 18. A good sense of humour is a definite perk, 19. All fast food is not junk food and 20. Ideas to make your common room in college more inviting. Question Answer sessions – 1. Idea of a Tech Startup, 2. Training programme of T&P Cell, 3. Inter-college Cultural Fest, 4. 3-day Foreign University delegation visit to the campus, 5. Computer training programme by a reputed MNC, 6. Shifting your Dept or Classrooms to new location on campus, 7. How to manage attendance while attending additional courses (Minors/Honors), 8. How to choose placement offers? 9. Involvement in Student Affairs through SAC, 10. Planning an excursion.
B. Listening:1. Comprehension Exercise on Teamwork, 2. Predicting what the speaker would say from the title of the talk, 3. Comprehension based on a narrative or a short video, TED Talks

IV. **A. Speaking:** Preparing speech using picture clues, asking Q&A using pictures.
B. Listening: Listening Comprehension using short films, audio files, interviews of famous personalities

V. **A. Speaking:** Preparing 30-day planner,Using important phrasal expressions in speech, Oral Presentations on – 1. Setting goals is important2. Asking the right question is the skill you need to develop, 3. Do college students want their parents’ attention4. Everyone needs to learn how to cook5. Doing household chores is everyone’s responsibility 6. Study groups facilitate peer-monitoring7. Is it OK for students to do things just because they want to fit in? 8. Students should compulsorily make time for physical activity, 9. Taking breaks to pursue other interests improves academic performance, 10. Strategies to avoid stress, 11. How best to use the media for educational activities, 12. Why volunteer for service activities? 13. International student exchange programme, 15. Work-life balance 16. Strategies to build on your strength and overcome weaknesses, 17. Strategies to build confidence and self-esteem18. Procrastination kills opportunities, 19. Setting a budget and sticking to it, 20. Grooming and etiquette 21. Pros and Cons of being Competitive, 22. Virtual classroom vs real classroom, 23. Freedom brings more responsibility 24. To-do lists help you become more productive 25. Having a diverse group of friends is an asset 26. One thing you wish you had learnt in High school 27. Why is it important to be non-judgmental towards others? 28. Humans need empathy, 29. Public speaking is a necessary skill 30. How to build and maintain good professional relationships.
B. Listening: Listening Comprehension, Speeches by Famous personalities

Pair work, Role-play, conversational practice and Individual speaking activities based on following essays from University of Success.

1. “How to Fashion Your Own Brand of Success” by Howard Whitman

2. “How to Recognize Your Failure Symptoms” by Dorothea Brande

3. “How to Conquer the Ten Most Common Causes of Failure” by Louis Binstock

4. “How to Develop Your Strength to Seize Opportunities” by Maxwell Maltz

5. “How to Make the Most of Your Abilities” by Kenneth Hildebrand

7. “How to Win Your War against Negative Feelings” by Dr Maxwell Maltz

8. “How to Find the Courage to Take Risks” by Drs. Tom Rust and Randy Reed

9. “How to Become a Self-Motivator” by Charles T Jones

10. “How to Eliminate Your Bad Habits”byOgMandino

Text Books

1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2ndEdition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

AICTE Recommended Books

1. Meenakshi Raman and Sangeeta Sharma. *Technical Communication.* Oxford University Press,2018.
2. Pushplata and Sanjay Kumar. *Communication Skills*, Oxford University Press, 2018.
3. Kulbushan Kumar. *Effective Communication Skills.* Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing

1. 1-language.com
2. http://www.5minuteenglish.com/
3. https://www.englishpractice.com/

Grammar/Vocabulary

4. English Language Learning Online
5. http://www.bbc.co.uk/learningenglish/
6. http://www.better-english.com/
7. http://www.nonstopenglish.com/
8. https://www.vocabulary.com/
9. BBC Vocabulary Games
10. Free Rice Vocabulary Game

Reading

11. https://www.usingenglish.com/comprehension/
12. https://www.englishclub.com/reading/short-stories.htm
13. https://www.english-online.at/

Listening

14. https://learningenglish.voanews.com/z/3613
15. http://www.englishmedialab.com/listening.html

17. BBC Learning English – Pronunciation tips
18. Merriam-Webster – Perfect pronunciation Exercises

All Skills

19. https://www.englishclub.com/
20. http://www.world-english.org/
    http://learnenglish.britishcouncil.org/

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		1
CO2									2	3		1
CO3									2	3		1

I-Year-I Semester	ENGINEERING PHYSICS LAB	L	T	P	C
BS1102L		0	0	3	1.5

Course Objectives:

The Applied Physics Lab is designed to:

- Understand the concepts of interference and diffraction and their applications.
- Apply the concept of LASER in the determination of wavelength.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect.
- Illustrate the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Course Outcomes:

The students will be able to:

1. Operate optical instruments like microscope and spectrometer
2. Determine thickness of a paper with the concept of interference
3. Estimate the wavelength of different colours using diffraction grating and resolving power
4. Plot the intensity of the magnetic field of circular coil carrying current with distance
5. Calculate the band gap of a given semiconductor

LIST OF EXPERIMENTS(Any 10 of the following listed 15 experiments)

1. Determination of wavelength of a Source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Variation of dielectric constant with temperature
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. LASER - Determination of wavelength by plane diffraction grating
11. Verification of laws of vibrations in stretched strings – Sonometer.
12. Determine the radius of gyration using compound pendulum
13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
14. Dispersive power of diffraction grating.
15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

I-Year-I Semester	PROBLEM SOLVING USING C LAB (Common to All Branches)	L	T	P	C
ES1103L		0	0	3	1.5

Course Objectives:

3. To design & develop of C programs using arrays, strings pointers & functions.
4. To review the file operations, pre-processor commands.

Exercise 1

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.

2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.

3. Write a C program to display multiple variables.

Exercise 2

1. Write a C program to calculate the distance between the two points.

2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3

1. Write a C program to convert a string to a long integer.

2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.

3. Write a C program to calculate the factorial of a given number.

Exercise 4

1 .Write a program in C to display the n terms of even natural number and their sum.

2. Write a program in C to display the n terms of harmonic series and their sum.

1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.

3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5

1. Write a program in C to print all unique elements in an array.

2. Write a program in C to separate odd and even integers in separate arrays.

Exercise 6

1. Write a program in C for multiplication of two square Matrices.

2. Write a program in C to find transpose of a given matrix.

Exercise 7

1. Write a program in C to search an element in a row wise and column wise sorted matrix.

2. Write a program in C to print individual characters of string in reverse order.

Exercise 8

1. Write a program in C to compare two strings without using string library functions.

2. Write a program in C to copy one string to another string.

Exercise 9

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation

2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.

2. Write a program in C to add two numbers using pointers.

Exercise 11

1. Write a program in C to add numbers using call by reference.

2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12

1. Write a program in C to swap elements using call by reference.

Exercise 13

1. Write a program in C to show how a function returning pointer.

2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand & write the difference.

2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15

1. Write a program in C to check whether a number is a prime number or not using the function.

2. Write a program in C to get the largest element of an array using the function.

Exercise 16

1. Write a program in C to append multiple lines at the end of a text file.

2. Write a program in C to copy a file in another name.

3. Write a program in C to remove a file from the disk.

Course Outcomes: By the end of the Lab, the student able to

1. **Comprehend** the various concepts of a C language
2. **Develop** algorithms and flowcharts
3. **Design** and development of C problem solving skills.
4. **Acquire** modular programming skills.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	2	1	-	-	-	3	3	1	2	1	2
CO2	2	3	3	2	-	-	-	-	1	1	2	2	2	2
CO3	3	3	3	2	-	-	-	-	2	1	2	2	2	3
CO4	2	2	2	2	-	-	-	-	2	1	2	2	2	2

I-Year-II Semester	MATHEMATICS-II	L	T	P	C
BS1201		3	1	0	3

Course objectives:

The main objectives are

1. To elucidate the different numerical methods to solve nonlinear algebraic equations
2. To disseminate the use of different numerical techniques for carrying out numerical integration
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

UNIT-1: Iterative methods	**11 HOURS**
Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.	
UNIT-2: Interpolation	**14 HOURS**
Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.	
UNIT-3: Numerical integration and solution of ordinary difference equations	**12 HOURS**
Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential 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–4: Laplace Transforms:	**14 HOURS**
Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof) Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.	
UNIT 5: Fourier series and Fourier Transforms:	**14 HOURS**
Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series. Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.	

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

CO1	Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)
CO2	Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals (SOLVE,APPLY, FIND)

	(SOLVE,APPLY, FIND)
CO4	Find or compute the Fourier series of periodic signals (SOLVE, APPLY, FIND, ANALYSE)
CO5	Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE, APPLY, FIND)

Text books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers

Reference books:

1. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. **H.K.Das,** Advanced Engineering Mathematics, 22^{nd} Edition, S. Chand & Company Ltd.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10^{th} Edition, Wiley-India.

Micro-Syllabus of MATHEMATICS-II

UNIT-1: Iterative methods: Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

Unit	Module	Micro content
1a. & 2.a **Solving given polynomial**	Numerical solution of algebraic and transcendental polynomials	Bisection method
		Method of false position
		Iteration method
		Newton-Raphson's method
1b. & 2b. **Solving linear system**	Solving linear system	Jacobi's method
		Gauss-seidel method

UNIT-2: Interpolation: Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for
Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

Unit	Module	Micro content
3a. & 4a. **Equal-Spaced difference tables**	Finite difference tables	Forward, backward & central difference tables
		Errors in polynomials
	Finding functional values for given data	Newton's forward and backward difference interpolation formula
		Gauss forward and backward difference interpolation formula
3b. & 4b. **Unequal spaced data & relation between various**	Unequal spaced data & relation between various operators	Lagrange's interpolation formula
		Relation between various operators (Shift, forward, backward, central, average & differential

UNIT-3: Numerical integration and solution of ordinary difference equations:
Trapezoidal rule–Simpson's 1/3rd and 3/8th rule–Solution of ordinary differential 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	Module	Micro content
5a. & 6a. Numerical integration	Numerical Integration	Trapezoidal rule
		Simpson's 1/3rd rule
		Simpson's 3/8th
	Numerical solution of ordinary differential equations for single variable	Taylors series method
		Picard's method
		Euler's method
5b. & 6b. Numerical solution of ordinary differential equations for single variable		Modified Euler's method

UNIT – 4: Laplace Transforms: Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)
Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

Unit	Module	Micro content
7a. & 8a. Laplace Transforms	Laplace transforms and theorem	Shifting theorems
		Derivatives and integrals
		Multiplication and division
7b. & 8b. Inverse Laplace transforms and Applications	Periodic functions &Inverse Laplace Transforms	Periodic functions
		Dirac delta functions
		Evaluation integrals using Laplace Transforms
		Solving differential equations using Laplace transforms

UNIT 5: Fourier series and Fourier Transforms:
Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.
Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals

Unit	Module	Micro content
9a. & 10a. **Fourier Series**	Fourier Series	Periodic functions
		Dirichlet’s conditions
		Even and odd function’s
		Change of interval
		Half range sine and cosine series
9b. & 10b. **Fourier Transforms**	Fourier Transforms	Fourier Sine and Cosine integral
		Properties of Fourier Transforms
		Fourier and Inverse Fourier Transforms
		Fourier cosine and Inverse Fourier cosine Transforms
		Fourier sine and Inverse Fourier sine Transforms
		Finite Fourier Transforms
		Inverse Finite Fourier Transforms

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

(Strong – 3; Moderate – 2; Weak – 1)

I-Year-II Semester	ENGINEERING CHEMISTRY	L	T	P	C
BS1202		3	1	0	3

Knowledge of basic concepts of chemistry for Engineering students will help them as professional engineers later in design and material selection as well as utilizing the available resources.

Course objectives:

1. Significance and use of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
2. Outline the basics for the construction of electrochemical cells, batteries and fuel cells.Understand the mechanism of corrosion and how it can be prevented.
3. Importance of advanced materials and their engineering applications.
4. Differentiate and discuss the materials used in major industries like steel industry, metallurgical industries, construction industries, electrical equipments and manufacturing industries. Lubrication is also summarized.
5. Essentiality of fuel technology.
6. Need of water purification and importance of various water purification methods.

UNIT-I: POLYMER TECHNOLOGY **13 HOURS**

Polymerisation: Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

Plastics: Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers: Natural rubber-Drawbacks-Vulcanization-Preparation-Propertiesand applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

Composite Materials: Fiber reinforced plastics-CFRP and GFRP.

Conducting polymers: Polyacetylene, doped conducting polymers- p-type and n-type doping.

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION **13 HOURS**

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H_2–O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion: Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

UNIT-III: CHEMISTRY OF MATERIALS **14 HOURS**

Nano materials: Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene- carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation method, and applications.

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

Lubricants: Definition, mechanism of lubricants and properties (definition and importance).

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,

Introduction-calorific value - HCV and LCV – problems using Dulong's formula – proximate and ultimate analysis of coal sample – significance of these analysis – problems – petroleum (refining – cracking) – synthetic petrol (Fischer-Tropsch & Bergius) – petrol knocking, diesel knocking – octane and cetane rating – anti-knocking agents – introduction to alternative fuels (bio-diesel, ethanol, methanol, natural gas, LPG, CNG) – Flue gas analysis by Orsat apparatus – rocket fuels.
UNIT-V: WATER TECHNOLOGY 12 HOURS Hardness of water – determination of hardness by complexometric method – boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement) – internal treatments – softening of hard water (zeolite process and ion exchange process) – treatment of industrial waste water – potable water and its specifications – steps involved in purification of water – chlorination, break point chlorination – reverse osmosis and electro dialysis.

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

CO1	explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
CO2	know the importance of various materials and their uses in the construction of batteries and fuel cells.
CO3	to acquire the knowledge of nanomaterials, refractories, lubricants and cement.
CO4	assess the quality of various fuels.
CO5	understand the importance of water and its usage in various industries.

Text books:

1. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publicating Co., Latest Edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 Edition.
3. Engineering Chemistry by Prasanth Rath, B. Ramadevi, Ch. Venkata Ramana Reddy, Subendu Chakravarthy; Cengage Publications, 2019 Edition.

Reference books:

1. A text book of Engineering Chemistry by S.S. Dara, S. S. Umare; S. Chand & Co., Ltd., Latest Edition.
2. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co., Latest Edition.

Micro-Syllabus of ENGINEERING CHEMISTRY

UNIT-I: POLYMER TECHNOLOGY 14 HRS

Polymerisation:Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

Plastics: Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers: Natural rubber-Drawbacks-Vulcanization-Preparation-Properties and applications of

Composite Materials: Fiber reinforced plastics-CFRP and GFRP.

Conducting polymers: Polyacetylene, doped conducting polymers- p-type and n-type doping.

Bio degradable polymers: Biopolymers and biomedical polymers.

Unit	**Module**	**Micro content**
Ia. Polymerization	Introduction, Methods of Polymerization And Properties of Polymers	Introduction - Polymer, monomer, functionality and polymerization. Methods of polymerisation - Emulsion and suspension Physical and mechanical properties of polymers.
Plastics	Compounding of plastics, fabrication of polymer articles, preparation, properties and applications of some polymers, e-plastic and disposal of e-plastic waste	Compounding of plastics Fabrication of polymer articles – compression, injection, blowing, extrusion Preparation, properties and applications of PVC, ploycarbonates and Bakelite Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.
Elastomers	Natural Rubber, vulcanization, synthetic rubbers	Natural rubber – Drawbacks – Vulcanization Preparation – Properties and applications of synthetic rubbers – Buna S, thiokol and polyurethane rubbers.
Composite materials	Fiber reinforced plastics	Fiber Reinforced Plastics (FRP) – CFRP and GFRP.
Conducting polymers	Polyacetylene polymer, p-type and n-type doping	Polyacetylene, doped conducting polymers- p-type and n-type doping.
Biodegradable polymers	Biopolymers and biomedical polymers	Biopolymers and biomedical polymers – polylactic acid polyglycolic acid polymers

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION
12 HRS

Single electrode potential - Electrochemical series and uses of series - Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H_2 –O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

***Corrosion**:* Definition - theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic

protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).		
Unit	**Module**	**Micro content**
Introduction	Single electrode potential	Oxidation potential
		Reduction potential
Concentration cells	Electrode concentration cell and electrolyte concentration cell	Electrode concentration cell and electrolyte concentration cell
Electro chemical series	Electro chemical series	Definition – Electro chemical series
		Significances of Electro chemical series
		Differences between Electro chemical series and galvanic series
Reference electrodes	Standard Hydrogen Electrode	Working Principle and Construction of a – Standard Hydrogen Electrode – Calomel Electrode – Glass Electrode
	Calomel Electrode	
	Glass Electrode	
Corrosion	Introduction	Definition – Corrosion
	Theories of Corrosion	Chemical Theory of Corrosion / Dry Corrosion Electro Chemical Theory of Corrosion / Wet Corrosion
	Types of Corrosion	Galvanic corrosion, Differential aeration corrosion, Stress corrosion, Water-line corrosion
	Passivity of metals	Passivity, Examples for passive metals
Factors affecting rate of Corrosion	(a) Nature of metal	*(a) Nature of metal:* (i) Position of metal in the Galvanic series (ii) Purity of metal (iii) Relative surface area of anodic and cathodic metal (iv) Nature of oxide film (v) Physical state of metal (vi) Solubility and volatility of corrosion products
	(b) Nature of environment	*(b) Nature of environment:* (i) Temperature (ii) Humidity (iii) pH of the medium (iv) Establishment of oxygen concentration cell (v) Impurities of the atmosphere (vi) Polarization of electrodes

methods		current
	|Cathodic and Anodic coatings	Galvanizing and Tinning
	Electroplating	Electroplating with example
	Electroless plating	Nickel Electroless plating
	Paints	Constituents of paints and its functions

UNIT-III: CHEMISTRY OF MATERIALS **12 HRS**

***Nano materials**:* Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene- carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation method, and applications.

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

Lubricants: Definition, mechanism of lubricants and properties (definition and importance).

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	**Module**	**Micro content**
Nano materials	Introduction, Sol-gel method, BET, TEM and SEM Methods	Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene- carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation method, and applications.
Refractories	Definition, Classification of Refractories, Failure of Refractories	Definition , classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.
Lubricants	Definition, Mechanism of Lubrication	Definition, mechanism of lubricants and properties (definition and importance).
Cement	Constituents of Portland cement, clinker formation, lime saturation factor, setting and hardening of cement, deterioration of 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: FUELS **12 HRS**

ultimate analysis of coal sample – significance of these analysis – problems – petroleum (refining – cracking) – synthetic petrol (Fischer-Tropsch & Bergius) – petrol knocking, diesel knocking – octane and cetane rating – anti-knocking agents – introduction to alternative fuels (bio-diesel, ethanol, methanol, natural gas, LPG, CNG) – Flue gas analysis by Orsat apparatus – rocket fuels.

Unit	**Module**	**Micro content**
Introduction	Introduction to fuels	Calorific Value – Higher Calorific Value – Lower Calorific Value
		Problems using Dulong’s formula
	Coal Analysis	Proximate analysis of coal and Significances
		Ultimate analysis of coal and Significances
Crude oil or Petroleum	Refining of Petroleum	Refining of Petroleum with schematic diagram,
		Cracking of Petroleum
Synthetic petrol	Fischer-Tropsch and Bergius methods	Fischer-Tropsch & Bergius methods with schematic diagram
Knocking of petrol and diesel	Knocking of petrol and diesel	Petrol knocking, diesel knocking – octane and cetane rating – anti-knocking agents
Alternative fuels	Introduction, biodiesel, ethanol, natural gas, LPG, CNG	Introduction to alternative fuels (bio-diesel, ethanol, methanol, natural gas, LPG, CNG), rocket fuels.
Flue Gas	Flue Gas Analysis	Flue gas analysis by Orsat apparatus

UNIT-V: WATER TECHNOLOGY
12 HRS

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

Unit	**Module**	**Micro content**
Hardness of water	Introduction, Determination of Hardness	Temporary hardness, Permanent hardness and Total hardness
		Determination of Hardness by complexometry
Boiler troubles	Boiler troubles	Priming and foaming, scale formation, boiler

Internal treatments	Softening of hard water	Zeolite process and ion exchange process
		Treatment of industrial waste water
Potable water	Potable water and its specifications	Potable water and its specifications
Purification of water	Purification of water, Reverse osmosis and Electro dialysis.	Steps involved in purification of water – chlorination, break point chlorination – reverse osmosis and electro dialysis.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2					2					
CO2	2	2					2					
CO3	2	2					2					
CO4	2	2					2					
CO5	2	2					2					

(Strong – 3; Moderate – 2; Weak – 1)

ES1201	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	1	0	3

Course objectives:

1. To introduce basics of electric circuits and to teach DC and AC electrical circuit analysis.
2. To explain the working principles DC machines and speed control of various DC motors.
3. To explain the working principles of transformers and AC machines and its applications.
4. To introduce the basics of semiconductor physics and operation and applications of Diodes.
5. To introduce the basics of transistors and explain the transistor configurations

Unit	Content	Hours
Unit 1 DC & AC Circuits:	**DC Circuits:** Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only] **AC Circuits:** Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor.[Elementary treatment only]	**14 HOURS**
Unit 2 DC Machines:	**DC Generator:** Construction-Principle and operation of DC Generator - EMF equation -Types– Applications [Elementary treatment only] **DC Motor**: Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test- Swinburne's test-Applications. [Elementary treatment only]	**13 HOURS**
Unit 3 AC Machines:	**Single Phase Transformer:** Construction, Principle and operation of Single-Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only] **Three Phase Induction Motor**: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only]	**13 HOURS**
Unit 4 Semiconductor Devices:	Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.	**13 HOURS**
Unit 5 Bipolar Junction Transistors:	Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.	**12 HOURS**

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

CO3	Illustrate working principles of DC and AC Machines. (Understand, Apply)
CO4	Describe working principles of diodes and transistors. (Understand, Apply)
CO5	Understand the applications of diodes and transistors. (Understand, Analyze)

Text books:

1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference books:

1. L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

Micro-Syllabus of Basics of Electrical & Electronics Engineering

UNIT-I: DC & AC Circuits:

DC Circuits:

Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only]

AC Circuits:

Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor. [Elementary treatment only]

Unit	**Module**	**Micro content**
1.a DC Circuits	Definitions & circuit elements	Definitions of Voltage, Current, Power & Energy
		Types and Classification of circuit elements: R, L, C elements Active, Passive; unilateral, bilateral; linear, nonlinear; lumped, distributed elements
	Ohm's law, KCL, KVL, Voltage & Current Division rules	Ohm's Law. Active elements -Representation of Voltage and current sources in ideal and Practical cases and Passive elements –Voltage & Current relationship of R - L and C elements
		Kirchhoff's Voltage and current laws –series and parallel circuits of R, L & C elements, Voltage and Current division rules for resistive circuit only
	STAR-DELTA transformation	star-delta and delta-star transformations of resistive circuit only [Elementary treatment only]
1.b AC Circuits	Phasor representation & AC fundamentals	Representation of sinusoidal waveforms –Phase difference and phasor representation of sinusoidal waveforms
		Peak, Average and RMS values for sinusoidal waveforms only
	AC circuits & Power	Definitions of reactance and Impedance, real power - reactive power - apparent power - power factor. [Elementary treatment only]

UNIT-II: DC Machines:

DC Generator:

Construction, Principle and operation of DC Generator - EMF equation - Types - Applications

DC Motor: Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test- Swinburne's test-Applications. [Elementary treatment only]		
Unit	**Module**	**Micro content**
2.a DC generators	DC generator principle of operation & applications	Construction details of dc generator-Field System, Armature
		Principle and operation of DC generator
		derivation of generated EMF-Simple problems on generated EMF
		Types of dc generators- Separately and Self excited (Shunt and series generators equivalent circuit [Elementary treatment only]) and applications.
2.b DC Motors	DC Motor principle of operation & Back EMF	Principle operation of DC Motor
		Significance of Back EMF-Simple problems on Back EMF
		Derivation of Torque Equation-Simple problems on Torque Equation Torque equation of DC motor
	Types of DC motors & Applications	Types of DC Motors (Shunt and series motors equivalent circuit) and Applications
	DC motor Speed control techniques	speed control (armature and field control methods)
	Testing of DC machines	Brake test procedure-Swinburne's test procedure [Elementary treatment only]

UNIT-III: AC Machines: **Single Phase Transformer:** Construction, Principle and operation of Single-Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only] **Three Phase Induction Motor**: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].		
Unit	**Module**	**Micro content**
3.a Single Phase transformer	Basics of transformer	Construction, principle of operation of single-phase transformer, Types of single-phase transformer
	EMF equation & Phasor diagram	EMF Equation of a transformer and simple problems on EMF equation of single-phase transformer
		Ideal Transformer on NO load with phasor diagram
	Transformer performance	Losses, Efficiency. [Elementary treatment only]
3.b. Three Phase Induction Motor	Basics of 3-phase induction motor	Construction and principles of 3-phase induction motor
	Types and applications	Types (Squirrel Cage and slip ring induction motor construction)- Applications

UNIT – IV: Semiconductor Devices

Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

Unit	Module	Micro content
4.a. Semiconductor physics & Diodes	Semiconductor Physics	Classification of materials based on energy band diagram
		Current density in conductor, Intrinsic semiconductor & properties of silicon and germanium
		Extrinsic semiconductor: P-type and N-type, Conductivity of extrinsic semiconductor and law of mass action, Diffusion & Drift currents-N junction formation.
	PN Junction Diode & Zener Diode	Working principle of PN junction diode: forward bias, reverse bias
		Diode current equation (Expression only), Basic problems on usage of diode current equation.
		Diode circuit models: Ideal Diode Model, Ideal Diode Model with V_{γ},. Reverse breakdown phenomena, Zener diode characteristics
4.b Diode Applications	Voltage regulator	Zener Diode as Voltage Regulator
	Diode Rectifier Circuits	PN junction Diode Rectifiers (Working principle, Input and Output Waveforms and Expressions of output DC voltage for each) PN junction Diode Rectifiers (Working principle, Input and Output Waveforms and Expressions of output DC voltage for each)
	Clipper circuits	Bridge. Basics of Clippers: Series Positive, Series negative, Shunt Positive, Shunt negative, Dual clipping (without bias voltage).

UNIT V: Bipolar Junction Transistors

Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics.[Elementary treatment only], Transistors as amplifiers, op-amp basics.

Unit	Module	Micro content
5.a BJT	BJT construction & working	Periodic functions Construction, Configuration and models
		Working of BJT, Definitions of α, β and γ
	BJT CB,CE characteristics	CB characteristics: Input, output characteristics , current relation, dynamic input and output resistances and base-width modulation
		CE characteristics: Input, output characteristics , current relation, dynamic input and output resistances
	BJT Amplifier	Transistor as an amplifier

	characteristics	Ideal characteristics of OP-AMP
	Basic OP-amp circuits	Inverting amplifier circuit
		Non-inverting amplifier circuit

CO PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3											1
CO4	3	2										1
CO5	3											1
AVG	3	2										1

(Strong – 3; Moderate – 2; Weak – 1)

ES1202		3	1	0	3

Course objectives:

The main objectives are

1. Identify various building materials and their structural requirements.
2. Review different types of masonry construction.
3. Explain the significance of cement and lime in construction.
4. Identify the suitable material for construction and various building components.
5. Discuss about various building services and finishing.

Unit-I: BUILDING MATERIALS-I 12 HOURS

Stones: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone

Aggregates: Classification of aggregate – Coarse and fine aggregates

Bricks: Composition of good brick earth, various methods of manufacturing of bricks.

Unit– II: BUILDING MATERIALS-II13 HOURS

Tiles: Characteristics of good tile - manufacturing methods, types of tiles.

Steel: General; Manufacture of steel; Uses of steel; Market forms of steel.

Glass: Manufacture of glass

Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber

Unit-III: BUILDING MATERIALS-III14 HOURS

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance

Unit-IV: BUILDING COMPONENTS AND MASONRY 13 HOURS

Building Components: Lintels, arches, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, Types of roofs – King and Queen post Trusses. R.C.C Roofs, Pre-fabricated roofs.

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls

Unit-V: BUILDING SERVICES AND FINISHES 13 HOURS

Building Services: Plumbing services, water distribution, sanitary lines and fittings, ventilators, functional requirements.

Finishing: Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish.

Formwork, Scaffolding

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

CO1	Identify suitability of stones, bricks, tiles, glass and steel as building materials. {Understand level, KL2}
CO2	Make out the appropriate masonry to be used for building construction and importance of wood {Apply level, KL3}

CO4	Pick up the appropriate building components for comfortable construction. {Apply level, KL3}
CO5	Identify the appropriate type of finishing techniques and building services which are generally used in buildings. {Understand level, KL2}

Text books:

1. Engineering Materials by S.C.Rangwala
2. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
3. Building Construction, B.C. Punmia, Laxmi Publications (p) ltd.

Reference books:

1. S.K. Duggal "Building Materials"- New age International Publisher,
2. R.K. Rajput "Engineering Materials (Including construction materials)"-, S.Chand Publications.
3. P.C Varghese "Building Construction" Prentice-Hall of India Private Ltd.

Micro-Syllabus of Building Materials and Construction

Unit-I: BUILDING MATERIALS-I

Stones: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone

Aggregates: Classification of aggregate – Coarse and fine aggregates

Bricks: Composition of good brick earth, various methods of manufacturing of bricks.

Unit	Module	Micro content
Ia/Ib.Building Materials-I	Stones	Properties of building stones
		Classification of Stone- Physical, Chemical and Geological
		Stone Quarrying
		Precaution in Blasting
		Dressing of Stone
	Aggregates	Aggregates definition
		Classifications of Aggregates based on size, Geological origin, Shape
	Bricks	Composition of Goof Brick Earth
		Harmful Ingredients in Brick Earth
		Comparison between brickwork and stonework
		Manufacturing of Bricks
		Tempering of Clay- Pug Mill
		Burning- Clamps
		Burning- Intermittent and Continuous Kilns
		Qualities of good Brick

Unit– II: BUILDING MATERIALS-II

Tiles: Characteristics of good tile - manufacturing methods, types of tiles.

Steel: General; Manufacture of steel; Uses of steel; Market forms of steel.

Glass: Manufacture of glass

Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber.

Materials-II		Manufacturing of Common and Encaustic Tiles
		Characteristic of Good Tile
		Types of Common Tiles- Drain Tiles, Roof Tiles, Floor or paving Tiles
	Steel	Steel- Introduction
		Manufacturing of Steel
		Bessemer’s Process
		Cementation Process
		Crucible steel process
		Duplex Process
		Eletyric Process
		L.D. Process
		Open-Hearth process
		Uses of Steel
		Market forms of Steel
	Glass	Introduction to Glass
		Classification of Glass based on chemical composition
		Types of Glass properties and their uses
		Manufacturing of Glass
	Wood	Classification of Trees
		Structure of Tree- Macro and Micro Structure
		Processing of Timber
		Seasoning of Timber
		Different of methods of Seasoning
		Conversion of Timber
		Preservation of Timber
		Defects in Timber
		Industrial Timber- Vbeneers, Plywood, Fiberboard, Impreg timber, compreg Timber, Hard Board, GUlam, Chip Board, Block Board, Flush Door Shutters
		List of Indian Timber Trees used for Engineering purposes

Unit-III: BUILDING MATERIALS-III

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance

Unit	Module	Micro content
IIIa/IIIb.Building Materials-III	Lime	Classification of Binding Materials
		Sources of Lime
		Constituent of Limestone
		Classification of Lime- Fat Lime, Hydraulic Lime, Poor Lime
		I.S Classification of Lime
		Comparison between fat lime and Hydraulic Lime
		Manufacturing of Fat Lime
		Manufacturing of Natural Hydraulic Lime

		Precaution while handling Lime
	Cement	Characteristics of Cement
		Properties of Cement
		Composition of Ordinary Cement
		Function of Cement Ingredients
		Harmful Constituents of cement
		Setting action of Cement
		Field Test for cement
		Laboratory Test for Cement
		Uses of Cement
		Varieties of Cement

Unit-IV: BUILDING COMPONENTS AND MASONRY

Building Components: Lintels, arches, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, Types of roofs – King and Queen post Trusses. R.C.C Roofs, Pre-fabricated roofs.

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

Unit	Module	Micro content
IVa/ IVb. Building Components and Masonry	Building Components	Lintels
		Definition
		Classification of Arches
		Classification of Arches
		Arches
		Definition
		Components of Arches
		Classification of Arches
		Stair Case
		Definition, terminology
		Classification of Stairs
		Floor
		Different Types of Floors
		Cement Concrete Flooring
		Mosaic Flooring
		Terrazzo Flooring
		Roof
		Types of Roofs
		King-Post Truss
		Queen Post Truss
		Madras- Terrace roofing
		Pre-fabricated roof
	Masonry	Advantage of Masonry
		Terminology
		Types of bonds
		Classification of Stone Masonry
		Rubble Masonry
		Ashlar Masonry
		Cavity Walls
		Partition Walls
		Types of Partition walls

functional requirements.

Finishing: Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of paint – Types of paints – Painting of new/old wood- Varnish.

Formwork, Scaffolding

Unit	**Module**	**Micro content**
Va/Vb. Building Services and Finishing	Building Services	Plumbing Services
		Water distribution
		Sanitary Line
		Sanitary Fittings
		Ventilator and its requirements
	Finishing	Damp Proofing
		Types of Damp proofing
		Materials used for Damp Proofing
		Water Proofing
		Types of Water proofing
		Materials used for Water Proofing
		Plastering
		Types of Plastering
		Pointing
		Paint
		Constituents of paint
		Types of paint
		Painting of various Surfaces
		Varnish
		Types of varnishes
		White washing and Colour Washing
	Scaffolding and formwork	Scaffolding
		Components
		Types of Scaffolding
		Form Work
		Classification of formwork

CO – PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1		2		1		2	1				
CO2	1		2			2	2					

CO4	1				3							
CO5	1				3							

I-Year-II Semester ES1203	ENGINEERING MECHANICS	L	T	P	C
		3	1	0	3

Course objectives:

The main objectives are

1. To understand the resolution of forces, equilibrium of force systems
2. To learn the analysis of forces in the structures and also the basic concepts of friction and its Applications to simple systems.
3. To understand the concepts of centroid, moment of inertia, centre of gravity and mass moment of inertia.
4. To understand the basic concepts of kinematics and kinetics.
5. To learn the concepts of work energy method and impulse momentum

UNIT- I: INTRODUCTION TO ENGINEERING MECHANICS 13 HOURS

Force systems: Basic Concepts, Resultant of coplanar concurrent forces, Components of force in space, Moment of force and its applications, couples and resultant of force systems, Equilibrium of Force Systems, Free body diagram, Equations of equilibrium, Equilibrium of planar and spatial system.

UNIT-II: ANALYSIS OF STRUCTURES AND FRICTION 11 HOURS

Trusses: Introduction, Analysis of trusses by method of joints, method of sections;

Friction: Introduction to Friction, Laws of friction, Application to simple systems and connected systems.

UNIT-III: CENTROID AND CENTRE OF GRAVITY, AREA MOMENT OF INERTIA AND MASS MOMENT INERTIA 14 HOURS

Centroid: Centroid of simple figures from basic principles, centroid of composite sections;

Centre of Gravity: Center of gravity of simple body from basic principles, Center of gravity of composite bodies, Pappus theorems.

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

Mass Moment of Inertia: Introduction of Mass Moment of Inertia, mass moment of inertia of composite bodies

UNIT IV: INTRODUCTION TO KINEMATICS AND KINETICS 14 HOURS

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – V: WORK -ENERGY METHOD 13 HOURS

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method

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

CO1	Compute the resultant and moment of a force system and apply the equations of equilibrium for a generalized force system **(Apply)**
CO2	Solve the forces in trusses, frames and also friction in various mechanical devices. **(Apply)**

	and understand the physical applications of these properties. (**Apply**)
CO4	Apply the basic concepts of dynamics to solve problems of engineering applications (**Apply**)
CO5	Solve problems using work energy equations for translation, fixed axis rotation and plane motion. (**Apply**)

Text books:

1. Reddy Vijay Kumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics.

2.S.P. Timoshenko and D.H. Young, Engineering Mechanics, McGraw-Hill International Edition,1983.

3. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Reference books:

1. Engineering Mechanics statics and dynamics – R.C. Hibbeler, 11th Edn – Pearson Publ.

2. Mechanics for Engineers, statics - F.P. Beer & E.R. Johnston – 5th Edn Mc Graw Hill Publ.

3. Engineering Mechanics statics and dynamics, A Nelson, Mc Graw Hill publications

Micro-Syllabus of ENGINEERING MECHANICS

UNIT- I: INTRODUCTION TO ENGINEERING MECHANICS

Force systems: Basic Concepts, Resultant of coplanar concurrent forces, Components of force in space, Moment of force and its applications, couples and resultant of force systems, Equilibrium of Force Systems, Free body diagram, Equations of equilibrium, Equilibrium of planar and spatial system.

Unit	Module	Micro content
1a. ***Force systems***	INTRODUCTION	Basic Concepts
		Resolving forces into rectangular components
		Classification of force system
	Resultant of forces	Resultant of coplanar concurrent forces. Parallelogram law of method **(Simple problems on analytical method only)**
		Components of force in space (**Simple problems using vector method for finding resultant)**
		Moment of force & couples Varignon's theorem **(Simple problems on analytical method only)**
		resultant of force systems
1b. Equilibrium	Equilibrium of Force Systems	Defining constraint, Types of supports and reaction forces
		Free body diagram
		Equilibrium of Force Systems
		Equations of equilibrium
		Equilibrium of planar system

		(Simple problems on vector method)

UNIT-II: ANALYSIS OF STRUCTURES AND FRICTION

Trusses: Introduction, Analysis of trusses by method of joints, method of sections;

Friction: Introduction to Friction, Laws of friction, Application to simple systems and connected systems.

Unit	Module	Micro content
2.a. ANALYSIS OF STRUCTURES	***Trusses***	Introduction, Analysis of trusses
		Analysis of trusses by method of joints **(Simple problems on 2D Truss only)**
		Analysis of trusses by method of sections **(Simple problems on 2D Truss only)**
2.b. Friction	***Friction***	Introduction, Applications of Friction
		Laws of friction
		Cone of friction
		Simple 2D problems on Friction

UNIT-III:

CENTROID AND CENTRE OF GRAVITY, AREA MOMENT OF INERTIA AND MASS MOMENT INERTIA

Centroid: Centroid of simple figures from basic principles, centroid of composite sections;

Centre of Gravity: Center of gravity of simple body from basic principles, Center of gravity of composite bodies, Pappus theorems.

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

Mass Moment of Inertia: Introduction of Mass Moment of Inertia, mass moment of inertia of composite bodies

Unit	Module	Micro content
3. CENTRE OF GRAVITY & MOMENT OF INERTIA	***Centroid***	Derivation of Centroid for simple figures such as Triangle, sector and semi circle from basic principles
		Centroid of composite sections
		Simple problems on *Centroid* of composite sections
	Centre of Gravity	Derivation of Center of gravity for simple body such as cylinder and cone from the basic principles
		Pappus theorems
	Area moments of Inertia	Definition, Parallel axis theorem and Perpendicular axis theorem
		Simple problems on *Area moments of Inertia*
	Mass Moment of Inertia	Mass Moment of Inertia importance and its Derivation for simple bodies such as cylinder and

UNIT IV: INTRODUCTION TO KINEMATICS AND KINETICS

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

Unit	**Module**	**Micro content**
4a. *Kinematics*	Rectilinear motion	Equations of motion in linear motion **Simple problems on linear motion**
		Projectile motion **Simple problems on Rectilinear motion**
	Curvilinear motion	Equations of motion in Curvilinear motion
		Relation between Linear and curvilinear moton (**Simple problems)**
	Motion of Rigid Body	Types and their Analysis in Planar Motion. (**Finding Instantaneous center)**
4b. *Kinetics*	Analysis as a Particle	D Alembert's principle
		Simple problems on Translatory motion using D Alembert's principle
	Analysis as a Rigid Body	Central Force Motion
		Equations of Plane Motion – Fixed Axis Rotation
		Rolling Bodies
		Simple problems on Rolling Bodies

UNIT – V: WORK -ENERGY METHOD

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

Unit	**Module**	**Micro content**
5. WORK - ENERGY METHOD	Work-Energy Applications to Particle Motion	Derivation of work energy method
		Simple problems on Translation using work energy method
		Simple problems on Connected System using work energy method
	Impulse momentum method	**Simple problems using Impulse momentum method**
		Simple problems on Connected System using Impulse momentum method

CO-PO mapping

C01	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C02	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C03	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C04	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C05	3	2	2	1	1	-	-	-	-	-	1	1	2	2

I-Year-II Semester ES1201L	CIVIL WORKSHOP PRACTICE LAB	L	T	P	C
		1	0	3	1.5

Course objectives: The course content aims to

1. Familiarize various tools and techniques used in carpentry
2. Train on different welding techniques
3. Understand building house wiring
4. Understand brick masonry methods
5. Familiarize various components used for Plumbing

Section	Contents	Mapped CO
I	**Carpentry** 1. Half-lap joint: Join two wooden blocks with the help of half-lap joint. 2. Dovetail joint: Join two wooden blocks with the help of dovetail joint. 3. Sawing and finishing: Prepare a plain smooth block (cuboid) of timber of given dimension using sawing and planning operations.	**CO1**
II	**Welding** 1. Fillet welding: Join two given plates at right angle using fillet weld. 2. But welding: Join two given plates using but weld. 3. Spot welding: Lap joint of two thin sheets using resistance spot welding.	**CO2**
III	**House wiring** 1. Parallel and series connection of two bulbs 2. Tube light and fan with regulator wiring 3. Bulb operating with Two way switch 4. Control and regulation of electrical devices using sensors	**CO3**
IV	**Masonry** 1. Assemble a L shape brick wall of 0.9 m length and 0.6 m height on each side with 9” and 4.5” thicknesses by arranging bricks in English bond (using only wet mud as mortar). Ensure that wall is in line, plumb and at right angle to a given structure 2. Assemble a T shape brick wall of 1.2 m length and 0.6 m height on each side with 9” and 4.5” thicknesses by arranging bricks in Flemish bond (using only wet mud as mortar). Ensure that wall is in line, plumb and at right angle to a given structure 3. Mark level of given height from ground level at different locations in the workshop using water pipe technique	**CO4**
V	**Plumbing**	**CO5**

	1. Identify various supply pipes and pipe fittings (like pipes of different diameter, nipple, reducer, union, T, elbow, tap etc) used in plumbing. 2. Identify various drain pipes and sanitary fittings(like p-trap, gully trap, etc) used in plumbing. 3. Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, T, elbow, tap etc. (This may involve basic tasks such as marking, cutting, threading, etc and use of appropriate techniques so that water leakage does not occur) and then dissemble this pipe line. 4. Various chemicals used for water sealing.	

***Any 2 experiments from each section should be completed.**

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

CO1	Understand variouscarpentry tools and techniques **{Understand}**
CO2	Develop different welding joints **{Apply level}**
CO3	Understand wiring methods for various electrical fittings. **{Understand}**
CO4	Differentiate construction of brick masonry in English and Flemish bond methods **{Analyze}**
CO5	Recognize various components and their functions of elements used for Plumbing **{Remember}**

CO-PO mapping

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											1		
CO2	3	2											1		
CO3	3	1											1		
CO4	3	3											2		
CO5	3	1											1		

(Strong – 3; Moderate – 2; Weak – 1)

I-Year-II Semester	ENGINEERING CHEMISTRY LAB	L	T	P	C
BS1202L		0	0	3	1.5

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations quantitative analysis .

Course objectives:

1. To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2. To expose the students in practical aspects of the theoritical concepts like pH, hardness of water etc.
3. To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

List of Experiments:(Any 10 of the following listed 16 experiments)

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Copper (II) using standard EDTA solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Iron (III) by colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9. Determination of concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ presence in an egg shell.
13. Estimation of vitamin- C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Prepatation of nylon-6, 6 and Bakelite (demonstration only)

eference Books:

. Text Book of Quantitative Analysis, Arthur J. Vogel.

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

CO1	To estimate the amount of metal ions present in different solutions (L4 & L3)
CO2	To analyze the quality parameters of water (L4)
CO3	To determine the strength of different solutions by using different instrumentation techniques (L3)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3							2			
CO2	2	2							2			
CO3	2	3							2			

(Strong – 3; Moderate – 2; Weak – 1)

I-Year-II Semester ES1203L	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

Course objectives:

1. To Verify Kirchhoff's laws, Voltage and Current division rules.
2. To learn speed control and testing of DC Shunt Motor.
3. To learn and understand the operation of induction motor.
4. To learn applications of diodes and transistors.

List of Experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Voltage division rule and current division rule.
3. Speed control of DC Shunt Motor.
4. Perform Brake test on DC Shunt Motor.
5. Conduct Swinburne's test on DC Shunt Motor.
6. Brake test on 3-phase Induction Motor.
7. Draw the V-I characteristics of P-N Junction Diode.
8. Draw the V-I characteristics of zener Diode.
9. Half wave rectifier and Full wave rectifier operations using diodes.
10. Draw the BJT-CB Configuration characteristics.
11. Draw the BJT-CE Configuration characteristics.
12. Draw the BJT-CC Configuration characteristics.
13. Study of circuit simulation software (any one- TINA-PRO/ PSPICE/ CIRCUIT MAKER/ GPSIM/ SAPWIN etc).

Text Books

1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References

1. L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

Course Outcomes

CO1.	Verify Kirchhoff's Laws and voltage and current division rules for DC supply.
CO2.	Analyze the performance of AC and DC Machines by testing.

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3											1
CO4	3	2										1

(Strong – 3; Moderate – 2; Weak – 1)

I-Year-II Semester	CONSTITUTION OF INDIA	L	T	P	C
MC1201		2	0	0	0

Course objectives:

1. To Enable the student to understand the importance of constitution
2. To understand the structure of executive, legislature and judiciary
3. To understand philosophy of fundamental rights and duties
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

Reference books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

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

CO1	Know the sources, features and principles of Indian Constitution.
CO2	Learn about Union Government, State government and its administration.
CO3	Get acquainted with Local administration and Pachayati Raj.
CO4	Be aware of basic concepts and developments of Human Rights.
CO5	Gain knowledge on roles and functioning of Election Commission

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	3			3		2	3	-	3	2
CO2	2	-	2			2		2	2	-	3	2
CO3	3	-	3			2		2	2	-	3	3
CO4	2	-	3			2		2	2	-	3	3
CO5	3	-	1			3		3	3	-	3	2

(Strong – 3; Moderate – 2; Weak – 1)

II-Year-I Semester	Mathematics – III	L	T	P	C
BS2101		3	1	0	3

Course objectives:

The main objectives are

1. Instruct the concept of Matrices in solving linear algebraic equations.
2. Familiarize the techniques in partial differential equations
3. Furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

Unit–1: Solving system of linear equations, Eigen values and Eigen Vectors13 HOURS Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations-Eigen values and Eigen vectors and their properties
Unit–2: Cayley-Hamilton theorem and quadratic forms13 HOURS Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation. **Application:** Free vibration of two mass systems.
Unit–3: Vector Differentiation13 HOURS Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives – Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.
Unit–4: Vector Integration12 HOURS Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Green's theorem in a plane- Stokes theorem- Gauss Divergence theorem.
Unit–5: Solutions of Partial differential Equations14 HOURS Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

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

CO1	develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO2	solve system of linear algebraic equations using Gauss elimination, Gauss Jordan
CO3	to interpret the physical meaning of different operators such as gradient, curl and divergence
CO4	estimate the work done against a field, circulation and flux using vector calculus
CO5	identify the solution methods for partial differential equation that model physical processes

Text books:

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

Reference books:

1. B.V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. H.K. Das, Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

e-resources:

Micro-Syllabus of MATHEMATICS – III

UNIT-I: Solving system of linear equations, Eigen values and Eigen Vectors

Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations- Eigen values and Eigen vectors and their properties

Unit	Module	Micro content
1a. Solving system of linear equations	Rank of the given matrix	Find rank of the given matrix by reducing into Echelon form.
		Find rank of the given matrix by reducing into Normal form.(Canonical form)
	System of linear equations	Solve the system of homogeneous linear equations.
		Solve the system of Non- homogeneous linear equations.
		Solve the given system of linear equations using Gauss Elimination method.
		Solve the given system of linear equations using Gauss Jordan method.
1b.Applications	Eigen values and Eigen vectors	Find eigen values and Eigen vectors of given matrix.
	Properties of Eigen values and Eigen vectors	If λ is an eigen value of Matrix A then find eigen values of A^m or A^{-1} or $B = A^2+k_1A+K_2I$ or ….
		The eigen vectors corresponding to distinct eigen values of real symmetric matrix are orthogonal.

UNIT-II: Cayley-Hamilton theorem and quadratic forms:

Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

Unit	Module	Micro content
	Cayley-Hamilton theorem	Verify Cayley-Hamilton theorem for given matrix A and hence find A^{-1} or A^4.
	Quadratic Forms	Reduce the given matrix into diagonal form.
		Reduce the quadratic form into canonical form using orthogonal transformation method.

UNIT – III: Vector Differentiation:

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

Unit	Module	Micro content
3a. Vector Differential operator	Divergent, Curl and Gradient	Find Gradient of given scalar function.
		Find Unit normal vector at given point on given surface.
		Find divergent or Curl of given vector function.
3b. Vector identities	Vector identities	Find Scalar potential function.
		Problems on Laplacian second order operator.
		Prove the given vector identity.

UNIT– IV: Vector Integration:

Unit	Module	Micro content
4a. Vector integration	Line integraton, surface integration & volume integration	Evaluate given line integration along the given curve.
		Find work done by force in moving a particle from A to B along curve C.
		Find surface integral of vector function.
		Find volume integral of vector function.
4b. Vector integration theorems	Green's theorem , Stoke's theorem and Gauss Divergence throem.	Verify Green's theorem.
		Evaluate using stoke's theorem.
		Evaluate using Divergence theorem.

UNIT– V: Solutions of Partial differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.
Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

Unit	Module	Micro content
5a. First order PDE	Formation of PDE	Form PDE by eliminating arbitrary constants.
		Form PDE by eliminating arbitrary functions.
	Solve First order PDE	Solve first order linear PDE.
		Solve first order non linear PDE.
5b. Higher order PDE	Solve Second order PDE.	Solve Second order linear PDE with constant coefficients with RHS terms $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

II-Year-I Semester	Strength of Materials	L	T	P	C
PC2101		3	1	0	3

Pre-Requisites: Knowledge in Engineering Mechanics.

Course objectives:

The main objectives are

1. To give preliminary concepts of strength of materials and principles of elasticity and plasticity, stress strain behavior of materials and their governing laws. The modulli of elasticityand their relations.
2. To impart concepts of bending moment and shear force for beams with different boundary and loading conditions and to draw the diagrams which shows variation along the span
3. To impart the concepts ofmeasuring deflections in beams under various loading and supportconditions
4. To give concepts of stresses developed in the cross section using bending and shear stress equations.
5. To give concepts of torsion and governing torque equation, the power transmitted by shafts and deflection of close and open coiled springs under axial pull and axial couple.

UNIT-I: SIMPLE STRESSES AND STRAINS **14 HOURS**

Elasticity and plasticity (Definitions) – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section-simple problems – composite bars – Temperature stresses(Concept only).

Strain energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications

UNIT– II: SHEAR FORCE AND BENDING MOMENT **13 HOURS**

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads (simple problems), uniformly distributed load, uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT- III: DEFLECTION OF BEAMS **12 HOURS**

Beam bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load- Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

Unit-IV: FLEXURAL STRESSES AND SHEAR STRESSES **14 HOURS**

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T Angle and Channel sections – Design of simple beam sections.

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

Unit-V: TORSION OF CIRCULAR SHAFTS AND SPRINGS **12 HOURS**

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: – Assumptions made in the theory of pure torsion – Torsion moment of resistance – Polar section modulus – Power

axial pull and axial couple –springs in series and parallel.

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

CO1	***Analyse*** the stresses and strains in a member subjected to different loadings and understand the strain energy under different load conditions. (Understanding, Analysing)
CO2	***Apply*** different methods and analyse the various beams subjected to different loads using shear force and bending moment diagrams (Applying, Analysing)
CO3	***Compute*** deflections in beams due to different loading conditions.(Applying)
CO4	***Evaluate*** flexure and shear stresses for different beam sections. (Evaluating)
CO5	***Analyse*** the shafts and springs by applying principle of torsion (Applying, Analysing)

Text books:

1. "Strength of materials", by R. K. Bansal, Volume 1 and 2.
2. "Strength of materials", by S.S. Bhavakati.

Reference books:

1. Strength of Materials by S.S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
2. Strength of materials by R.K. Rajput, S. Chand & Co, New Delhi.
3. Strength of Materials by S.Ramamrutham, Dhanpat Rai Publishing Co., (P) Ltd. New Delhi
4. Theory of Structures by S.P.Timoshenko& DH. Young.

MICRO SYLLABUS

UNIT-I: SIMPLE STRESSES AND STRAINS

Elasticity and plasticity (Definitions) – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section-simple problems – composite bars (Concept and problems) – Temperature stresses(Concept only-no problems).

Strain energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications

Unit	Module	Micro content
Ia. Elasticity and plasticity	stress – strain diagram for mild steel	Elasticity and plasticity , Types of stresses and strains
		Hooke's law ,Working stress, factor of safety
	Elastic moduli	Young's modulus
		Shear modulus
		Bulk modulus
		Relation between them
	Stress- strain diagram for mild steel	stress – strain diagram for mild steel
	Bars of varying cross-section and composite bars	Concept and problems (simple)
	Temperature stresses	Concept only
Ib. Strain energy	Resilience, Gradual, sudden, impact and shock loadings – simple applications.	Definitions
		Derivation of gradual and sudden loading

UNIT–II: SHEAR FORCE AND BENDING MOMENT

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads (simple problems), uniformly distributed load, uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit	Module	Micro content
II Shear Force and Bending Moment	Introduction	Definition of beam, Types of beams
		Concept of shear force and bending moment
	Beams (simply supported , cantilever and overhanging)	Point loads
		Uniformly Distributed Load
		Uniformly Varying Load
		Simple problems
	Point of contra flexure and relation between load , SF and BM	Point of contra flexure and relation between load , SF and BM

UNIT-III: DEFLECTION OF BEAMS

Beambending into a circular arc–slope, deflection and radius ofcurvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load- Mohr's theorems – Moment area method – application to cantilever and simply supported beams- simple cases.

Unit	Module	Micro content
III.Deflection of beams	Introduction	Concept of slope and deflection
		Beambending into a circular arc–slope, deflection and radius ofcurvature (Concept only)
	Double Integration method	Slopes and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load(concept and problems)
	Macaulay's method	Slope and deflections for simply supported beams subjected to point loads, U.D.L, one side over hanging beam (Concept and problems)
	Mohr's theorems – Moment area method	Application to cantilever and simply supported beams- simple cases.

UNIT-IV: FLEXURAL STRESSES AND SHEAR STRESSES

Flexural Stresses**:** Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T Angle and Channel sections – Design of simple beam sections.

Shear Stresses**:** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections.

Unit	Module	Micro content
IVa. Flexural Stresses	Introduction	Theory of simple bending, assumptions Neutral axis
	Derivation of bending equation	M/I =f/y = E/R
		Determination of bending stresses
		Rectangular and circular sections (Solid and Hollow)

		Design of simple beams sections.
IVb. Shear Stresses	Introduction	Derivation and assumptions
	Shear stresses distribution	Rectangular, circular, triangular, I, T and angle sections.

UNIT-V: TORSION OF CIRCULAR SHAFTS AND SPRINGS

Torsion of Circular Shafts**:** Theory of pure torsion – Derivation of Torsion equations: – Assumptions made in the theory of pure torsion – Torsion moment of resistance – Polar section modulus – Power transmitted by shafts (concept and problems) – Combined bending and torsion and end thrust (Concept only-no problems).

Springs**:** Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple –springs in series and parallel (concept only).

Unit	**Module**	**Micro content**
Va. Torsion of Circular Shafts	Introduction	Theory of pure torsion, derivation and assumptions
		Polar moment of inertia and torsion moment of resistance
	Power transmitted by shafts	Power transmitted by shafts (concept and problems
		Combined bending and torsion and end thrust(Concept only)
Vb. Springs	Introduction	Types of springs
	Deflection	Close coiled helical spring under axial pull and axial couple
		Open coiled helical springaxial pull and axial couple
		springs in series and parallel (concept only)

CO – PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2		2						1		
CO2	3	2		1						2		
CO3	2	2		2						2		
CO4	3	2		2						2		
CO5	3	2		2						1		

II-Year-I Semester	FLUID MECHANICS	L	T	P	C
PC2102		3	1	0	3

Course objectives:

The main objectives are

1. Understand the properties of fluid and their behavior at various conditions.
2. Understand the various forces acting on hydraulic structures and flow properties.
3. Understand the concept of conservation of mass and its application.
4. Understand the concept of energy and momentum conservation and their application.
5. Study behavior of fluid at various fluid properties and characteristics.
6. Study the energy losses in pipe flow and measurement of flow in pipes.

Unit-I: FLUID PROPERTIES 12 HOURS
Physical properties of fluids – specific weight, specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion, pressure at a point, classification of fluids, Pascal's law and its practical significance, Hydrostatic law of pressure distribution - atmospheric, absolute, gauge and vacuum pressures - measurement of pressure. Pressure gauges, Manometers – Piezometer, Differential U – tube Manometer and inverted U-tube manometer. Digital Manometers; Application of fluid properties in day to day life.
Unit– II: HYDRO STATICS AND FLUID KINEMATICS13 HOURS
Hydro Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Centre of pressure. **Fluid Kinematics:** Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and ir-rotational flows – Equation of continuity for one, two, three dimensional flows – stream function and velocity potential function.Application of hydrostatic in regulation of flow in canals.
Unit-III: FLUID DYNAMICS13 HOURS
Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line from the fundamentals and from Euler's equation – its limitations and applications. Momentum equation and its application – hydraulic analysis of the pipe bend.Application of energy equations in the field.
Unit-IV: MEASUREMENT OF FLOW13 HOURS
Classification of orifices, small orifice and large orifice. Difference between mouthpiece and orifice. Pitot tube, Venturimeter and Orifice meter - flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs.Digital flow measuring devices.
Unit-V: LAMINAR FLOW AND TURBULENT FLOWS14 HOURS
Reynold's experiment – its practical significance. Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows. 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, Hazen-Williams formula.Conducting field survey for new advanced pipes and their losses (Case Base learning).

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

CO1	Explain the influence of the fluid properties in static condition and motion. (Understand)
CO2	State and explain hydrostatic forces on submersible hydraulic structures. (Apply)
CO3	Estimate various properties and characteristics in a pipe flow using continuity, momentum and energy equations. (Apply)
CO4	Analyze the behavior of fluids using mathematical equations in Laminar and Turbulent

Text books:
1. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi 2. A text of Fluid mechanics and hydraulic machines, R. K. Bansal – Laxmi Publications (P) ltd., New Delhi Digital Design by Mano, PHI
Reference books:
1. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan, CENGAGE Learning. 2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education

Micro-Syllabus of Fluid Mechanics

Unit-I: FLUID PROPERTIES

Physical properties of fluids – specific weight, specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion, pressure at a point, classification of fluids, Pascal's law and its practical significance, Hydrostatic law of pressure distribution - atmospheric, absolute, gauge and vacuum pressures - measurement of pressure. Pressure gauges, Manometers – Piezometer, Differential U – tube Manometer and inverted U-tube manometer. Digital Manometers; Application of fluid properties in day to day life.

Unit	Module	Micro content
Ia/Ib. Fluid Properties	Physical properties	specific weight of fluids
		specific gravity of fluids
		viscosity of fluids
		surface tension of fluids
		vapour pressure of fluids
		simple problems on relationship among the properties of fluids
	Pascal's law	Pascal's law
		its practical significance
	Hydrostatic law of pressure distribution	Hydrostatic law of pressure distribution
		problems on Hydrostatic law of pressure distribution
	Measurement of pressure	Pressure gauges
		Manometers
		Piezometer
		Differential U – tube Manometer
		inverted U-tube manometer
		simple problems on U – tube differential manometer.

Unit– II: HYDRO STATICS AND FLUID KINEMATICS

Hydro Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Centre of pressure.

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irvelocity potential function.Application of hydrostatic in regulation of flow in canals.

Unit	Module	Micro content
IIa/ IIb. Hydro Statics and Fluid Kinematics	Hydrostatic forces on submerged plane	Horizontal surfaces
		Vertical surfaces
		Inclined surfaces
		curved surfaces
	Center of pressure	problems on vertical place surfaces
		problems on inclined place surfaces
	Stream line	Definitions and properties
	path line	Definitions and properties
	stream tube	Definitions and properties
	Classification of flows	Classification of flows
		practical examples
	continuity equation for three dimensional flows	Derivation
		simple problems
	Stream function	Stream function
		properties
	Velocity potential function	Velocity potential function
		properties

Unit-III: FLUID DYNAMICS

Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line from the fundamentals and from Euler's equation – its limitations and applications. Momentum equation and its application – hydraulic analysis of the pipe bend.Application of energy equations in the field.

Unit	Module	Micro content
IIIa/IIIb.Fluid Dynamics	Euler's Equation Bernoulli's equation along a stream line	Derivation
		Derivation
		applications
		simple problems.
	Momentum equation	Momentum equation
		application
	Hydraulic analysis of pipe bend	simple problems on pipe bend

Unit-IV: MEASUREMENT OF FLOW

Classification of orifices, small orifice and large orifice. Difference between mouthpiece and orifice. Pitot tube, Venturimeter and Orifice meter - flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs. Digital flow measuring devices**.**

Unit	Module	Micro content
IVa/ IVb. Measurement of	flow measurement	Derivation using the small orifice
		Derivation using the large orifice

		numerical problems
	flow measurement	Derivation using Venturi meter
		Derivation using Orifice meter
		Derivation using rectangular notches
		Derivation using broad crested weirs
		numerical problems
		error estimation in measured discharge
	discharge measurement	Derivation using triangular notches
		error estimation in measured discharge.
		Derivation using trapezoidal notches
		error estimation in measured discharge.
		Derivation using stepped notches
		error estimation in measured discharge.

Unit-V: LAMINAR FLOW AND TURBULENT FLOWS

Reynold's experiment – its practical significance. Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro dynamically smooth and rough flows. 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, Hazen-Williams formula. Conducting field survey for new advanced pipes and their losses (Case Base learning).

Unit	**Module**	**Micro content**
Va/Vb.Laminar Flow and Turbulent Flow	Reynold's experiment	Reynold's experiment
		practical significance
	laminar and turbulent flow	Difference between laminar and turbulent flow
	Hagen-Poiseulle Formula	Derivation
		simple numerical problems
	Flow between parallel plates	Flow between parallel plates
		simple numerical problems
	Darcy-Weisbach equation	Derivation
		Numerical problems
	minor losses	Various types of minor losses
	Pipes in series	Numerical Problems
	pipes in parallel	Numerical Problems
	energy line	Total energy line
	gradient line	hydraulic gradient line
	friction factor	variation of friction factor with Reynold's number
	Moody's Chart	Theory only
	Hazen-Williams formula	Theory only

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2		2		3								
CO3		2		3								
CO4	2			3								
CO5	3	1		2								

II-Year-I Semester	SURVEYING	L	T	P	C
PC2103		3	1	0	3

Course objectives:

The main objectives are

1. To understand the concept of chain surveying, instruments for chaining and the concept of linear measurements.
2. To Know about the compass, angles and bearings. To know the application of compass in the field work. To know the concept of traversing.
3. To find the elevation difference between various points. To know about various methods of levelling. To Know the uses of contour maps and locating the contours.
4. To know how to operate the theodolite. To find the horizontal & vertical angles. To understand the concept of tachometry.
5. To calculate the areas along irregular boundaries and volume of earthwork from various rules. To Know the elements of simple & compound curves. To understand the basic concepts behind the EDM, Total station, GIS & GPS.

Unit-I: FUNDAMENTAL CONCEPTS, LINEAR MEASUREMENTS & CHAIN SURVEYING13 HOURS

Introduction: Object, Primary divisions, Classification & Principles of Surveying. Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale.

Chain Surveying: Instruments for chaining, Ranging out survey lines, Error due to incorrect chain, Errors in chaining, Tape corrections.Chain triangulation, Survey stations, Survey lines, Field book, Obstacles in chaining, Cross staff survey**.**

Unit– II: COMPASS SURVEYING & TRAVERSING13 HOURS

Compass Surveying: Introduction, Definitions, Designation of bearings, Types of compass, temporary adjustments of compass, Included angles, Magnetic declination, Dip, Local attraction, Errors in compass survey.

Traversing: Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.

Unit-III: LEVELLING AND CONTOURING13 HOURS

Levelling: Definitions in levelling, Methods of levelling, levelling instruments, Temporary adjustments of a level, Principles of levelling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.

Contouring: Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.

Unit-IV: THEODOLITE AND TACHEOMETRIC SURVEYING12 HOURS

Theodolite: Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.

Tachometric Surveying: Introduction of tachometry, Methods of tachometry- Fixed hair method, Movable hair method & Tangential method.

Unit-V: CALCULATION OF AREA & VOLUME, CURVES, EDM, TOTAL STATION, GIS & GPS 14 HOURS

Calculation of Area & Volume: Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.

Total Station: Introduction of curves & Classification. Elements of simple & compound curves. Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).

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

CO1	Understand the concept of chain surveying, instruments for chaining and the overall concept of linear measurements. (Remembering, Understanding & Applying)
CO2	Know the uses of compass, calculate the angles from bearings. Understand the concept of

CO3	Find the elevation difference between various points using a level. Understand the concept of various methods of levelling. Know the uses of contour maps in the field and locating the contours. (Remembering, Understanding & Applying)
CO4	Operate the theodolite & find the horizontal & vertical angles. Know the uses of tacheometry & find the distance & elevation of different points (Remembering, Understanding & Applying)
CO5	Calculate the areas along irregular boundaries & area from coordinates. Find the volume of earthwork from various rules. Know the elements of simple & compound curves. Understand the basic concepts behind the EDM, Total station, GIS & GPS. (Remembering, Understanding & Applying)

Text books:

1. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, ArunK.Jain, Laxmi Publications.
2. Surveying, Vol. I & II by S. K. Duggal, TataMc-Graw Hill.

Reference books:

1. Surveying and Levelling by N. N. Basak, Tata McGraw Hill.
2. Surveying Vol. I & II by Dr. K. R. Arora, Standard Book House.
3. Surveying and Levelling by Subramanian, Oxford University Press.
4. Textbook of Surveying by C. Venkatramaiah , University Press.

e-resources:

- https://nptel.ac.in/courses/105/107/105107122/
- https://nptel.ac.in/courses/105/104/105104101/

Micro-Syllabus of Surveying

Unit-I: FUNDAMENTAL CONCEPTS, LINEAR MEASUREMENTS & CHAIN SURVEYING

Introduction: Object, Primary divisions, Classification & Principles of Surveying. Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale.

Chain Surveying: Instruments for chaining, Ranging out survey lines, Error due to incorrect chain, Errors in chaining, Tape corrections.Chain triangulation, Survey stations, Survey lines, Field book, Obstacles in chaining, Cross staff survey**.**

Unit	**Module**	**Micro content**
Ia/Ib.Fundamental Concepts, Linear Measurements and Chain Surveying	Object, Primary divisions, Classification & Principles of Surveying	Object of surveying, Divisions: Plane & Geodetic
		Classification of surveying
		Principles of surveying
	Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale	Scales- Plane scale & Diagonal scale
		Formula of error due to wrong scale- Short problems
		Formula of Shrunkscale- Short problems
	Instruments for chaining	Instruments for chaining
	Ranging out survey lines	Direct & Indirect ranging Ranging
	Error due to incorrect chain	Formula for error due to incorrect chain- Short problems
	Errors in chaining	Cumulative & Compensating

		pull, sag, slope corrections- Short problems
	Chain triangulation, Survey stations, Survey lines, Field book	Chain triangulation, Terminology, Field book- Single line & Double line field book
	Obstacles in chaining	Obstacles to chaining, Obstacles to Ranging, Obstacles to both (Concept only, No problems)
	Cross staff survey	Concept & problems on Cross staff survey

Unit– II: COMPASS SURVEYING & TRAVERSING

Compass Surveying: Introduction, Definitions, Designation of bearings, Types of compass, temporary adjustments of compass, Included angles, Magnetic declination, Dip, Local attraction, Errors in compass survey.

Traversing: Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.

Unit	**Module**	**Micro content**
IIa/ IIb. Compass Surveying & Traversing	Introduction, Definitions, Designation of bearings	Introduction, Definitions
		Designation of bearings- Whole circle bearings & Quadrantal bearings, Conversions- Fore bearing & Back bearing, Conversions.
	Types of compass, temporary adjustments of compass	Prismatic compass & Surveyor's compass, Difference between Surveyor's & Prismatic compass
		Temporary adjustments of Prismatic compass
	Included angles, Magnetic declination, Dip, Local attraction, Errors in compass survey	Angles from bearings, Bearings from angles.
		Magnetic declination, Variations in Declinations. Problems in Declination
		Local attraction, Elimination of local attraction, Problems on local attraction
		Errors in compass survey
	Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.	Introduction, Methods of traversing
		Closing error concept
		Balancing the traverse by Bowditch's method, Transit method & Axis method only.

Unit-III: LEVELLING AND CONTOURING

Levelling: Definitions in levelling, Methods of levelling, levelling instruments, Temporary adjustments of a level, Principles of levelling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.

Contouring: Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.

and Contouring	levelling, Levelling instruments, Temporary adjustments of a level	Methods of levelling
		Levelling instruments- Level & Staff only
		Temporary adjustments of a level
	Principles of leveling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.	Steps in levelling, Differential levelling
		Bookings & Reducing levels- H.I Method & Rise and fall method. Problems on both methods
		Correction for Curvature & Refraction
		Errors in levelling
	Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.	Introduction of contouring
		Characteristics of contours
		Methods of locating contours
		Uses of contour maps.

Unit-IV: THEODOLITE AND TACHEOMETRIC SURVEYING

Theodolite: Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.

Tachometric Surveying: Introduction of tachometry, Methods of tachometry- Fixed hair method, Movable hair method & Tangential method.

Unit	**Module**	**Micro content**
Iva/ IVb. Theodolite And Tacheometric Surveying	Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.	Introduction of theodolite, Definitions
		Temporary adjustments,
		Measurement of Horizontal angles by Repetition method & Reiteration methods
		Vertical angle by general method
		Fundamental lines and desired relations, Errors in theodolite survey
	Introduction of tacheometry, Methods of tacheometry- Fixed hair method, Movable hair method & Tangential method.	Introduction of tachometry
		Methods of tachometry- Fixed hair method, Movable hair method & Tangential method
		Principle of stadia method, Distance & Elevation formulae for staff vertical condition. Problems
		Tangential method, Problems

Unit-V: CALCULATION OF AREA & VOLUME, CURVES, EDM, TOTAL STATION, GIS & GPS

Calculation of Area & Volume: Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.

Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).		
Unit	**Module**	**Micro content**
Va/ Vb.Calculation of Area & Volume, Curves, Edm, Total Station, GIS & GPS	Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.	Computation of area from offsets- Mid ordinate, Average ordinate, Trapezoidal & Simpson's rule
		Area by co-ordinates
		Volume- Measurements from cross sections- Level section only
		Volume by Trapezoidal & Prismoidal rules only
		Volume from spot levels & volume from contour plan.
	Introduction of curves & Classification. Elements of simple & compound curves.	Introduction of curves & Classification
		Elements of simple curve
		Elements of compound curve
	Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).	Introduction of EDM, Total station
		Introduction of Remote sensing
		Introduction of GIS (Geographic Information System)
		Introduction of GPS (Global Positioning System)

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2									2	
CO2	3	2									2	
CO3	2	2									2	1
CO4	3	2			1						2	1
CO5	3	2			2						2	3

II-Year-I Semester **PC2104**	**CONCRETE TECHNOLOGY**	**L T P C** **3 1 0 3**

Course objectives:

The main objectives are

1. Identify the physical and chemical properties of concrete ingredients and able to conduct tests on cement and aggregates.
2. Comprehend the workability of concrete, manufacturing processes of concrete and the behavior of fresh, hardened concrete.
3. Gain the knowledge about NDT methods, quality control of concrete and how to conduct the tests on hardened concrete.
4. Identify the properties like elasticity, creep, shrinkage; special concretes and their applications in the diverse construction field.
5. Acquire the practical knowledge on mix design principles, concepts and methods.

Unit-I: CONCRETE INGREDIENTS & ITS PROPERTIES 14 HOURS

Cements & Admixtures: Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

Unit-II: FRESH & HARDENED CONCRETE 13 HOURS

Fresh Concrete: Production of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability bydifferenttests– Settingtimesofconcrete–Effectoftimeandtemperatureonworkability– Segregation & bleeding.

Hardened Concrete: Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Curing.

Unit-III: TESTING AND QUALITY CONTROL OF CONCRETE13 HOURS

Testing of Hardened Concrete: Compression tests–Tension tests–Factors affecting strength – Flexure tests–Splitting tests–Non-destructive testing methods– codal provisions for NDT.

Quality control of Concrete: Behavior of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance; Inspection and testing of concrete-Concrete cracking, types of cracks, causes and remedies.

Unit-IV: PHYSICAL PROPERTIES OF CONCRETE AND SPECIAL CONCRETES

15 HOURS

Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

Special concretes: Light weight aggregates – Lightweight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres– Factors affecting properties & Applications of F.R.C – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self consolidating concrete – SIFCON.

criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

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

CO1	Illustrate the physical and chemical properties of concrete ingredients and able to conduct tests on cement and aggregates.
CO2	Clarify the physical properties of fresh and hardened concrete and also about the manufacturing of concrete.
CO3	Estimate the creep and shrinkage of concrete and how to conduct the different tests such as compression and tension on hardened concrete and also summarize the quality control of concrete under different conditions.
CO4	Distinguish the special concretes like Self compacting concrete, Fibre reinforced concrete, Polymer concrete and light weight concrete etc.
CO5	Design the mix proportions for the specific work for required strength and workability with available materials at workplace.

Text books:

1. Concrete Technology by M. S. Shetty – S. Chand & Co. ;2004
2. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
3. Concrete Technology by M.L. Gambhir – Tata Mc. Graw Hill Publishers, NewDelhi

Reference books:

1. Concrete Technology by A.R. Santha Kumar, Oxford University Press, NewDelhi.
2. Concrete Technology by A.R. Santha Kumar, Edition-2013, Oxford University Press, New Delhi.
3. Design of Concrete Mixes by N.Krishnam Raju,2nd edition,CBS Publishers & Distributors
4. Concrete: Microstructure, Properties and materials by P Kumar Mehta, P J M Monteiro, MC Graw Hill Education Publisher, New Delhi.
5. Concrete Technology by R.S. Varshney, Oxford and IBH.

Code Books:

- IS10262: 2019 Guidelines for concrete mix design proportioning
- IS 456: 2000 Plain and Reinforced Concrete - Code of Practice

Micro-Syllabus of Concrete Technology

Unit-I: CONCRETE INGREDIENTS & ITS PROPERTIES

Cements & Admixtures: Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

Unit	Module	Micro content
Ia/Ib. Concrete	Cements &	Portland cement: history ,manufacturing process

Properties		compounds and their functions
		Cement hydration, hydration 5 stages, setting times
		Structure of hydrated cement
		Tests on physical properties: sp.gravity, fineness, compressive strength, normal consistency, initial and final setting time, soundness
		Admixtures: purpose and applications, types of admixtures
		Various Mineral and chemical admixtures and their applications.
		Various types of cement and their applications.
	Aggregates	Classification of aggregate
		Particle shape & texture
		mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate
		Bulking of sand
		Alkali aggregate reaction - factors affecting-control measures
		Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate
		Maximum size of aggregate IS 456 recommendations.

Unit-II: FRESH & HARDENED CONCRETE

Fresh Concrete: Production of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability bydifferenttests–Settingtimesofconcrete–Effectoftimeandtemperatureonworkability– Segregation & bleeding.

Hardened Concrete: Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Curing.

Unit	Module	Micro content
IIa/IIb. Fresh and Hardened Concrete	Fresh Concrete	Various stages Production of concrete: Batching,Mixing, Transporting, Placing, Compacting, Finishing, Curing
		Properties of fresh concrete. Workability – Factors affecting workability–Measurement of workability by different tests: slump, compaction factor, vee-bee tests
		Effect of time and temperature on workability

		Segregation & bleeding, factors affecting and control measures
	Hardened Concrete	Water / Cement ratio, role of w/c ratio in strength contribution
		Abram's Law – Gel Space ratio – Maturity concept-plowman's maturity equation problems
		Factors affecting strength – Relation between compression & tensile strength

Unit-III: TESTING AND QUALITY CONTROL OF CONCRETE

Testing of Hardened Concrete: Compression tests–Tension tests–Factors affecting strength – Flexure tests–Splitting tests–Non-destructive testing methods– codal provisions for NDT.

Quality control of Concrete: Behavior of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance; Inspection and testing of concrete-Concrete cracking, types of cracks, causes and remedies.

Unit	Module	Micro content
IIIa/IIIb. Testing and Quality control of Concrete	Testing of Hardened Concrete	Compression tests: cubes and cylinders as per Indian standard
		Tension test: direct and split tensile strength
		Flexure tests Tension tests: 4 point bending test
		Various Non- destructive testing methods and their applications
		Rebound hammer and UPV test methodology.
	Quality control of Concrete	Behavior of concrete in extreme environment
		temperature problem in concreting, hot weather, cold weather and under water conditions: control techniques
		Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance;
		Concrete cracking, types of cracks, causes and remedies

Unit-IV: PHYSICAL PROPERTIES OF CONCRETE AND SPECIAL CONCRETES

Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

Special concretes: Light weight aggregates – Lightweight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres– Factors affecting properties & Applications of F.R.C – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self consolidating concrete – SIFCON.

Unit	Module	Micro content
IVa/IVb. Physical Properties of Concrete and Special Concretes	Elasticity, Creep & Shrinkage	Modulus of elasticity, measurement concrete elasticity, various types of modulus of elasticity: initial tangent, tangent, secant modulus, and chord modulus
		Relation between modulus of elasticity and compressive strength
		Creep, factors effecting creep, creep measurement

		carbonation shrinkage, factors affecting and control measures
	Special concretes	Introduction and applications
		Light weight aggregates, Lightweight aggregate concrete, Cellular concrete, No-fines concrete
		High density concrete
		Fibre reinforced concrete, Different types of fibres, Factors affecting properties & Applications of F.R.C
		Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications
		High performance concrete
		Self-consolidating concrete
		SIFCON
		Self-healing concrete

Unit-V: MIX DESIGN

Factors in the choice of mix proportions – Durability of concrete– Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

Unit	Module	Micro content
Va/Vb. Concrete Mix Design	Durability requirements and acceptance criteria	Durability of concrete : durability requirements as per IS456
		Factors in the choice of mix proportions
		Statistical methods –Acceptance criteria
		List of variousmethods of Proportioning of concretemixes
	IS method of mix design	BISmethodofmixdesign as per 10262:2019.
		Problems on Mix design as per IS10262

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2	2			2				2	1
CO2	3	2	2	2							1	2
CO3	2	2	1	2								
CO4	3		2				1				1	1
CO5	3	3	3				1				2	2

II-Year-ISemester PC2101L	STRENGTH OF MATERIALS LAB	L	T	P	C
		0	0	3	1.5

Course objectives:

The main objectives are

1. Providing hands on practice on material behavior subjected to tensile, compressive, torsion and shear loadings.
2. The course also deals with material hardness and impact resistance.

List of Experiments

1. Study of stress-strain characteristics of Mild steel/HYSD bars by UTM.
2. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam.
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on Cantilever beam..
4. Verification of Maxwell's Reciprocal theorem on beams.
5. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam with one end overhang.
6. Determination of modulus of rigidity by conducting torsion test on solid circular shaft.
7. Determination of hardness of the given material by Brinnel's/Vicker's/ test
8. Determination of hardness of the given material by Rockwell hardness test.
9. Determination of impact strength of the given material by conducting Charpy/Izod test
10. Determination of ultimate shear strength of steel by conducting direct shear test.
11. Determination of modulus of rigidity of the material of closely coiled helical spring.
12. Determination of compressive strength of wood/ concrete cube/ brick/ with grain parallel / perpendicular to loading.

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

CO1	Perform necessary experiments to determine the mechanical properties of materials under different loading conditions
CO2	Analyze the experimental results for assessment of the strength of the given material.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2								
CO2	3			2								

II-Year-I Semester PC2102L	SURVEYING FIELD WORK	L	T	P	C
		0	0	3	1.5

Course objectives:

- To know about various surveying instruments & their applications in the field.

List of Experiments

1. Survey of an area by Chain surveying using chain & cross staff.
2. Chaining across obstacles.
3. Determination of distance between two inaccessible points using prismatic compass.
4. Radiation & intersection methods by Plane table.
5. Differential levelling using auto level.
6. Contouring by Indirect method.
7. Measurement of horizontal & vertical angles using theodolite.
8. Trigonometric levelling: Base is accessible & inaccessible conditions.
9. Determination of Tachometric constants- Field procedure.
10. Determination of elevation & horizontal distance of a point using tachometer.
11. Setting out simple curve.

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

CO1	Do plane surveying with chain, compass & plane table.
CO2	Do levelling & contouring.
CO3	Operate the theodolite & tachometer in the field applications.
CO4	Setting out simple curve.

CO – PO Mapping

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

II-Year-I Semester PC2103L	CONCRETE TECHNOLOGY LAB	L	T	P	C
		0	0	3	1.5

Course objectives:

The main objective is

- To test the basic properties, ingredients of cement, fresh and hardened concrete properties.

List of Experiments At least 10 Experiments must be conducted

Tests on Cement

1. Determination of specific gravity of cement.
2. Determination of fineness of cement By dry sieving
3. Determination of normal Consistency of Cement
4. Determination of initial and final setting time of cement.
5. Determination of compressive strength of cement.
6. Determination of soundness of cement.
7. Determination of fineness of cement by air permeability method.

Tests on Aggregate

8. Determination of specific gravity of fine aggregate and coarse aggregate
9. Determination of grading and fineness modulus of fine aggregate and coarse aggregate by sieve analysis.
10. Determination of bulking of sand.

Tests on fresh Concrete

11. Determination of workability of concrete by slump test
12. Determination of workability of concrete by compaction factor method.
13. Determination of workability of concrete by Vee-bee consistency test.

Tests on hardened Concrete

14. Determination of compressive strength of concrete
15. Determination of split tensile strength of concrete.
16. Determination of young's modulus of concrete. (Demonstration)
17. Non-Destructive testing on concrete using rebound hammer

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

CO1	Able to conduct experiment and determine the various Laboratory tests on cement
CO2	Able to conduct experiment and determine the properties of fine and course aggregate
CO3	Able to conduct experiment and determine the properties of fresh concrete
CO4	Able to conduct experiment and determine the properties of Hardened concrete

CO – PO Mapping

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

II-Year-I Semester	ADVANCED AUTO CAD	L	T	P	C
SOC2101		0	0	4	2

Course objectives:

The main objective is

1. To develop skills to use AUTOCAD Software to create 2D Drawings and 3D Models.

List of Experiments

1. Symbols for various materials used
2. King post truss
3. Queen Post truss
4. English bond
5. Flemish Bond
6. Dog Legged Staircase
7. Double Panel Door and their parts
8. Window and their parts
9. Plotting a site using chain surveying field book.
10. Finding the area of the given boundary using compass (Closed Traverse).
11. Plotting Road profile (Longitudinal section and cross section)
12. Isometric Drawings in 3D for simple figures
13. Learning Different Operations like Threading, Sweep, Loft
14. Preparation of map using total station coordinates

Note:

Student is required to complete minimum of 12 drawings

II-Year-I Semester	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
MC2101		2	0	0	0

Course objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

1. The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
3. The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
4. To know the student traditional knowledge in different sector.

UNIT – I: Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.
UNIT – II: Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.
UNIT – III: Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.
UNIT – IV: Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.
UNIT – V: Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

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

CO1	understand the concept of Traditional knowledge and its importance
CO2	Know the need and importance of protecting traditional knowledge.
CO3	Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers
CO4	Know the various enactments related to the protection of traditional knowledge.
CO5	Understand the concepts of Intellectual property to protect the traditional knowledge

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

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II-Year-II Semester	SCIENTIFIC COMPUTING USING PYTHON	L	T	P	C
ES2201		3	1	0	3

Pre-Requisites: Engineering Mathematics

Course objectives:

1. To understand basic operations in Python
2. To apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario
3. To Perform, Store and retrieve information using Data structures
4. To Understand Use of python libraries for problem solving
5. To Create graphical form representation for computed data.

Unit–1: INTRODUCTION AND DATA TYPES **13 HOURS**

Introduction: History of Python, Need of Python Programming, Applications of python, Running Python Scripts, Variables, Assignment, Keywords and Identifiers, Input-Output, Indentation.

Data Types: Integers, Floats, Complex Numbers, Strings, Booleans; Type Conversion.

Unit–2: OPERATORS AND CONTROL FLOW12 HOURS

Operators: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Control Flow: Boolean Expression, if, if-else, for, while, break, continue, pass.

Unit–3: DATA STRUCTURES AND FUNCTIONS13 HOURS

Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences and Comprehensions.

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive and Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Unit–4: MODULES, PYTHON PACKAGES, LIBRARIES14 HOURS

Modules: Creating modules, import statement, from.

Math Module: Constants, Power and logarithmic functions, Trigonometric functions, Angular conversion, Hyperbolic functions.

Python package: Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Popular libraries: Introduction and applications of popular libraries: Scipy, Numpy, Sympy, Matplotlib, and Pandas

Numpy Library: Numpy import, Basic functions, Matrices Addition, Subtraction, Multiplication, Transpose, Inverse, Eigen values and Eigenvectors using Numpy.

Unit–5:DATA VISUALIZATION **13 HOURS**

Matplotlib: Loading the library and importing the data, How Mat plot lib works, different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labelling.

Scipy: Interpolation and Numerical Integrations Using Scipy

CO2	Apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario {Apply, KL3}
CO3	Perform, Store and retrieve information using Data structures {analyse, KL4}
CO4	Understand Use of python libraries for problem solving. {Understand level, KL2}
CO5	Create graphical form representation for computed data. {Create, KL6}

Text books:

1. Python for civil and structural engineers by Vittorio Lora.
2. Scientific Computing In Python By Abhijit Kar Gupta. TECHNO WORLD PUB

Reference books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Numerical Python: Scientific Computing and Data Science Applications by Robert Johansson.
3. Let Us Python by Yashavant Kanetka

Micro-Syllabus of Scientific Computing Using Python

Unit-I: INTRODUCTION AND DATA TYPES
Introduction: History of Python, Need of Python Programming, Applications of python, Running Python Scripts, Variables, Assignment, Keywords and Identifiers, Input-Output, Indentation.
Data Types: Integers, Floats, Complex Numbers, Strings, Booleans; Type Conversion.

Unit	Module	Micro content
Ia. Introduction to Python	Introduction	History of Python
		Need of Python Programming
		Applications of python
		Running Python Scripts using Jupyter Notebook and Spyder.
	Variables and literals	Variables
		Assignment, list of Keywords and Identifiers,
		Naming rules
		Input-Output (print, input),
		Indentation.
Ib. Data Types	python data types	Integers, Floats, Complex Numbers, Strings, Booleans
		Finding of variable type
		Type Conversion

Unit– II: OPERATORS AND CONTROL FLOW
Operators: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations
Control Flow: Boolean Expression, if, if-else, for, while, break, continue, pass.

Unit	Module	Micro content
IIa. Operator	**Operators**	Arithmetic Operators
		Comparison (Relational) Operators
		Assignment Operators
		Logical Operators
		Membership Operators
		Identity Operators
		Expressions and order of evaluations.
		if, if-elif-else

<table>
<tr><td></td><td></td><td>Break,
Continue,
Pass</td></tr>
<tr><td colspan="3">Unit-III: DATA STRUCTURES AND FUNCTIONS
Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences and Comprehensions.
Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive and Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="5">IIIa.Data Structures</td><td rowspan="5">Data Structures</td><td>Lists - Operations, Slicing,</td></tr>
<tr><td>tuples</td></tr>
<tr><td>sets</td></tr>
<tr><td>Dictionaries</td></tr>
<tr><td>Sequences and list comprehensions</td></tr>
<tr><td rowspan="4">IIIb. Functions</td><td rowspan="4">Functions</td><td>Defining Functions, Calling Functions, Passing Arguments</td></tr>
<tr><td>Keyword Arguments, Default Arguments, arbitrary arguments</td></tr>
<tr><td>Recursive and Anonymous Functions</td></tr>
<tr><td>Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.</td></tr>
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<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="7">IVa/ IVb. Modulues, Python, Packages, Libraries</td><td rowspan="2">Modules</td><td>Creating modules, import statement, from</td></tr>
<tr><td>Math Module: Constants, Power and logarithmic functions, Trigonometric functions, Angular conversion, Hyperbolic functions.</td></tr>
<tr><td>Python package</td><td>Introduction to PIP, Installing Packages via PIP, Using Python Packages.</td></tr>
<tr><td>Popular libraries</td><td>Introduction and applications of popular libraries: Scipy, Numpy, Sympy, Matplotlib, and Pandas</td></tr>
<tr><td rowspan="3">Numpy Library</td><td>Numpy import, Basic functions,</td></tr>
<tr><td>Matrices Addition, Subtraction, Multiplication, Transpose, Inverse</td></tr>
<tr><td>, Eigen values and Eigenvectors using Numpy</td></tr>
<tr><td colspan="3">Unit-V: DATA VISUALIZATION
Matplotlib: Loading the library and importing the data, How Mat plot lib works, different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labelling.
Scipy: Interpolation and Numerical Integrations Using Scipy</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
</table>

		different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labeling.
	Scipy	Interpolation and Numerical Integrations Using Scipy

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1							1
CO2	3	3	3	3	1							
CO3	2	3	2									
CO4	2	3	1	1	3						1	2
CO5	3	3	2	1	2					2		1

II-Year-II Semester PC2202	TRANSPORTATION ENGINEERING	L	T	P	C
		3	1	0	3

Course objectives:

The student should be able to

1. To impart knowledge on history of road development in India, Highway alignment and design of road geometric elements
2. To learn various traffic surveys and their use in designing various road elements
3. To describe tests related to quality of materials and learn various highway construction and maintenance procedures.
4. To acquire design principles of Highway Geometrics and Pavements
5. To know various components and their functions in a railway track and to acquire design principles of geometrics in a railway track

Unit–1: 13 HOURS **Highway Development and Planning:** Highway development in India, Highway planning, Different road development plans, Classification of roads, Road network patterns, Highway alignment – Factors affecting **Highway Geometric Design:** Importance of geometric design, Highway cross sectional elements, Sight distance elements, Design of horizontal Alignment - Design of super elevation and extra widening; Design of transition curves, Design of vertical alignment, Gradients, Vertical curves.
Unit–2:14 HOURS **Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method
Unit–3: 14 HOURS **Highway Materials:** Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design. **Highway Construction And Maintenance:** Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation
Unit–4: 12 HOURS **Pavement Design :** Pavements – Types, Functions and components; Design factors, Flexible pavement design methods, Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method
Unit–5:12 HOURS **Introduction To Railway Engineering**: Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints **Track Geometric Design** – Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves

	Apply)
CO2	Design Intersections and prepare traffic management plans (**Understand, Apply & Create**)
CO3	Judge the suitability of pavement materials in road construction and able to construct and maintainhighways (**Understand & Evaluate**)
CO4	Design flexible and rigid pavements (**Create**)
CO5	Plan, design and maintain railway track and its elements **(Understand & Create)**

Text books:

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee
2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi
3. Railway Engineering, Satish Chandra and Agarwal M. M., Oxford University Press, New Delhi

Reference books:

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi Railway Engineering, Saxena & Arora – Dhanpat Rai, New Delhi.
2. Highway, Railway, Airport and Harbor Engineering, Subramanian K. P, Scitech Publications (India) Pvt Limited, Chennai

Micro Syllabus of Transportation Engineering

Unit-1: Highway Development and Planning: Highway development in India, Highway planning, Different road development plans, Classification of roads, Road network patterns, Highway alignment – Factors affecting

Highway Geometric Design: Importance of geometric design, Highway cross sectional elements, Sight distance elements, Design of horizontal Alignment - Design of super elevation and extra widening; Design of transition curves, Design of vertical alignment, Gradients, Vertical curves.

Unit	Module	Micro content
1. Highway Development and Planning & Highway Geometric Design	Highway development in India, Highway planning, Different road development plans	Highway development in India, Jayakar Committee Recommendations, Central Road Fund, Indian Road congress
		Highway planning
		Different road development plans (Three twenty year road development plans)
	Classification of roads, Road network patterns, Highway alignment – Factors affecting	Classification of roads
		Road network patterns (Rectangular, Star and Block, star and circular, star and grid, hexagonal, minimum travel pattern)
		Factors affecting highway alignment
	Importance of geometric design, Highway cross sectional elements, Sight distance elements	Importance of geometric design
		Highway cross sectional elements
		Sight distance elements (SSD, OSD) Theory and simple problems
	Design of horizontal	Design of horizontal Alignment (Design speed

	extra widening; Design of transition curves	Design of super elevation (Derivation and Simple Problems)
		Design of extra widening (Mechanical and Psychological widening) Derivation and problems
		Design of transition curves (Spiral, lemniscate, Cubic parabola)
	Design of vertical alignment, Gradients, Vertical curves	Design of vertical alignment (Gradients: Ruling, Limiting, Exceptional, Minimum)
		Design of vertical curves (Summit curves, valley curves)

Unit-2: Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method

Unit	**Module**	**Micro content**
2. Traffic Engineering	Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies	Basic Parameters of Traffic
		Volume, Speed and Density
		Traffic Volume Studies
	Speed studies –spot speed and speed & delay studies; Parking Studies	Speed studies
		Spot speed, speed & delay studies
		Parking Studies
	Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors	Road Accidents-Causes and Preventive measures
		Condition Diagram and Collision Diagrams
		PCU Factors
	Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings	Factors Affecting capacity of Highways
		LOS Concepts
		Road Traffic Signs
		Road markings
	Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections	Types of Intersections; At-Grade Intersections
		Design of Plain, Flared, Rotary and Channelized Intersections
	Design of Traffic Signals –Webster Method –IRC Method	Design of Traffic Signals
		Webster Method
		IRC Method

Unit-3: Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.
Highway Construction And Maintenance: Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation

Unit	**Module**	**Micro content**
3. Highway Materials & Highway Construction And Maintenance	Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio	Subgrade soil: classification (based on grain size) –Group Index (Definition, Problems)
		Subgrade soil strength – California Bearing Ratio, Plate load test
	Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates	Modulus of Subgrade Reaction (Definition)
		Stone aggregates: Desirable properties (Strength, Hardness, Toughness, Durability, Shape of aggregates, Adhesion with bitumen)
		Tests for Road Aggregates (Crushing, Abrasion, Impact, Soundness, Shape, Specific gravity and water absorption test, Bitumen adhesion test)
	Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design	Bituminous Materials: Types – Desirable properties
		Tests on Bitumen (Penetration, Ductility, Viscosity, Softening Point, Flash and fire point test)
		Bituminous paving mixes: Requirements
		Marshall Method of Mix Design (Theory)
	Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads	Types of Highway Construction – Earthwork
		Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads
	Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation	Bituminous Pavements and Construction of Cement Concrete Pavements
		Pavement Failures (Flexible pavement and Rigid pavement failures)
		Maintenance of Highways, pavement evaluation

Unit-4: Pavement Design : Pavements – Types, Functions and components; Design factors, Flexible pavement design methods, Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of

Unit	Module	Micro content
4. Pavement Design	Pavements – Types, Functions and components; Design factors, Flexible pavement design methods	Pavements – Types, Functions and components
		Design factors
		Flexible pavement design methods(CBR Method, IRC Method)
	Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method	Rigid Pavements: Design Considerations
		Wheel load stresses –Temperature stresses – Frictional stresses
		Combination of stresses
		Design of slabs – Design of Joints
		IRC method

Unit-5:Introduction To Railway Engineering: Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints

Track Geometric Design – Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves

Unit	Module	Micro content
5. Introduction To Railway Engineering & Track Geometric Design	Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints	Permanent way definition, Ideal requirements of permanent way, Components (Rails, Sleepers, Ballast) and their functions
		Rail Fastenings – Creep of Rails
		Theories related to creep (Wave theory, Percussion Theory, Drag Theory) – Adzing of Sleepers
		Sleeper density, Problems on sleeper density, Rail joints
	Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve	Alignment – Engineering Surveys - Gradients
		Cant and Negative Super elevation, associated problems
		Cant Deficiency, Degree of Curve, Relation between degree and radius of curve
	Safe speed on curves – Transition curve – Compound curves – Reverse curves	Safe speed on curves, Problems on maximum permissible speed on curves
		Transition curve – Compound curves – Reverse curves
	Extra clearance on curves	Extra clearance on curves

	curves – vertical curves	Vertical curves

CO-PO Mapping

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

II-Year-II Semester	STRUCTURAL ANALYSIS	L	T	P	C
PC2203		3	1	0	3

Pre-Requisites: Strength of Materials

Course objectives:

1. Familiarize student with statically determinate and indeterminate structures
2. To analyze fixed beams and propped cantilever beams
3. Enable students to analyze beams and frames by application of slope and deflection methods
4. Equip student with quick and approximate analysis of building frames for gravity and lateral Loads
5. Enable students to determine deflections of beams, frames and trusses by application of Energy Methods.
6. To analyze the variation of force in beams & trusses and draw influence line diagram
7. Introduce basic concepts of matrix analysis

Unit–1: 14 HOURS

Introduction: Structure, Load, Response,Static indeterminacy and structural integrity (stable / unstable) of beams - trusses - frames, Limitations of formulas – effect of support reactions and improper constraints, Kinematic indeterminacy, Internal forces in statically determinate simple beams, cantilever and simply supported frames

Analysis of Propped Cantilever and Fixed Beams: Analysis of Propped Cantilever beams – SFD, BMD and deflection (Elastic curve), Analysis of Fixed beams – SFD, BMD and deflection (Elastic curve)

Unit–2:12 HOURS

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

Moment Distribution Method: Member flexural stiffness, Carry over factor**,** Distribution factor,Application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway and with sway – SFD and BMD.

Unit–3: 13 HOURS

Gravity Load Analysis Using Approximate Methods: Analysis of continuous beams and portal frames using Inflection Points, Analysis of building frames using Substitute Frame Method

Lateral Load Analysis Using Approximate Methods: Application to building frames. (i) Portal Method (ii) Cantilever Method.

Unit–4:14 HOURS

Deflections using Energy Methods: Introduction-Strain energy in linear elastic system, expression of strainenergy due to axial load - bending moment - shear forces, Application of Castigliano's theorems-Deflections of statically determinate trusses and frames.

Influence Lines: Influence lines for simply supported beams -Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections, single point load, U.D. load longer than the span, U.D. load shorter than the span-Influence lines for forces in members of Pratt and Warren trusses**.**

Unit–5:Introduction to Matrix Methods (System Approach): 12 HOURS

Flexibility method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

Stiffness method: Introduction, application to continuous beams (maximum of two unknowns)

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

CO1	Distinguish between statically determinate and indeterminate structures
CO2	Analyze fixed beam and propped cantilever beam
CO3	Analyze continuous beam and frames by application of slope-deflection and moment distribution methods. Apply approximate methods and determine the structural response of building frames subjected to gravity loads and lateral loads respectively
CO4	To find deflections in simple structures by application of energy method and plot the influence diagram for variation of force quantity in beams and trusses
CO5	Carry out matrix analysis of continuous beams

Text books:

1. C.S. Reddy, Basic Structural Analysis, Tata McGraw-Hill
2. R. C. Hibbeler, Structural Analysis, Pearson Education
3. K. U. Muthu et al., Structural Analysis – Vol I & II, IK International

Reference books:

1. Devdas Menon, Structural Analysis, Narosa Publishers
2. T. S. Thandavamoorthy, Structural Analysis, OUP, India
3. S. S. Bhavikatti, Structural Analysis Vol I & II, Vikas Publications
4. V. N. Vazirani , M. M. Ratwani and S. K. Duggal, Analysis of Structures- Vol. I and II, Khanna Publishers, NewDelhi
5. G. S. Pandit and Gupta, Matrix Analysis of Structures, Tata McGraw-Hill
6. Structural Analysis I and II, IIT Kharagpur, NPTEL web course material

Micro-Syllabus

UNIT – I

I Introduction: Structure, Load, Response,Static indeterminacy and structural integrity (stable / unstable) of beams - trusses - frames, Limitations of formulas – effect of support reactions and improper constraints, Kinematic indeterminacy, Internal forces in statically determinate cantilever and simply supported frames

Analysis of Propped Cantilever and Fixed Beams: Analysis of Propped Cantilever beams – SFD, BMD and deflection (Elastic curve), Analysis of Fixed beams – SFD, BMD and deflection (Elastic curve)

Unit	**Module**	**Micro content**
Ia. Introduction	Introduction	Structure, Load, Response,Static indeterminacy and structural integrity (stable / unstable) of beams - trusses - frames, Limitations of formulas – effect of support reactions and improper constraints
		Kinematic indeterminacy – beams, trusses and frames
	Internal forces in statically determinate frames (Reference : 8.3 and 8.4 of Structural Analysis by Devdas Menon)	cantilever and simply supported frames subjected to simple loading (Udl / Concentrated loads)

Ib. Analysis of Propped Cantilever and Fixed Beams	Propped Cantilever Beams	Analysis of propped cantilever beams subjected to Simple Loading – Udl, Concentrated Load, Concentrated Moment – SFD & BMD, deflection –elastic curve
	Fixed Beams	Analysis of fixed beams subjected to Simple Loading – Udl, Concentrated Load, Concentrated Moment, Rotational slip at Support – SFD & BMD, deflection –elastic curve

UNIT – II Slope-Deflection Method: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports - SFD and BMD.
Moment Distribution Method: Member flexural stiffness, Carry over factor**,** Distribution factor,Application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway and with sway – SFD and BMD.

Unit	**Module**	**Micro content**
IIa. Slope – Deflection Method	Introduction	Assumptions, Sign convention, Derivation and procedure

	Analysis of Continuous beams	Analysis of Continuous Beams without / with support settlements - subjected to simple loading (Udl, Concentrated Load, Concentrated Moment, Triangular load on different spans, Different EI) and Far ends hinged / fixed / overhang – BMD and SFD
IIb. Moment Distribution Method	Introduction	Kinematic indeterminacy, Member flexural stiffness, Carry over factor**,** Distribution factor, Analysis procedure
	Analysis of Continuous Beams	Analysis of Continuous Beams without / with support settlements - subjected to simple loading (Udl, Concentrated Load, Concentrated Moment, Triangular load on different spans, Different EI) and Far ends hinged / fixed / overhang – BMD and SFD
	Analysis of Frames without Sway	Single – Storey and Single-Bay Portal Frames subjected to Simple Loading
	Analysis of Sway Frames	Single – Storey and Single-Bay Portal Frames subjected to Simple Loading
UNIT – III UNIT – III Gravity Load Analysis Using Approximate Methods: Analysis of continuous beams and portal frames using Inflection Points, Analysis of building frames using Substitute Frame Method **Lateral Load Analysis Using Approximate Methods**: Application to building frames. (i) Portal Method (ii) Cantilever Method		
III a. Gravity Load Analysis	Analysis by assumption of Inflection points	Analysis of three-span continuous beam (No support settlement and Constant EI) subjected to UDL and / point loads
		Analysis of Single / TwoBay- Two Storey portal frame (Constant EI and Fixed Bases) subjected to constant UDL on beams
	Substitute Frame Method	Analysis at particular floor level of Three Bay – Two Storey portal frame (Fixed Bases) subjected to UDL (DL & LL) on beams for maximum and minimum bending moments
III b. Lateral Load Analysis	Portal Method	Analysis of Two Bay – Two Storey Portal Frame with Fixed Bases
	Cantilever Method	Analysis of Two Bay – Two Storey Portal Frame with Fixed Bases

UNIT – IV Deflections using Energy Methods: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load - bending moment - shear forces, Application of Castigliano's theorems-Deflections of statically determinate trusses and frames. **Influence Lines:** Influence lines for simply supported beams -Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections, single point load, Two point loads, U.D. load longer than the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses**.**		
IVa. Deflections using Energy Method	Introduction	Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load - bending moment - shear forces
	Analysis of Trusses	Analysis of statically determinate Trusses subjected to Simple Loading
	Analysis of Frames	Analysis of statically determinate Bent / Cantilever Frames subjected to simple loading
IVb. Influence Lines	Introduction	Influence lines for simply supported beams - Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections
	Application to Beams	Simply supported beams (constant EI) subjected to single point load, Two point loads (spacing less than span of beam), U.D. load longer than the span, U.D. load shorter than the span
	Application to Trusses	Analysis of Warren and Pratt Trusses
UNIT – V Introduction to Matrix Methods (System Approach): Flexibility method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements. Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.		
Va. Flexibility Method (System Approach)	Analysis of Continuous Beams	Analysis of continuous beams (with maximum two unknowns) without and with support settlements subjected to simple loading (Udl / concentrated loads – No combination)
Vb. Flexibility Method (System Approach)	Analysis of Continuous Beams	Analysis of continuous beams (with maximum two unknowns) without and with support settlements subjected to simple loading (Udl / concentrated loads – No combination)

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3								2		
CO2	1	3								2		
CO3	2	3										
CO4	1	3								2		
CO5	2	3										

II-Year-II Semester	HYDRAULICS AND HYDRAULIC MACHINERY	L	T	P	C
PC2204		3	1	0	3

Pre-Requisites: Fluid Mechanics

Course objectives:

The student should be able to

1. To understand the fundamental concepts of open channel uniform flow and Non-uniform flow conditions.
2. To study the concept of boundary layer control and its practical applications.
3. To understand the need of relationship between model and prototype and able to predict the prototype behavior based on the field conditions
4. To predict the influence of hydrodynamic forces acting on vanes at different conditions.
5. To understand the working mechanism and performance characteristics of a turbine.
6. To understand the working mechanism and performance characteristics of a pump.

Unit–1: FLOW IN OPEN CHANNELS 14 HOURS **Uniform Flow in Open Channels**: Types of channels –Types of flows – Velocity and pressure distribution – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth. **Non-Uniform Flow in Open Channels:** Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.
Unit–2:BOUNDARY LAYER THEORY12 HOURS Boundary layer (BL) – concepts, Characteristics of boundary layer along a thin flat plate - laminar and turbulent Boundary layer, separation of BL, Control of BL, flow around submerged Objects-Drag and Lift- Magnus effect.
Unit–3: HYDRAULIC SIMILITUDE12 HOURS Dimensional Analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.
Unit–4:HYDRAULIC TURBINES 14 HOURS **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. **Hydraulic Turbines:** Classification of turbines. Pelton wheel - Francis turbine – Kaplan turbine - working, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Units and specific quantities, performance characteristics curves of the turbine.
Unit–5:PUMPS 13 HOURS **Centrifugal Pumps:**Classification, different heads and efficiencies, work done - Manometric head-minimum starting speed of the pump-specific speed, performance characteristics curves of pumps. **Reciprocating Pumps:** Classification, working principle, work done, indicator diagram and slip

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

CO1	Able to Design of an economical open channel section and estimate the energy profile of the flow in the channel.
CO2	Able to apply concept of boundary layer in operation and design of moving vehicles

CO4	Able to predict the type of material, size and shape of vanes using the analysis of impact of jet.
CO5	Able to configure various components of turbines, pumps and their installation.

Text books:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers
2. A text of Fluid mechanics and hydraulic machines, Rajput
3. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi

Reference books:

1. Fluid Flow in Pipes and Channels, G.L. Asawa, CBS
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education.
3. A text of Fluid mechanics and hydraulic machines, R. K. Bansal – Laxmi Publications (P) ltd., New Delhi Digital Design by Mano, PHI
4. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan, CENGAGE Learning.

Micro-Syllabus of Hydraulics and Hydraulic Machinery

Unit-I: FLOW IN OPEN CHANNELS

Uniform Flow in Open Channels: Types of channels –Types of flows – Velocity and pressure distribution – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth.

Non-Uniform Flow in Open Channels: Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

Unit	Module	Micro content
Ia. Uniform Flow in Open Channels	Uniform Flow in Open Channels	Velocity and pressure distribution in various channels
		Most Economical channel sections – Rectangular Channel section, Circular Channel Section and Trapezoidal channel section
		Specific Energy Diagram – Critical depth, critical velocity & critical discharge – numerical problems on critical depth in rectangular channel.
Ib. Non-Uniform Flow in Open Channels	**Non-Uniform Flow in Open Channels**	Difference between Gradually varied flow and rapid varied flow
		Dynamic equation for gradually varied flow
		Various type of flow profiles
		Direct step method – rectangular channel
		Hydraulic Jump – Typical features
		The relationship between initial depth and final depth

Unit-II: BOUNDARY LAYER THEORY

Boundary layer (BL) – concepts, Characteristics of boundary layer along a thin flat plate - laminar and turbulent Boundary layer, separation of BL, Control of BL, flow around submerged Objects-Drag and Lift- Magnus effect.

<table>
<tr><td rowspan="6">Layer Theory</td><td rowspan="6">Theory</td><td>Characteristics of Boundary along the thin flat plate</td></tr>
<tr><td>Mechanism of Separation of Boundary layer</td></tr>
<tr><td>Control measures for separation of boundary layer</td></tr>
<tr><td>Drag - Lift – Types – Empirical formulae</td></tr>
<tr><td>Flow around the cylindrical object</td></tr>
<tr><td>Magnus effect</td></tr>
<tr><td colspan="3">Unit-III: HYDRAULIC SIMILITUDE
Dimensional Analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="4">IIIa/IIIb.Hydraulic Similitude</td><td rowspan="4">Hydraulic Similitude</td><td>Dimensional analysis using Rayligh's and Buckingham method</td></tr>
<tr><td>Different types of hydraulic models</td></tr>
<tr><td>Dimensionless numbers</td></tr>
<tr><td>Relationship between varies variables of model and prototypes</td></tr>
<tr><td colspan="3">Unit-IV: HYDRAULIC TURBINES
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.
Hydraulic Turbines: Classification of turbines. Pelton wheel - Francis turbine – Kaplan turbine - working, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Unit and specific quantities, performance characteristics curves of the turbine.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="2">IVa. Basics of Turbo Machinery</td><td rowspan="2">Basics of Turbo Machinery</td><td>Impact of jet on stationary, moving and inclined curved vanes – velocity triangles</td></tr>
<tr><td>Angular momentum principle</td></tr>
<tr><td rowspan="6">IVa. Hydraulic Turbines</td><td rowspan="6">Hydraulic Turbines</td><td>Difference between Pelton and Francis Turbine</td></tr>
<tr><td>Working principle, velocity triangle and work done</td></tr>
<tr><td>Different types of efficiencies</td></tr>
<tr><td>Draft tube – functional significance of draft tube</td></tr>
<tr><td>Relationship between the unit variables</td></tr>
<tr><td>Performance characteristics curves of the turbines</td></tr>
<tr><td colspan="3">Unit-V: PUMPS
Centrifugal Pumps:Classification, different heads and efficiencies, work done - Manometric head-minimum starting speed of the pump-specific speed, performance characteristics curves of pumps.
Reciprocating Pumps: Classification, working principle, work done, indicator diagram and slip.Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="6">Va/Vb.Pumps</td><td rowspan="6">Pumps</td><td>Working principle and efficiencies of centrifugal pump</td></tr>
<tr><td>Minimum starting speed of the pump</td></tr>
<tr><td>Specific speed – empirical formula and its significance</td></tr>
<tr><td>Performance characteristics curves of the pumps</td></tr>
<tr><td>Difference between reciprocating pump and centrifugal pump</td></tr>
<tr><td>Working principle and work done of reciprocating</td></tr>
</table>

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1			1	1		1
CO2	3	3	2	2	2	1			1	1		1
CO3	3	3	2	2	2	1			1	1		1
CO4	3	3	2	2	2	1			1	1		1
CO5	3	3	2	2	2	1			1	1		1

II-Year-II Semester PC2205	ENVIRONMENTAL ENGINEERING	L T P C 3 1 0 3

Pre-Requisites:

Chemistry,EnvironmentalScience,FluidMechanics,Hydraulics&HydraulicMachinery

Course objectives:

The course deals with concepts of water demand and water quality parameters,design of water treatment units, sewage quality parameters, sewage treatment units, sludge handlinginsewagetreatment.

Unit–1: WATERDEMANDS-STANDARDS-SOURCES: 13 HOURS

Aspects of Environmental Engineering – Protected water supply – Need – Water demands – Fluctuations – Design period-Population forecast – Water quality – Drinking water standards-Testing and significance – Quality and Quantity and other considerations of surface and sub-surface sources – Yield calculations – Intake works – Storage reservoir capacity – Systems ofwatersupply–Requirements–Detectionofleakages–Selectionofpump–Economicaldiameterofpumpingmain.

Unit–2: TREATMENTOFWATERANDDISTRIBUTION: 13 HOURS

Watertreatment,conventionaltreatmentflowdiagram–Sedimentationtypes–Principles–Design factors–Coagulation –DesignofClariflocculator –Filtration–Slow,RapidgravityfiltersandPressurefilters–Designprinciples-Disinfection–TheoryofChlorination–Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipemethod. Valves–Otherappurtenances.

Unit–3: WASTEWATERMANAGEMENT: 13 HOURS

Introduction:Wastewatertreatmentsystem–Definitionsofterms–Collectionandconveyanceofsewage–Sewageflowrates–Stormwater–Characteristicsofsewage–Cyclesofdecay–BOD–COD–Ultimatedisposalofsewage–self-purificationofrivers–sewage farming

Unit–4: DESIGNOFSEWERSANDPRIMARYTREATMENT: 13 HOURS

Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewagetreatment–Primarytreatment:-Screens–Gritchamber–Sedimentationtanks–Designprinciples.SeptictanksandImhofftanks-rurallatrines–Houseplumbing–Appurtenances.

Unit–5:SECONDARYBIOLOGICALTREATMENT:13 HOURS

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Lowcost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons.Sludge Digestion–Design principles–Disposal.

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

CO1	**Assess**thequalityandquantityofwaterrequirementsforacity
CO2	**Design**ofdifferenttreatmentunitsanddistributionsystemsforwatersupply
CO3	**Analyze**thecharacteristics,collection,conveyanceanddisposalofwastewater
CO4	**Design**ofsewers andvariousunitsina wastewatertreatmentplant
CO5	**Design**ofsecondaryandbiologicaltreatmentunits

Text books:

1. B.C.PunmiaBC,A.K.JainandA.K.Jain,“WaterSupplyEngineering”,LaxmiPublications.2nd Edition1995, Reprint 2005.
2. B.C.Punmia,A.K.JainandA.K.Jain,“WastewaterEngineering”,LaxmiPublications,2ndEdition1998, Reprint 2014.

Reference books:

1. S.K.Garg,“WaterSupplyEngineering”,KhannaPublishers,26th revisedEdition,NewDelhi.2010.
2. S.K. Garg, “Sewage disposal and Air Pollution Enginering”, Khanna Publishers New Delhi. 36th Edition, 2017.
3. H.S.Peavy,D.Rowe,andG.Tchobanoglous,“EnvironmentalEngineering”,McGrawHillPublishers,New Delhi. 1985.
4. G.S.BirdieandJ.S.Birdie,“WaterSupplyandSanitaryEngineering”DhanpatRaiPublishingCompanyNew Delhi, 6th Edition, 2002.
5. K.N.Duggal,“ElementsofEnvironmentalEngineering”,S.Chand&CompanyLimited,NewDelhi, 2007.
6. P.N.Modi,“SewageTreatmentDisposal&WastewaterEngineering”,StandardBookHouse,2016.
7. Manualonseweragesandsewagetreatment,CPHEEO,Ministryofurbanaffairsandemployment,Govt. ofIndia, New Delhi, 2001
8. WaterandWastewaterEngineering,NPTELvideolecturesand webnotes

Micro-Syllabus of Environmental Engineering

Unit-I: WATERDEMANDS-STANDARDS-SOURCES

Aspects of Environmental Engineering – Protected water supply – Need – Water borne diseases – Water demands –Fluctuations – Design period-Population forecast – Water quality – Drinking water standards-Testing and significance – Quality and Quantity and other considerations of surface and sub-surface sources – Yield calculations – Intake works — Storage reservoir capacity – Systems ofwatersupply–Requirements–Detectionofleakages–Selectionofpump–Economicaldiameterofpumpingmain.

Unit	Module	Micro content
WATERDEMANDS-STANDARDS-SOURCES	WaterDemands	Per capita Demand and factors influencing it
		Types of water demands and its variations
		Factors affecting water demand
	Design period	Factors affecting the Design period
	Water borne diseases	Control of waterborne diseases
	Aspects of Environmental Engineering	Role of Environmental Engineer
	Testing and significance	Characteristics & Analysis of water–Physical, Chemical and Biological
	Intake works	Types of Intakes
	Drinking water standards	IS 10500 2012 and WHO guidelines for drinking water
	Yield calculations	Wells

Unit– II: TREATMENTOFWATERANDDISTRIBUTION

Watertreatment,conventionaltreatmentflowdiagram–Sedimentationtypes–Principles–Design factors– Coagulation –DesignofClariflocculator –Filtration– Slow,RapidgravityfiltersandPressurefilters–Designprinciples-Disinfection–TheoryofChlorination–Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipemethod. Valves–Otherappurtenances.

Unit	Module	Micro content
TREATMENTOFWATERANDDISTRIBUTION	Disinfection	Other Disinfection methods
	Distribution systems	Requirements of Distribution systems
		Methods of Distribution system
	Valves	Sluice valves, air valves, scour valves and check valves
	Otherappurtenances	Hydrants, and water meters

Unit-III: WASTEWATERMANAGEMENT

Introduction:Wastewatertreatmentsystem–Definitionsofterms–Collectionandconveyanceofsewage–Sewageflowrates–Stormwater–Characteristicsofsewage–Cyclesofdecay–BOD–COD–Ultimatedisposalofsewage–self-purificationofrivers–sewage farming.

Unit	Module	Micro content
WASTEWATERMANAGEMENT	Introduction	Systems of sanitation
	Wastewatertreatmentsystem	Relative merits & demerits
	Characteristicsofsewage	Physical, Chemical and Biological Examination
		Determination of bending stresses
	BOD–COD	BOD equations
		Problems
	Ultimatedisposalofsewage	Methods of disposal Disposal into water bodies Oxygen Sag Curve Disposal into sea, disposal on land

Unit-IV: DESIGNOFSEWERSANDPRIMARYTREATMENT

Designprinciples.SeptictanksandImhofftanks-rurallatrines–Houseplumbing–Appurtenances.		
Unit	**Module**	**Micro content**
DESIGNOFSEWERSANDPRIMARYTREATMENT	Layouts	Types of sewers
	Design of sewers	Problems on design of sewers
	Sewers appurtenances	Cleaning and ventilation of sewers
	Sewage pumping	Pumping stations Location Components Types of pumps and their suitability with regard to wastewaters
	SeptictanksandImhofftanks-rurallatrines	Working Principles and Design Reuse and disposal of septic tank effluent
	Houseplumbing	One pipe and two pipe systems
	Appurtenances	Sanitary fittings and other accessories

Unit-V: SECONDARYBIOLOGICALTREATMENT

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Lowcost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons.Sludge Digestion–Disposal.

Unit	**Module**	**Micro content**
SECONDARYBIOLOGICALTREATMENT	Biological treatment	Aerobic and anaerobic treatment process-comparison
	Trickling filters	Mechanism of impurities removal Classification Design, operation and maintenance problems

		Volumetric strain
		Changes in diameter, and volume of thin cylinders.
	Activated Sludge Process	Principles, designs, and operational problems modifications of Activated Sludge Processes
	Sludge Digestion	Characteristics SVI Handling and treatment of sludge Thickening Anaerobic digestion of sludge
		Radial stresses
		Thick cylinders (simple problems)
		Compound cylinders (simple problems)
	Disposal	Sludge Drying Beds. Centrifuge

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2									
CO2	3	2		2		1						
CO3	2	2										
CO4	2	2		2		2						
CO5	2	2		2		2						

II-Year-II Semester	SCIENTIFIC COMPUTING PYTHON LAB	L	T	P	C
ES2201L		0	0	3	1.5

Course objectives:

1. To understand basic operations in Python
1. To apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario.

List of Experiments:

Section 1

Exercise 1 – Input and Output

a) Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them.

b) Write a Program which takes input for a variable and returns its type.

c) Write a Python program to get the Python version you are using.

Exercise 2 - Operations

a) Write a Python program that will accept the base and height of a triangle and compute the area.

b) Write a program to compute distance between two points coordinates taking (x1, y1) and (x2, y2) input from the user (Pythagorean Theorem)

c) Write a program to convert length in m to Ft-in

Section 2

Exercise - 3 Control Flow: If-Else

a) Write a Program for checking whether the given number is an Even or Odd.

b) Write a program to convert angles bearings) in Whole circle bearing (WCB) system to Reduced Bearing (RB) system.

c) Write a Python program to convert temperatures to and from Celsius, Fahrenheit. Or vice versa.

Exercise 4 - Control Flow – For, while

a) Python Program to Find the Sum of first N Natural Numbers

b) Python Program to Display the multiplication Table

c) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Section 3

Exercise - 5 - DS

a) write a Program to Illustrate Different List Operations

b) Find mean and standard deviation for the given set of numbers in a list.

c) write a Program to Illustrate Different Tuples Operations

Exercise - 6 DS - Continued

a) Python Program to Illustrate Different Set Operations

b) Python Program to Illustrate Different Dictionaries Operations

Exercise - 7 Functions

a) Python Program to Make a Simple Calculator using functions

b) Write a function to compute and return area of triangle with user give three sides.

c) Write a program to find the sum of natural using recursive function

Section 4

Exercise - 8 - Modules

a) Define all functions used in Exercise 7 create as module and save it as “functions.py”.

b) Execute all the operations performed in Exercise 7 by importing above module “functions.py” without

Exercise 9 - Math Module

a) write a Program to Illustrate Different Constants, Power and logarithmic, Angular conversion functions in math module

b) write a Program to Illustrate Different Trigonometric and Hyperbolic functions in math module

Exercise 10 - Numpy

a) Write a program that defines a matrix and prints using Numpy.

b) Write a program to perform Addition, Subtraction, Multiplication of two square matrices of same size using Numpy.

c) Write a program to perform Transpose, Inverse, Eigen values and Eigenvectors of a 5x5 matrix using Numpy.

Section 5

Exercise 11 – Matplotlib

a) Write a Program to Draw bending moment and shear force diagram of a cantilever with point load at end.

b) Write a Program to Draw bending moment and shear force diagram of a simply supported beam with UDL.

Exercise 12 - Scipy

a) Write a program to find numerical integration of a given equation and range [a,b] using Scipy.

b) Write a program to perform 1D linear interpolation between two numbers using Scipy.

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

CO1	Perform necessary experiments to det Understand basic oprations in Python.
CO2	**Apply** use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario.
CO3	**Perform**, Store and retrieve information using Data structures.
CO4	**Understand** Use of python libraries for problem solving.
CO5	**Create** graphical form representation for computed data.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1							1
CO2	3	3	3	3	1							
CO3	2	3	2									
CO4	2	3	1	1	3						1	2
CO5	3	3	2	1	2					2		1

II-Year-II Semester	BUILDING PLANNING AND DRAWING	L	T	P	C
PC2202L		0	0	3	1.5

Pre-Requisites: AutoCAD Basics

Course objectives:

1. Initiating the student to different building bye-laws and regulations.
2. Imparting the planning aspects of residential buildings and public buildings.
3. Giving training exercises on various sign conventions and different building units.
4. Imparting the skills and methods of planning of various buildings.

List of Experiments

1. History of Indian Architecture
2. Overview of NBC- 2016 and Building Bye Laws
3. Principles of Planning of a Residential building, Orientation of building and Minimum standards for various parts of Residential Building with respect to AP GO No: 168
4. Principles of Planning of Commercial buildings and Minimum standards for various parts of Commercial Buildings with respect to AP GO No: 168
5. Prepare a line diagram of 2BHK for the given site according Go No: 168
6. Prepare a line diagram of 3BHK for the given site according Go No: 168
7. Overview of IS 962-1989 and Software's used for 2D and 3D drawings
8. Draw the Sign conventions of Building, Electrical and Plumbing
9. Draw any given Field Measurement book sketch
10. Draw the Plan, Section and Elevation of a two bed room house
11. Draw the Plan, section and Elevation of a MIG house
12. Draw the Plan, Section and Elevation of an Educational building
13. Plan, Section and Elevation of a Hotel/Motel building
14. Plan, Section and Elevation of a Hospitals/Dispensaries building
15. Draw the plan of a given Layout
16. Draw a detailing Diagram of RCC Beam & Column
17. Draw a detailing diagram of RCC Slab and Isolated foundation

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

CO1	Able to plan various buildings as per the building by-laws.
CO2	Able to distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.
CO3	Expected to learn the skills of drawing building elements and plan the buildings as per requirements.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2			2		2		
CO2	2	2	1		1					3		
CO3	2	2	1		3		2	2		3		1

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II-Year-II Semester	FLUID MECHANICS AND HYDRAULIC MACHINERY LAB	L	T	P	C
PC2203L		0	0	3	1.5

Pre Requisites: Fluid Mechanics, Hydraulics and Hydraulic Machinery

Course Objectives:

- To impart practical exposure to use various flow measuring devices for making engineering judgments.
- To provide practice in estimating friction losses.
- To impart training to use various hydraulic turbines and pumps.

List of Experiments

1. Calibration of Venturimeter& Orifice meter
2. Determination of Coefficient of discharge for a small orifice by Constant head method.
3. Calibration of Orifice meter
4. Calibration of contracted Rectangular Notch and /or Triangular Notch
5. Determination of Coefficient of loss of head in a sudden contraction andfriction factor.
6. Verification of Bernoulli's equation.
7. Impact of jet on vanes
8. Performance test on Pelton wheel turbine
9. Performance test on Francis turbine.
10. Efficiency test on centrifugal pump.
11. Efficiency test on reciprocating pump.

Course Outcomes: After Successful completion of course the student can able to

CO1	Calibrate flow measurement devices like Venturimeter and orifice meter, etc...
CO2	Estimate the friction and measure the frictional losses in fluid flow.
CO3	Compute the performance of various hydraulic turbines and pumps

CO – PO mapping

Mapping	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
C01	3	3	….	3	….	….	….	….	….	….	….	….	2	….	….
C02	3	3	….	2	….	….	….	….	….	….	….	….	….	2	….
C03	3	3	2	2	….	….	….	….	….	….	….	….	….	2	….

II-Year-II Semester	DIGITAL LAND SURVEYING	L	T	P	C
SOC2201		0	0	4	2

Course objectives:

To practice various advanced digital surveying instruments & mapping techniques.

List of Experiments

1. Basics of Instrument setup of Total station.
2. Measuring coordinates of control points with respect to base station using Total Station.
3. Measurement of distance between two points using Total station (with single station point).
4. Area measurement using Total station (with single station point).
5. Verification of Total station, station shifting with back sighting.
6. Measurement of distance between two points using Total station (with minimum 3 station point shiftings)
7. Area measurement using Total station (with minimum 3 station point shiftings).
8. Measurement of various features of given area using total station.
9. Exporting measured survey points coordinates data to .csv file format
10. Importing 2-Dimentinal and 3-Dimentinal points coordinates data in .csv file format to AutoCADDrawing
11. Exporting Point Data in .CSV file to Total station.
12. Stake out of a single bedroom plan on ground using total station.
13. Preparation of Contour map of a given area using Total Station and relative software.
14. Finding of GPS coordinates of Give point with an accuracy upto 3m.
15. Measurement of area using GPS (minimum area of 10acres).
16. Introduction to photogrammetric surveying, using Drones
17. Flight planning and data collection using an autonomous Drone.
18. Processing of photogrammetric data and preparation of Orthomosaic Map and 3D model.

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III-Year-I Semester HS3101	ENGINEERING ECONOMICS AND MANAGEMENT	L	T	P	C
		3	1	0	3

PRE-REQUISITES: 1) Basic Sciences and Humanities

Course objectives: The student should be able to

CO 1: To understand the concept and nature of Economics and Demand and to familiarize about the Production function, Input Output relationship, Cost-Output relationship and Break Even Analysis.

CO 2: To understand the nature of markets and the concepts of Money and RBI functions.

CO 3: To familiarize with the process of management, principles, and to provide conceptual knowledge on functional management that is on Human resource management and Marketing management.

CO 4: To learn different Accounting Systems, preparation of Financial Statement and to familiarize with the tools of project Management.

CO 5: To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Economics and Theory of Production 13 Hrs** Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics –Concept of Demand, Types of Demand, Determinants of Demand-Law of Demand -Elasticity of Demand, Types of Elasticity of Demand. Theory of production; production function, Law of variable proportions & law of returns to scale, Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, simple problems.	**CO1**
II	**Introduction to Markets and Money 12 Hrs** Markets: meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly). National Income, GNP, GDP, NNP, NDP, Personal income and GST (Goods & Service Tax). Money: meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools, Banking; meaning, types, functions, Central Bank-RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	**CO2**
III	**Introduction to Management 12 Hrs**	**CO3**

	of Management. Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management. Marketing Management: Functions of Marketing - Marketing strategies based on product Life Cycle, Channels of distributions.	
IV	**Introduction to Accounting & Project Management** **15 Hrs** Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements. Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path (Simple Problems).	**CO4**
V	**Capital and Capital Budgeting:** **12 Hrs** Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).	**CO5**

Content Beyond the syllabus:

Introduction to Managerial Economics and demand Analysis: Managerial Economics, Nature & Scope, Demand forecasting for new products, Concept of supply**.**

Theory of Production and Cost Analysis: Production Process, Types of production, ISO- Quants, ISO Costs.

Introduction to Markets and Money: Price Output determination, Pricing Methods and Stock Market and inflation influence on industry.

Introduction to Management: Evolution of Management thought, theories of Motivation, Leadership styles.

Project Management: Brief about Project crashing.

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	1. The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for a product and Input-Output-Cost relationships.
CO2	2. The Learner is also ready to understand the nature of different markets and also to have the knowledge of Money & Banking.

CO4	4. The Learner will acquire the knowledge to prepare Financial Statements and the techniques of project management.
CO5	5. The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

Learning Resources
Text books:
1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2018, 2e. 2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2012. 3. Management Science, Aryasri, Tata McGraw Hill, 2014. 4. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to *Management Science'* Cengage, Delhi, 2012. 5. Engineering Economy and Management 1 Edition Pravin Kumar – Wiley Publication. 6. Engineering Economics & Management- Dr. Vilas Kulkarni & HardikBavishi - Vikas Publishing.
Reference books:
1. R. L Varshney, K.L. Maheshwari : Managerial Economics, Sultan Chand&Sons 2014,22e. 2. Suma Damodaran : Managerial Economics, Oxford 2010,2e. 3. Ambrish Gupta: 'Financial Accounting for Management', Pearson 2015,5e. 4. Dr. S.N. Maheswari: Financial Accounting, Vikas Publications 2018. 5. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2017. 6. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018. 7. Human Resource Management: Gary Dessler, 14^{th} Edition, pearson 2015. 8. Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4^{th} Edition.
e- Resources & other digital material
1. www.managementstudyguide.com
2. www.tutorialspoint.com
3. www.lecturenotes.in

1.

UNIT – I Introduction to Economics and Theory of Production **13 Hrs**

Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics –Concept of Demand, Types of Demand, Determinants of Demand-Law of Demand -Elasticity of Demand, Types of Elasticity of Demand.

Theory of production; production function, Law of variable proportions & law of returns to scale, Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, simple problems.

Unit	Module	Micro Content
Unit I	Concept of Economics	Economics, Definitions of Economics
		Micro economics, Macro economics
		Scope of Micro & Macro Economics
		Difference Between Micro & Macro Economics
		Meaning & Definitions of Managerial Economics
	Basic Economic tools of Managerial economics	Opportunity cost Principle
	Concept of Demand	What is Demand, Demand Analysis & Objectives
	Types of Demand	Demand distinctions, Demand function
		Factors determining demand
	Demand Schedule	Individual demand schedule, Market demand schedule
	Demand Curve	Individual demand curve, Market demand curve
	Law of Demand	Assumption of law of demand, Change in demand, Exceptions of law of demand, why does demand curve slope downwards.
	Elasticity of Demand, Types of Elasticity of Demand & Measurement	Meaning of elasticity of demand, types of Price and income elasticity of demand, factors effecting elasticity of demand, measurements of elasticity of demand, significance of elasticity of demand
	Theory of Production	Production function, Production process, importance of production, assumptions
	Laws of Returns to scale	Schedule and graph
	Cost Analysis	Types of costs, cost & output relationship in short run and long run
	Break even Analysis	Uses, limitations of Break even analysis, Key terminology in Break analysis, Simple problems on BEP, graphical representation of Break even analysis.

UNIT - II Introduction to Markets and Money: **12 Hrs**

Markets: meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly).National Income, GNP, GDP, NNP, NDP, Personal income and GST (Goods & Service Tax).

Money: meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools, Banking; meaning, types, functions, Central Bank- RBI; its functions,

	Perfect Competition	Features
	Monopoly	Features
	Monopolistic competition	Features
	Oligopoly	features
	Macro Economics	National income, ,GNP, GDP, NNP, NDP, Personal Income and GST
	Money	Functions, types
		Monetary Policy
		Fiscal Policy
	Banking	Types, Functions
	RBI	Concept and functions
	Bank Rates	CRR, bank rate, repo rate, reverse repo rate, SLR

UNIT – III Introduction to Management: 12 Hrs

Concept –nature and importance of Management Functions of Management, Principles of Management.

Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.
Marketing Management: Functions of Marketing - Marketing strategies based on product Life Cycle, Channels of distributions.

Unit III	Management	Concepts, functions, Principles
	HRM	Concepts of HRM, Personnel Management
		Diff B/w HRM & PM
		Function of HRM
	Marketing Management	Concepts of Marketing
		Functions of Marketing
		Product Life Cycle
		Marketing strategies based on product Life Cycle
		Channels of distributions.

UNIT – IV Introduction to Accounting & Project Management 15 Hrs

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements.

Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path (Simple Problems).

Unit IV	Financial Accounting	Meaning, definitions, objectives & significance, users of accounting, accounting cycle, GAAP.
	Book Keeping	Single and double entry book keeping, types of Accounting
	Journal	Features, Pro-forma, Advantages & Limitations, preparation of journal entries, simple problems
	ledger	Features, Pro-forma, Advantages & Limitations, preparation of ledger, simple

		Limitations, preparation of Trial balance, simple problems.
	Final accounts	Trading account- Pro-forma, Simple problems
		Profit & Loss account- Pro-forma, Simple problems
		Preparation of balance sheet with simple adjustments
	Project Management	Net work Analysis –Simple Problems
		PERT – Simple Problems
		CPM – Simple Problems
		Diff B/w PERT & CPM

UNIT - V Capital and Capital Budgeting **12 Hrs**

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

Unit V	Capital	What is capital, need of capital types of capital
		Types of fixed capital, types of working capital
	Capital Budgeting	Meaning, Nature & scope of capital budgeting
		Capital budgeting procedure, capital budgeting decisions, method of capital budgeting.
	Payback period	Meaning, formula, advantages & disadvantages, simple problems
	Accounting rate of return(ARR)	Meaning, formula, advantages & disadvantages, simple problems
	Net present value (NPV)	Meaning, formula, advantages & disadvantages, simple problems
	Profitability index (PI)	Meaning, formula, advantages & disadvantages, simple problems
	Internal rate of return (IRR)	Meaning, formula, advantages & disadvantages, simple problems

CO-PO mapping Table with Justification

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	1	1	-	-	-	-	1	-	1	1	2	-
CO 2	1	2	-	-	-	1	1	-	1	-	2	-
CO 3	-	-	-	-	-	1	1	1	1	1	2	-
CO 4	1	2	-	3	-	-	1	-	1	2	2	-
CO 5	1	2	-	3	-	-	1	1	1	2	2	-

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	1		
CO2	-	1		
CO3	-	1		
CO4	-	1		
CO5	-	1		

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III-Year-I Semester	SOIL MECHANICS	L	T	P	C
PC3101		3	0	0	3

Course Objectives:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

UNIT-I

INTRODUCTION AND INDEX PROPERTIES OF SOILS 10 HOURS

Soil formation– Soil structure and clay mineralogy, Adsorbed water, Mass- Volume relationships – Relative density. Grain size analysis– Sieve and Hydrometer methods – Consistency limits and indices– IS Classification of soils.

UNIT– II

PERMEABILITY & SEEPAGE THROUGH SOILS 12 HOURS

Soil water – Capillary rise – Flow of water through soils – Darcy's Law- Permeability – Factors affecting permeability, Capillary phenomenon in soils – Laboratory determination of coefficient of permeability – Permeability of layered systems. Total, neutral and effective stresses – Quick sand condition – Seepage through soils –Flow nets: Construction, Characteristics and Uses.

UNIT-III

STRESS DISTRIBUTION IN SOILS 12 HOURS

Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.

UNIT-IV

COMPACTION & CONSOLIDATION 13 HOURS

Mechanism of compaction – Factors affecting compaction– Effects of compaction on soil properties – Field compaction Equipment –compaction control. Stress history of clay; Compressibility of soils, Terzaghi's one dimensional consolidation theory, Consolidation test, pre-consolidation pressure, e - p and e-log p curves, total settlement.

UNIT-V

SHEAR STRENGTH OF SOILS 13 HOURS

Mohr – Coulomb failure theories – Types of laboratory strength tests– Strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays, pore pressure coefficients.

TEXT BOOKS:

1. Arora. K.R., "Soil Mechanics and Foundation Engineering", 5th Edition, Standard Publishers and Distributors, 2001.
2. Gopal Ranjan, Rao A.S.R., "Basic and Applied Soil Mechanics", 2nd Edition, New Age Intl. (P) Ltd., 2005.

REFERENCES:

1. Das. B.M., "Principles of Geotechnical Engineering", 7th Edition, Cengage Learning, 2010.
2. Murthy V. N. S., "Textbook of Soil Mechanics and Foundation Engineering", 1st Edition,
3. CBS Publishers, 2018.
4. Venkataramiah. C., "Geotechnical Engineering", 3rd Edition. New Age International Pvt. Ltd, 2008.

Course Outcomes:

The students will be able to

CO1: ***Classify*** -soil and their engineering properties (Understanding)

CO2:***Explain***-the importance of permeability, seepage and its effects (Understanding, Applying)

CO3: ***Calculate*** -the stresses in soils under external loads (Analysing, Evaluating)

CO4: ***Analysis***- settlement behaviour of soils under compaction and consolidation (Analysing, Evaluating)

CO5: ***Explain***- the failure mechanism under the influence of different loading and drainage conditions (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus-Soil Mechanics

UNIT-I: INTRODUCTION AND INDEX PROPERTIES OF SOILS Soil formation– Soil structure and clay mineralogy, Adsorbed water, Mass- Volume relationships – Relative density. Grain size analysis– Sieve and Hydrometer methods – Consistency limits and indices– IS Classification of soils.		
Unit	**Module**	**Micro content**
Ia. Introduction	Introduction	Soil formation– Soil structure-Adsorbed water
	Clay mineralogy	Structural units of clay minerals
		Important clay minerals
	Mass –volume relationships	Mass densities, weight densities, specific gravity, void ratio, porosity, degree of saturation, air content, percentage void ratio and their relations, relative density(concept and problems)
Ib. Index properties of soil	Grain size analysis, Atterberg's limits, I.S classification	Mechanical sieve analysis, hydrometer method(concept, no problems)
		Consistency limits-LL,PL and SL
		Indices
		I.S classification
Unit– II: PERMEABILITY & SEEPAGE THROUGH SOILS Soil water – Capillary rise – Flow of water through soils – Darcy's Law- Permeability – Factors affecting permeability, Capillary phenomenon in soils – Laboratory determination of coefficient of permeability – Permeability of layered systems. Total, neutral and effective stresses – Quick sand condition – Seepage through soils –Flow nets: Construction, Characteristics and Uses.		

	Flow of water through soils	Darcy's Law
		Permeability – Factors affecting permeability, Capillary phenomenon in soils
		Laboratory determination of coefficient of permeability (concept and problems)
		Permeability of layered systems (concept and problems)
II.b. Seepage through soils	Stresses in soil & Seepage through soils	Total, neutral and effective stresses
		problems
		Quick sand condition
		Flow nets, construction
		Flow net, Characteristics and uses

Unit-III: STRESS DISTRIBUTION IN SOILS

Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.

Unit	**Module**	**Micro content**
III. Stress distribution in soils	Introduction	Stress distribution of soils
	Boussinesq's theory	For point loads and different shapes(concept and problems)
	Westergaard's theory	For point loads and different shapes(concept and no problems)
	Newmark's influence chart	Construction procedure, Applications

Unit-IV: COMPACTION & CONSOLIDATION:

Mechanism of compaction – Factors affecting compaction– Effects of compaction on soil properties – Field compaction Equipment –compaction control. Stress history of clay; Compressibility of soils, Terzaghi's one dimensional consolidation theory, Consolidation test, pre-consolidation pressure, e - p and e-log p curves, total settlement.

Unit	**Module**	**Micro content**
IVa. Compaction	Introduction	Mechanism of compaction
	Compaction	Factors affecting compaction
		Effects of compaction on soil properties
		Field compaction Equipment
		Field compaction-Compaction control
IVb.Consolidation	Introduction	Difference between compaction and consolidation
	Consolidation	Stress history of clay
		Compressibility of soils
		Terzaghi's one dimensional consolidation theory, Assumptions
		Consolidation test
		pre-consolidation pressure, e - p and e-log p curves
		Types of settlements, total settlement, problems

Unit-V: SHEAR STRENGTH OF SOILS

Mohr – Coulomb failure theories – Types of laboratory strength tests– Strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays, pore pressure coefficients.

Unit	Module	Micro content
V. Shear strength of soils	Introduction	Shear strength of soils
	Shear strength theories	Mohr – Coulomb failure theories
	Laboratory strength tests	Types of laboratory strength tests
		Strength tests based on drainage conditions
	Strength of soils	Shear strength of sands
		Critical Void Ratio
		Concept of liquefaction
		Shear strength of clays
		Pore pressure coefficients (concept only)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-I Semester	DESIGN AND DRAWING OF CONCRETE STRUCTURES	L	T	P	C
PC3102		3	1	0	3

Course Objectives:

1. To impart basic concepts of design of individual components of the reinforced concrete structures using limit state and working stress method.
2. To impart concepts of limit state design and serviceability checks for different components of RCC structures using the Indian standard codes with different loading conditions and to sketch the reinforcement details of designed structure.
3. To understand the principles of singly reinforced beams and doubly reinforced beams.
4. To enable the students to design of Important RCC structures like beams, slabs, and columns and footings.
5. For the given loads, impart the students to design according to IS codes.

Unit-I: INTRODUCTION TO DESIGN METHODS **10 HOURS**

Working stress method: Introduction- loading standards – Dead, live, wind and earthquake loads, Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance for balanced, under-reinforced and over-reinforced sections. – Design for bending –analysis and design of singly reinforced and doubly reinforced beams.

Limit state method: Concepts of limit state design – Characteristic loads –Characteristic strength – Partial load and safety factors – Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

Unit– II: DESIGN OF BEAMS **13 HOURS**

Beams: Design of singly and doubly reinforced beams-effective depth-Moment of Resistance-Minimum depth and minimum tension reinforcement- Design examples of simply supported and cantilever beams.

Flanged sections: Analysis of singly and doubly reinforced flanged sections – Design of flanged sections- effective width of flange- Minimum depth and minimum tension reinforcement.

Shear and Torsion: Limit state design of section for Shear and torsion – Concept of Anchorage and development length, Deflection- IS Code provisions.

Unit-III: DESIGN OF SLABS **13 HOURS**

Slabs: Introduction to types of slabs- One way slab- two-way slabs- Design examples for one way and two-way slabs – Continuous slab design – Reinforcement detailing.

Unit-IV: DESIGN OF COLUMNS **12 HOURS**

Columns: Different types of columns – Design of short and long columns – Columns subjected to axial load – Columns subjected to uni-axial and bi axial bending – IS code provisions– Reinforcement detailing.

Unit-V: DESIGN OF FOOTINGS **12 HOURS**

Footings: Different types of footings – Design of isolated footings – Square, rectangular shape footings – Design of footings subjected to axial load and uni axial moment – Reinforcement Detailing.

Note: All designs from Unit II should be in limit state design.
Following plates should be prepared by the students.
1. Reinforcement detailing of Rectangular beams, T-beams and L-beams.
2. Reinforcement detailing of columns and isolated footings.
3. Detailing of one-way and two-way slabs.
4. Reinforcement detailing of continuous slabs.

FINAL EXAMINATION (END SEMESTER) PATTERN:

The end examination paper should consist of Part A and Part B. PART A consists of two questions (each 24 marks) in Design and Drawing out of which ONE question is to be answered. PART B should consist of five questions of 12m each in design out of which THREE are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXT BOOKS:

1. Limit State Design, A. K. Jain.
2. Limit State Design of Reinforced concrete, B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, 2007, Laxmi Publications.

REFERENCE BOOKS:

1. Reinforced concrete design, S.Unnikrishna Pillai & Devdas Menon, 3rd edition,Tata Mc.Graw Hill, New Delhi.
2. N.C. Sinha and S.K Roy, *"Fundamentals of Reinforced Concrete"*, 4th Edition, S. Chand publishers, 2002
3. N. Krishna Raju and R.N. Pranesh, *"Reinforced Concrete Design"*, 8th Edition, New age International Publishers, New Delhi, 2004.
4. Fundamentals of Reinforced concrete design, M.L. Gambhir, 3rd edition, Printice Hall of India Private Ltd.
5. IS Codes: IS 456:2000, IS 875(Part I & II)

Course Outcomes:

The students will be able to

CO1: ***Understand*** the fundamental behaviour of RCC structures and code provisions of IS 456:2000 and IS 875.

CO2: ***Analyse*** the different types of beams subjected to different loading conditions and understand the variation of moment of resistance (Understanding, Analysing)

CO3: ***Apply*** the IS code provisions for design of sections and determining the reinforcement detailing satisfying the given loading conditions (Applying, Analysing)

CO4: ***Design*** of slabs, columns and footings for given loading conditions (Designing)

CO5: ***Drawing*** the reinforcement detailing of beams, columns and footings and slabs for obtained data in design. (Analysing, drawing)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Designing, 6 - Drawing

Micro-Syllabus of Design and Drawing of reinforced Concrete Structures

Unit-I: INTRODUCTION TO DESIGN METHODS

Working stress method: Introduction- loading standards – Dead, live, wind and earthquake loads, Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance for balanced, under-reinforced and over-reinforced sections. – Design for bending–analysis and design of singly reinforced and doubly reinforced beams.

Limit state method: Concepts of limit state design – Characteristic loads –Characteristic strength – Partial load and safety factors – Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

Unit	Module	Micro content
Ia. Working stress Method	Introduction	Loading standards, dead load, live load, earthquake load and wind load
	Elastic theory	Design constant
		Modular ratio
		Depth of neutral axis
	Moment of Resistance	For balanced section
		For under reinforced section
		For over reinforced section
	Design	Singly reinforced section
		Doubly reinforced section
Ib. Limit state method	Basic concept of limit state design.	Partial load and safety factors
		Assumptions
		Stress block parameters
		Limiting moment of resistance

Unit– II: DESIGN OF BEAMS

Beams: Design of singly and doubly reinforced beams-effective depth-Moment of Resistance-Minimum depth and minimum tension reinforcement- Design examples in simply supported and cantilever beams

Flanged sections: Analysis of singly and doubly reinforced flanged sections – Design of flanged sections- effective width of flange- Minimum depth and minimum tension reinforcement

Shear and Torsion: Limit state design of section for Shear and torsion – Concept of Anchorage and development length, Deflection- IS Code provisions.

Unit	Module	Micro content
II. Design of Beams	Rectangular beams	Design of singly reinforcement and doubly reinforcement beams (limit state)
		Moment of resistance
		Minimum reinforcement
		Design examples of simply supported and cantilever beams
	Flanged beams	Analysis of singly and doubly reinforced flanged sections
		Effective width of flange
		Design of flanged sections
	Shear and Torsion	Limit state design of section for Shear and torsion
		Concept of Anchorage
		Development length
		Deflection

Unit-III: DESIGN OF SLABS

Slabs: Introduction to types of slabs- One way slab- two way slabs- Design examples for one way and two way slabs – Continuous slab design – Reinforcement detailing.

Unit	Module	Micro content
III. Design of slabs	Types of slabs	One way slabs
		Two way slabs
		Continuous slabs
		IS code provisions
	Design examples	One way slabs
		Two way slabs
		Continuous slabs
		Reinforcement Detailing

Unit-IV: DESIGN OF COLUMNS

Columns: Different types of columns – Design of short and long columns – Columns subjected to axial load – Columns subjected to uni-axial and bi axial bending – IS code provisions– Reinforcement detailing.

Unit	Module	Micro content
IV. Columns	Introduction	Different types of columns
	Design of columns	Short columns subjected to axial load
		Short columns subjected to uni-axial and bi-axial bending moments
		Design of long columns
		Reinforcement detailing

Unit-V: DESIGN OF FOOTINGS

Footings: Different types of footings – Design of isolated footings – Square, rectangular footings – Design of footings subjected to axial load and uni axial moment – Reinforcement Detailing.

Unit	Module	Micro content
V. Design of Footings	Introduction	Different types of footing
		Different loading conditions
	Design of isolated footings	Square and rectangular footings
		Footings subjected to axial load
		Footings subjected to uni axial moments
		Reinforcement detailing

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1								2	
CO2	2	3									3	
CO3	3	4									3	
CO4	2	4	5									5
CO5	6	1	3							6	3	

III-Year-I Semester	BUILDING SERVICES	L	T	P	C
OE3101A		3	1	0	3

Course Objectives:

At the end course the student able to know the requirements of building services such as

1. Types of air conditioning,
2. Types of transportation system,
3. Firefighting, electrical services,
4. Concepts of green building and energy efficient systems

Unit-I **12 HOURS**

Introduction to Building Services:

Definitions - Objective and uses of services - Applications of services for different types building considering - Classification of services- Types of services and selection of services- Natural and artificial lighting principles and factors- Arrangement of luminaries, Distribution of illumination, Utilization factors- Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.

Unit II **12 HOURS**

Electrical Services and Layout:

Electrical services in the building -Technical terms and symbols for electrical installations and Accessories of wiring- Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring - Types of insulation- electrical layout for residence, small work shop, show room, school building, etc.

Unit III **12 HOURS**

Mechanical Services in Buildings:

Introduction of mechanical services - Lift - Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car. Elevators & Escalators -Different types of elevators and Escalators - Freight Elevators-Passenger elevators –Hospital elevators -Uses of different types of elevators and Escalators. Air Conditioning- Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners (Central type, Split Unit).

Unit IV **12 HOURS**

Fire Protection, Acoustic and Sound Insulations:

Introduction- Causes of fire and Effects of fireGeneral Requirements of Fire Resisting building as per IS and NBC 2005-Characteristics of Fire resisting materials- Maximum Travel Distance- ire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs- Requirement of good Acoustic -Various sound absolvent- Factors to be followed for noise control in residential building

Unit V **12 HOURS**

Miscellaneous Services and Green Buildings Provisions:

Rain water Harvesting for buildingsConcept of GREEN buildings -Components of GREEN building - Introduction and Significance to Grey water- Components of Grey water system -Management of Grey water system.

TEXT BOOKS:

1. A text book on Building Services by R. Udaykumar, Eswar Press, Chennai
2. Building Services by S. M. Patil, Seema Publication, Mumbai Revised edition
3. Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition", Faye C. McQuiston, Jerald D. Parker and Jeffrey D. Spitler, John Wiley & Sons

REFERENCE BOOKS:

1. SP 7: 2005 National Building Code of India, Bureau of Indian Standards, BIS, New Delhi
2. Building Construction by B. C. Punmia, Laxmi Publications (P) Ltd., New Delhi
3. IS 3534: 1976 "Outline dimensions of electric lifts"
4. IS1860: 1980 "Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts"

III-Year-I Semester	DISASTER MANAGEMENT	L	T	P	C
OE3101B		3	1	0	3

Course Objectives:

The subject provides different disasters, tools and methods for disaster management

Course Outcomes:

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

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts
- Understanding coping Strategies
- Understanding planning of disaster managements

UNIT - I **10 HOURS**

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II **10 HOURS**

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III **10 HOURS**

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV **10 HOURS**

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

UNIT - V **10 HOURS**

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans.

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

2. Disaster Management by Mrinalini Pandey Wiley 2014.

3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.

2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

III-Year-I Semester
OE3101C

TRAFFIC SAFETY

L	T	P	C
3	1	0	3

Course Objectives:

At the end course the student able to know the requirements of building services such as

1. This module on the fundamentals of traffic engg. & some of the statistical methods to analyse the traffic safety.
2. The accident interrogations and risk involved with measures to identify the causes are dealt.
3. The role of road safety in planning the urban infrastructures design is discussed.
4. Various mitigation measures to prevent the road accidents are dealt

Unit-I **10 HOURS**

Fundamentals of Traffic Engineering:

Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT II **10 HOURS**

Accident Investigations and Risk Management: Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction.

UNIT III **10 HOURS**

Road Safety in Planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT IV **10 HOURS**

Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their safety.

UNIT V **10 HOURS**

Mitigation Measures: Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law, Road safety audit.

TEXT BOOKS:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999. Towards Safe Roads in Developing country, TRL – ODA, 2004.
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
3. Fundamentals of Traffic Engineering, Richardo G Sigua

REFERENCE BOOKS:

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)

2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson

3. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).

4. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016

5. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India.

6. Transportation Engineering – An Introduction, C.Jotinkhisty, B. Kent Lall

7. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson 8. Road Safety by NCHRP.

III-Year-I Semester OE3101D	PROJECT MANAGEMENT	L	T	P	C
		3	1	0	3

Course Objectives:

The objective of this course is

1. Able to plan, coordination, and control of a project from beginning to completion.
2. Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.

Unit-I: **10 HOURS**

Management process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

Unit– II: **12 HOURS**

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management.

Unit-III: **14 HOURS**

Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.Resource planning - planning for manpower, materials, costs, equipment. Labour - Scheduling - Forms of scheduling - Resource allocation.

Unit-IV: **10 HOURS**

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document, Deposits by the contractor– Arbitration- negotiation – M-Book - Muster roll -stores.

Unit-V: **10 HOURS**

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws

Safety in construction: Occupational and safety hazard assessment. Human factors in safety.

TEXT BOOKS:

1. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987
2. Ghalot, P.S., Dhir, D.M., Construction Planning and Management, Wiley Eastern Limited,1992.

REFERENCE BOOKS:

1. ‘Construction technology and management by S.Seetharaman.

Unit-I:

nagement process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

Unit	Module	Micro content
I. Management process	Introduction	Roles & management theories
		Social responsibilities
		Planning and strategic management
		Decision making: tools and techniques
		Organizational structure
		Human resource management

Unit– II:

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management.

Unit	Module	Micro content
Unit-II	Construction Projects	Classification of Construction projects
		Construction stages
	Resources	Functions of Construction Management and its Applications
	Planning	Preliminary Planning
		Collection of Data
		Contract Planning

Unit-III:

Network Techniques in construction management - Bar chart, milestone chart, CPM, PERT- Cost & Time optimization.Resource planning - planning for manpower, materials, costs, equipment. Labour - Scheduling - Forms of scheduling - Resource allocation

Unit	Module	Micro content
III. Network Techniques in construction management	Scheduling techniques	Bar chart, Milestone chart, CPM & PERT
	Resource Planning	Manpower, materials, cost, labour & equipment
	Scheduling	Forms of scheduling
	Resource allocation	Resource allocation

Unit-IV:

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document, Deposits by the contractor– Arbitration- negotiation – M-Book - Muster roll -stores.

Unit	Module	Micro content

		Contract document
		Specification
		Important conditions
	Tender	Introduction and tender document
	Deposits	Arbitration
		Negotiation
		M-Book
		Muster roll stores

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws

Safety in construction: Occupational and safety hazard assessment. Human factors in safety.

Unit	Module	Micro content
V.Management Information System	Acts & regulations	Labour Regulations
		welfare Legislation
		Laws relating to Wages
		Insurance and Safety Regulations
		Workmen's Compensation Act
	Safety in construction	Occupational and safety hazard assessment
		Human factors in safety

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2						3	
CO2	2				2						3	

	PSO1	PSO2	PSO3
CO1	1		2
CO2	1		2

III-Year-I Semester	ADVANCED STRENGTH OF MATERIALS	L	T	P	C
PE3101A		3	1	0	3

Course Objectives:

1. To give preliminary concepts of principal stresses developed in the cross section of the beams analytically as well as graphically due to stresses acting on the cross section and stresses on any inclined plane and to know different failure theories adopted in designing of structural members

2. To classify columns and calculation of load carrying capacity using different empirical formulas and to assess stresses due to axial loads for different end conditions.

3. To calculate combined effect of direct and bending stresses with different engineering structures.

4. To impart the concept of unsymmetrical bending, location of neutral axis and shear centre.

5. To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section due to internal pressure.

UNIT-I: PRINCIPAL STRESSES

Introduction –Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses–Two perpendicular normal stresses accompanied by a state of simple shear — Principal stresses, Mohr's circle of stresses - graphical solutions (Basic concept)

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 theory- Simple applications.

(14 Lectures)

UNIT-II: COLUMNS AND STRUTS

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula. **(13 Lectures)**

UNIT-III: DIRECT AND BENDING STRESSES

Stresses under the combined action of direct loading and B.M., Core of a sections, stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to

direct loading and B.M. about both axes. **(14 Lectures)**

UNIT-IV: UNSYMMETRICAL BENDING

Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis.

Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts **(12 Lectures)**

UNIT-V: THIN CYLINDERS AND THICK CYLINDERS

Thin Cylinders: Thin seamless cylindrical shells –Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction, Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders. **(12 Lectures)**

Text Books:

1. Mechanics of Materials- by R. C. Hibbler
2. Strength of materials by S. S. Bhavakatti
3. Strength of materials by R.K.Bansal vol. 1 & 2

Reference Books:

1. Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi.
2. Introduction to text book of Strength of Material by U.C. Jindal, Galgotia publications.
3. Strength of materials by R. Subramanian, Oxford university press, New Delhi.
4. Strength of Materials by S. Ramamrutham Dhanpat Rai Publishing Co., (P) Ltd. New Delhi
5. Theory of Structures by S.P.Timoshenko & DH. Young

Course Outcomes

The student will be able to

CO1 **Analyse:** principal stresses and understands theories of failure and its application. (Understanding, Analysing)

CO2 **Analyze and evaluate:** the stresses in columns by various theories. (Analyzing, Evaluating)

CO3 **Analyze:** strength and stability of structural members subjected to, direct and bending Stresses. (Applying, Analysing)

CO4 **Understand:** the concepts of unsymmetrical bending and shear center. (Understanding)

CO5 **Interpret:** the stresses in thick and thin cylindrical shells subjected to internal pressure (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 – Creating

UNIT-I: PRINCIPAL STRESSES

Introduction –Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses–Two perpendicular normal stresses accompanied by a state of simple shear(Concepts and problems) –– Principal stresses and strains (Concept and problems) and Mohr's circle of stresses- graphical solutions(Concept only)

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 theory- Simple applications

Unit	Module	Micro content
Ia. Principle stresses	Introduction	Principle stress and principle plane
		Stresses on inclined plane- Uni-axial loading
	Biaxial stresses	Normal and tangential stresses on inclined plane in a bar when bar is subjected by two perpendiculars like stresses /unlike stresses.(concept and problems)
	Bar subjected by two perpendicular normal stresses and simple shear	Two perpendicular normal stresses accompanied by a state of simple shear. (Concepts and problems)
	Principle stresses	Location of principle planes and magnitude of principle stresses, Location of planes carrying shear stress, maximum shear stress (concept and problems) and concept of Principle strains.
	Mohr's graphical method	Mohr circle of stresses to find normal and tangential stresses, on inclined plane when bar is subjected by principle like stresses/unlike stresses accompanied by simple shear on the surface. Location of principle planes, major and minor principle stresses, location of shear stress and maximum shear stress (Concept only-no problems)
Ib. Theories of failure	Theories of failure (concept and simple problems)	Maximum Principal Stress theory
		Maximum Principal Strain theory
		Maximum shear stress theory
		Maximum strain energy theory
		Maximum shear strain energy theory

UNIT– II: COLUMNS AND STRUTS

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory– Rankin's formula – Long columns subjected to eccentric loading – Secant formula (concepts and problems) – Empirical formulae – Straight line formula (concept only). – Prof. Perry's formula (concept only)

Unit	Module	Micro content
II-	Introduction	Definition of column and strut, types of columns – Short, medium and long columns, Axially loaded compression members – Crushing load

		Derivation of Euler's critical load formulae for various end conditions
		Equivalent length of a column, slenderness ratio, problems
		Euler's critical stress – Limitations of Euler's theory
	Rankin's formula	Derivation of Rankin's formula, problems
	Long columns subjected to eccentric loading	Secant formula (concepts and problems)
	Empirical formulae	Straight line formula – Prof. Perry's formula (concept only)

UNIT-III: DIRECT AND BENDING STRESSES

Stresses under the combined action of direct loading and B.M. Core of a sections (concept and problems) – determination of stresses in the case of chimneys, retaining walls and dams (Concept and problems) – conditions for stability – stresses due to direct loading and B.M. about both axis.(Concept and problems)

Unit	**Module**	**Micro content**
III. Direct and bending stresses	Introduction	Concept of direct and bending stresses
	Stresses under the combined action of direct loading and B.M	Stresses due to eccentric loading on column sections-Rectangle, circular, hollow rectangle, hollow circular,(concept and problems)
		Stresses due to direct loading and B.M. about both axis.(Concept and problems)
	Core of a sections	Core of a sections- rectangle, circular, hallow circular, hallow rectangle
	Stresses in chimneys, retaining walls and dams	Dams (Concept and problems)
		Retaining walls (Concept and problems)
		Chimneys(Concept and problems)
	Stability conditions	Stability conditions of a Dam

Unit-IV: UNSYMMETRICAL BENDING

Introduction – Centroidal principal axes of section –Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis. Shear Centre**:** Introduction - Shear centre for symmetrical and unsymmetrical sections-(Concepts only)

Unit	**Module**	**Micro content**
IV. Unsymmetrical bending	Introduction	Centroidal principal axes of section
		Moments of inertia referred to any set of rectangular axes
	Stresses in beams subjected to unsymmetrical bending (Concept andproblems)	Stresses in beams subjected to unsymmetrical bending
		Principle axis
		Resolution of bending moment into two rectangular axes through the centroid
		Location of neutral axis

		Shear centre for symmetrical and unsymmetrical sections-(Concepts only)

UNIT-V: THIN CYLINDERS AND THICK CYLINDERS

Thin Cylinders: Thin seamless cylindrical shells –Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders.

Unit	**Module**	**Micro content**
Va. Thin Cylinders	Introduction	Thin cylindrical shells
		Derivation of longitudinal and circumferential stresses
	Strains & changes in dimensions of cylinder	Hoop strain
		Longitudinal strain
		Volumetric strain
		changes in diameter, and volume of thin cylinders.
Vb. Thick Cylinders	Introduction	Introduction to thick cylinders, Lame's theory for thick cylinders
	Derivation	Hoop stresses
		Radial stresses
		Thick cylinders (simple problems)
		Compound cylinders (simple problems)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2						2		
CO2	3	2		1						2		
CO3	3	2		2						2		
CO4	3	2		1						1		
CO5	3	2		1						2		

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III-Year-I Semester	REINFORCED SOIL STRUCTURES	L	T	P	C
PE3101B		3	1	0	3

Course Objectives:

1. To understand the history and mechanism of reinforced soil
2. To know the various types of geo-synthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures.

UNIT-I **10 HOURS**

PRINCIPLES, MECHANISMS AND MATERIALS:

Historical background, principles, concepts and mechanisms of reinforced earth. Materials used in reinforced soil structures, fill materials, reinforcing materials- metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers, facing elements, properties and methods of Testing.

UNIT– II **10 HOURS**

DESIGN ASPECTS AND APPLICATION:

Design aspects of reinforced earth, Design and applications of reinforced earth of various structures, like retaining walls, foundations, pavements, embankments and slopes

UNIT-III **12 HOURS**

DURABILITY OF REINFORCEMENT MATERIALS:

Measurement of corrosion factors, resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion – influence of environmental factors on the performance of Geosynthetic materials. Testing of geotextiles.

UNIT-IV **12 HOURS**

CASE HISTORIES AND APPLICATIONS:

Performance studies of reinforced dams, embankments, pavements, foundations and underground structure - case studies.

UNIT-V **12 HOURS**

SOIL NAILING:

Concept of soil nailing, methods of nailing, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil, applications.

TEXT BOOKS:

1. Gray, D.H., and Sotir, R.B., Biotechnical and Soil Engineering Slope Stabilization: A Practical Guide for Erosion control, 3rd Edition, John Wiley & Sons, 1996.
2. Koerner, R. M., "Design with Geosynthetics", 3rd Edition Prentice Hall, 2002

3. RamanathaAyyar ,T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N., Comprehensive reference book on Coir Geotextile, 1st Edition, Centre for Development for Coir Technology,2002.
4. SivakumarBabu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, 1st Edition, University Press (India), Pvt. Ltd., 2006.
5. Swami Saran, Reinforced Soil and its Engineering Applications", 1st Edition, IK International Pvt. Ltd., 2006

REFERENCES:

1. Christopher, B. R., et al., Reinforced soil structures, Vol. 1: Design and Construction guidelines, Report FHWA-RD-89-043, Federal Highway Administration, USA, 1990.
2. Gerard P.T.M. Van Santvrot, Geo-textiles and Geomembranes in Civil Engineering, 1st Edition, A. A. Balkema,Oxford and IBH Publishing Company, 2006.
3. John, N.W.M., Geotextiles. 2nd Edition, Blackie, 2004.
4. Mandal, J. N., Reinforced Soil and Geo-textiles, Proc. of IGC-1988, Oxford and IBH Publishing Company PrivateLtd., 1988.
5. Mandal, J. N., Geosynthetics World, 1st Edition, Wiley Eastern Limited, 2002.
6. Muller, W.W., HDPE Geomembranes in Geotechnics, 3rd Edition, Springer, 2007.
7. Tarmat, R. J., Geosynthetics: Applications, Design and Construction, Proc. of 1st European Geosynthetics Conference, Netherlands, A. A. Balkema, 2004.

CODES:

1. Federal Highway Administration, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Vols. I & 2, Publication No. FHWA-NHI-10-024, 2009.
2. BS 8006-1:2010, Code of practice for strengthened/reinforced soils and other fills, 2010.
3. BS 8006-2:2011, Code of practice for strengthened/reinforced soils. Soil nail design, 2011.

Course Outcomes:

The students will be able to

CO1: **Explain** – the principles and mechanisms of reinforced soil (Understanding)

CO2: ***Evaluate*** the applications of reinforced soil (Understanding, Evaluating)

CO3: ***Explain*** the functions of geotextiles (Understanding)

CO4: ***Analyse*** the durability of reinforcing materials (Analysing)
CO5: ***Applying*** -Develop the applications of reinforced soil in civil engineering (Applying)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus **REINFORCED SOIL STRUCTURES**

UNIT-I: PRINCIPLES, MECHANISMS AND MATERIALS:

Historical background, principles, concepts and mechanisms of reinforced earth. Materials used in reinforced soil structures, fill materials, reinforcing materials- metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers, facing elements, properties and methods of Testing.

Unit	Module	Micro content
I.Principles,	Introduction	Introduction to reinforced soil structures

	structure	Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers
		Facing elements, properties and methods of testing.

UNIT– II: DESIGN ASPECTS AND APPLICATION:
Design aspects of reinforced earth, Design and applications of reinforced earth of various structures, like retaining walls, foundations, pavements, embankments and slopes

Unit	Module	Micro content
II. Designs aspects and applications	Introduction	Design aspects of reinforced earth
	Design and applications	Design and applications of reinforced earth
		Applications to retaining walls, foundations, pavements, embankments and slopes

UNIT-III: DURABILITY OF REINFORCEMENT MATERIALS:
Measurement of corrosion factors, resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion – influence of environmental factors on the performance of Geosynthetic materials. Testing of geotextiles.

Unit	Module	Micro content
III. Durability of reinforcement materials	Introduction	Durability of reinforcing materials
	Measurement of corrosion factors	Resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion
	Environmental factors	Environmental factors on the performance of Geosynthetic materials
	Testing of geotextiles	Various test methods of geotextiles

UNIT-IV: CASE HISTORIES AND APPLICATIONS:
Performance studies of reinforced dams, embankments, pavements, foundation and underground structure - case studies

Unit	Module	Micro content
IV. Case histories and applications	Introduction	Introduction to applications
	Performance studies	Reinforced dams, embankments, pavements, foundation and underground structure
		Case studies

UNIT-V: SOIL NAILING:
Concept of soil nailing, methods of nailing, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil, applications.

Unit	Module	Micro content
V. Soil nailing	Introduction	Concept of soil nailing
	Soil nailing	Methods, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil
		Applicatons

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-I Semester	AIR POLLUTION AND CONTROL	L	T	P	C
PE3101C		3	1	0	3

Course Learning Objectives:

The course will address the following:

- To know the sources of air pollutants
- To know the analysis of air pollutants
- To know the Threshold Limit Values (TLV) of various air pollutants
- To learn plume behaviour in different environmental conditions
- To acquire the design principles of particulate and gaseous control
- To learn plume behaviour in different environmental conditions

Unit –I Introduction **10 HOURS**

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Environmental criteria for setting industries and green belts.

Unit –II Meteorology **10 HOURS**

Types of inversion, photochemical smog Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.

Unit- III Ambient Air Quality Management **10 HOURS**

Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

Development of air quality models-Gaussian dispersion model

Unit IV Control Techniques **10 HOURS**

Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. **:**Control of NOx and SOx emissions – Environmental friendly fuels – In-plant Control Measures, process changes, methods of removal and recycling.

Unit V Air pollution due to automobiles **10 HOURS**

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards.

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, Laxmi Publications, New Delhi, 2015

2. Air Pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Company

3. Air pollution" H. C. Perkins, Tata McGraw Hill Publication

4. Introduction t o Environmental Engineering" Mackenzie Davis and David Cornwell, "McGraw-

Course Outcomes:

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

CO1	Decide the ambient air quality based on the analysis of air pollutants
CO2	Ascertain and evaluate sampling techniques for atmospheric and stack monitoring
CO3	Judge the plume behaviour in a prevailing environmental conditions and estimation of plume rise
CO4	Choose and design control techniques for particulate and gaseous Emissions
CO5	Selection of appropriate control measures for Automobile pollution

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Air pollution and Control

Unit –I Introduction

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Environmental criteria for setting industries and green belts.

Unit	Module	Micro content
I Introduction	Source of air pollution	Classification pollution based on source, nature, reaction with ambient air etc
	Characterization of air pollutants	Typical features of air pollutants, their sources
	Effects of air pollution	Impact of air pollutants on human health, animals, plants and materials
	Environmental criteria for industries	Various factors to be considered for a selection of site for Industries and gree belts

Unit –II Meteorology

Smog, environmental smog and photochemical smog Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths

Unit	Module	Micro content
Unit II Meterology	Smog	Types of smog-Environmental smog and photochemical smog
		Environmental impacts of smog
	Plume behaviour	Various types of plume based on climate conditions
		Typical features of different types of flumes
	Measurement of metrological l variables	Various metrological parameters measurement and their role in Air pollution control
	Plume Rise	Estimate of Plume rise and its significance in control of air pollution

Unit- III Ambient Air Quality Management Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3) Development of air quality models-Gaussian dispersion model		
Unit	**Module**	**Micro content**
Unit III	Sampling	Various sampling techniques for particular matter, dust and gases pollutants
	Ambient air quality	Planning of Ambient air quality survey
		Preparation of report on air quality management
	Stack monitoring	Objectives of Stack monitoring and devices used in monitoring and their function
		Report on Stock monitoring results
	Air quality models	Objective of air quality models ,Gaussian dispersion model
Unit IV Control Techniques Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. **:**Control of NOx and SOx emissions – Environmental friendly fuels – In-plant Control Measures, process changes, methods of removal and recycling		
Unit	**Module**	**Micro content**
Unit IV Control Techniques	Control of particulate matter	Various particulate matter control devices-working principle- construction-operation and maintenance
	Control of NOx and SOx emission	Various methods of control of NOx and SOx emissions from industrial air stream
Unit V Air pollution due to automobiles Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards.		
Unit	**Module**	**Micro content**
Unit V Air pollution due to automobiles	Automobile pollution	Causes and effects of Automobile pollutants
		Various methods of Control of Automobile pollution
	Noise pollution	Cause, effects and control of Automobile pollution
		Causes, effects and control measures of Noise pollution

CO – PO Mapping

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

III-Year-I Semester	AIRPORT PLANNING AND DESIGN	L	T	P	C
PE3101D		3	1	0	3

Course Objectives:

1. The module introduces the Airport planning issues along with the designing of Runway.

2. The visual aids required from Airport Traffic operating are dealt with the necessary inputs required for efficient drainage system has significance in maintenance the airport.

Course Outcomes:

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

1. Understand the regional planning concepts for an airport.

2. Design the runway length after considering the correction required for basic runway length.

3. Understand the Structural Design of Airport Pavements.

4. Understand the visual aids required for safe landing and takeoff operation of airport.

5. Analyze and design the Airport drainage.

UNIT - I **10 HOURS**

Airport Planning: General- Regional Planning- Development of New Airport- Data Required before Site Selection- Airport Site Selection- Surveys for Site Selection- Drawings to be prepared- Estimation of Future Air Traffic Needs.

UNIT - II **13 HOURS**

Runway Design: Runway Orientation- Basic Runway Length- Corrections for Elevation, Temperature and Gradient- Airport Classification- Runway Geometric Design- Airport Capacity- Runway Configurations- Runway Intersection Design.

UNIT - III **13 HOURS**

Structural Design Of Airport Pavements: Introduction- Various Design Factors- Design Methods for Flexible Pavement- Design Methods for Rigid Pavement- LCN System of Pavement Design- Joints in Cement Concrete Pavement- Airport Pavement Overlays- Design of an Overlay.

UNIT- IV **10 HOURS**

Visual Aids: General- Airport Marking- Airport Lighting.

UNIT - V **10 HOURS**

Airport Grading And Drainage: General- Computation of Earthwork- Airport Drainage- Special Characteristics and Requirements of Airport Drainage- Design Data- Surface Drainage Design Subsurface Drainage Design.

REFERENCE BOOKS:

1. Airport Planning And Designing by S.K. Khanna, M.G. Arora.

2. Highway Engineering including Expressways and Airport Engineering by Dr. L.R. Kadyali, Dr.N.B. Lal.

3. Highway Engineering including Airport Pavements by Dr. S.K. Sharma.

4. Transportation Engineering by S.P. Chandola.

III-Year-I Semester	WATERSHED MANAGEMENT	L	T	P	C
PE3101E		3	1	0	3

Course Objectives:

1. Introduce the concept of watershed management
2. Understand the watershed characteristics
3. Learn the principles of soil erosion and measures to control erosion
4. Appreciate various water harvesting techniques.
5. Learn land management practices for various land use/land cover.

Unit-I: **10 HOURS**

INTRODUCTION: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

Unit– II: **10 HOURS**

CHARACTERISTICS OF WATERSHEDS: Physiography - Size, shape, slope, drainage; climate, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

Unit-III: **12 HOURS**

PRINCIPLES OF EROSION: Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation.
MEASURES TO CONTROL EROSION: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

Unit-IV: **12 HOURS**

WATER HARVESTING: Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

Unit-V: **10 HOURS**

LAND MANAGEMENT: Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

TEXT BOOKS:

1. ‘Watershed Management’ by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2. ‘Land and Water Management’ by Murthy.VVN, Kalyani Publications, 2007.
3. ‘Watershed Management’ by Murthy J V S, New Age International Publishers, 2006.

REFERENCES:

1. ‘Water Resource Engineering’ by Wurbs R A and James R A, Prentice Hall Publishers, 2002.
2. ‘Watershed Hydrology’ by Black P E, Prentice Hall, 1996.

III-Year-II Semester	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
PC3101L		0	0	3	1.5

Course Objectives:

This course deals with the laboratory approaches of determining certain major parameters related to water and wastewater quality and analyzing the laboratory data with respect to permissible limits and field conditions.

Course Outcomes:

At the end of the course the students can able to

CO1: Assess physical parameters of water as turbidity and colour

CO2: Determine the chemical characteristics as pH, TDS

CO3: Assess pollution characteristics of waste water by analyzing DO, BOD and COD

CO4: Assess the total hardness of a given water sample

CO5: Calculate the amount of coagulant required for optimum sedimentation for a giventurbid sample

LIST OF EXPERIMENTS

The following tests are to be performed on a water/wastewater sample.

1. Determination of pH value and Conductivity.
2. Determination of Turbidity of water sample.
3. Determination of TDS in water sample.
4. Determination of Total, temporary and permanent hardness of water sample.
5. Determination of Total, Calcium and Magnesium hardness of water sample.
6. Determination of Chloride concentration of water sample.
7. Determination of Acidity of water sample.
8. Determination of Alkalinity of water sample.
9. Determination of Fluorides in water sample.
10. Determination of Iron.
11. Determination of Sulphates in water sample.
12. Determination of Residual chlorine in water sample.
13. Determination of Dissolved Oxygen of water sample.
14. Determination of Optimum dose of coagulant.
15. Determination of Settleable solids using Imhoff cone in sewage sample.
16. Determination of Suspended, fixed and volatile solids in sewage sample.
17. Determination of Total, fixed and volatile solids in sewage sample.
18. Determination of Biochemical Oxygen Demand (BOD) of sewage.
19. Determination of Chemical Oxygen Demand (COD) of sewage.

Note: A minimum of twelve (12No) shall be done and recorded

TEXT BOOK/REFERENCE

Laboratory manual prepared by Civil Engineering Department

REFERENCES:

1. National Environmental Engineering Research Institute, “Laboratory manual on water analysis”, NEERI, Nagpur, India, 1987.
2. Sawyer and Mc Carty, “Chemistry for Environmental Engineering” McGraw-Hill, 1978.
3. Relevant IS Codes

Mapping

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

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III-Year-II Semester	TRANSPORTATION ENGINEERING LABORATORY	L	T	P	C
PC3102L		0	0	3	1.5

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

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

a. Test aggregates and judge the suitability of materials for the road construction

b. Test the given bitumen samples and judge their suitability for the road construction

c. Obtain the optimum bitumen content for Bituminous Concrete

d. Determine the traffic volume, speed and parking characteristics.

e. Draw highway cross sections and intersections.

SYLLABUS

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

TEXT BOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. Highway Material Testing & Quality Control by Rao Wiley India pvt. Ltd., Noida, New Delhi

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III-Year-II Semester	ENGINEERING GEOLOGY LABORATORY	L	T	P	C
PC3103L		0	0	3	1.5

Course objectives:
1. To identify the mega-scopic types of Ore minerals & Rock forming minerals.
2. To identify the mega-scopic types of Igneous, Sedimentary, Metamorphic rocks.
3. To identify the topography of the site & material selection

Outcomes:

At the end of the course the students can able to

CO1: Identify and classify the geological minerals

CO2: Measure the rock strengths of various rocks

CO3: Prepares, analyses and interpret the Engineering Geologic maps.

CO4: Test the geological material and ground to check the suitability of civil engineering project construction.

CO5: Investigate the project site for mega/mini civil engineering projects site selection for mega engineering projects like Dams, Tunnels, disposal sites etc

LIST OF EXPERIMENTS

1. Description of Physical properties of minerals. (Demonstration)
2. Identification of
    a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group &Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc…
    b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite,Chromite, etc…
3. Description of Various Classification of Rocks and their properties. (Demonstration)
4. Identification of rocks.
    a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, GranitePoryphery, Basalt, etc…
    b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc…
    c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist,Marble, Khondalite, etc…
5. Study of common Goelogical Structures and Importance in Civil Engineering. (Demo)
6. Interpretation and drawing of sections for geological maps showing tilted beds, faults,unconformities etc.
7. Simple Structural Geology problems.
8. Strength of the rock using laboratory tests.
9. Field work – To identify Minerals, Rocks, Geomorphology& Structural Geology.
10. A Report on importance of Study of Geology in Constrction & Selection of site for mega/mini civil engineering projects like Dams, Tunnels, disposal sites etc.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	2	2									
CO3	3	2	1									
CO4	3	2	2									
CO5	2	2	1									

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III-Year-II Semester

SAC3101

SKILL ADVANCED COURSE 1
SOFT SKILLS

L	T	P	C
1	0	2	2

Module-1	*Employability skills –II (Industry Readiness)*	Hours
Practice of Mock Group Discussion Résumé Building Strategies Psychometric Test – Practice – Feedback Behavioral Competency Building – Part II (HR Round Preparation) Industry Sneak Mock Verbal Tests Practice with Explanation Mock Interviews including Technical Project(s) Presentation		09 Hours
Module-2	***Employability skills -II (Quantitative & Reasoning Abilities)***	22 Hours
Permutations & Combinations} 06 Hrs. Probability } 06 Hrs. Data Sufficiency } 10 Hrs.		
Module-3	***Employability skills –II (Industry Readiness)***	
Module-4	***Employability skills –II (Cognitive Ability)***	14 Hours
Data Interpretation } 06 Hrs. Analytical Reasoning } } 08 Hrs. Puzzles }		

III-Year-I Semester	ENVIRONMENTAL STUDIES	L	T	P	C
MC3101		2	0	0	2

OBJECTIVE:
To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
Definition, Scope and Importance – Need for Public Awareness.
NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

LEARNING OUTCOMES
Students will be able to
1. articulate the basic structure, functions, and processes of key social systems affecting the environment.
2. explain how water resources should be used.
3. articulate basic understanding of effects of modern agriculture on environment.
4. explain how various paradigms or world views and their implicit and explicit assumptions and values shape the viewer's perception of environmental problems and solutions.

UNIT – II: Ecosystems, Biodiversity, and its Conservation
ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:
a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

LEARNING OUTCOMES
Students will be able to
1. get a clear picture of structure and functions of ecosystems.
2. explain why renewable and non-renewable energy resources are important.
3. get awareness about land degradation, soil erosion & desertification.
4. gain a rigorous foundation in various scientific disciplines as they apply to environmental

UNIT – III: Environmental Pollution and Solid Waste Management
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. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

LEARNING OUTCOMES UNIT-3
Students will be able to

1. demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematics in the broad sense.
2. conduct basic conservation biology research.
3. explain endangered and endemic species of India.
4. identify the threats to biodiversity.

UNIT – IV: Social Issues and the Environment
SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

LEARNING OUTCOMES:
Students will be able to

1. understand Cause, effects and control measures of air pollution.
2. understand soil, noise & water pollution.
3. explain the enforcement of Environmental legislation
4. understand solid waste management.

UNIT – V: Human Population and the Environment
HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.
FIELD WORK : Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

LEARNING OUTCOMES
Students will have

1. knowledge about watershed management and environmental ethics.
2. explain the reasons for global warming

TEXT BOOKS :

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES :

2. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
3. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
4. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
5. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
6. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
7. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

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

COURSE OUTCOMES

CO1	Able to U**nderstand** The concepts of the ecosystem
CO2	Able to U**nderstand** The natural resources and their importance
CO3	Able to learn The biodiversity of India and the threats to biodiversity ,and **Apply** conservation practices
CO4	Able to learn Various attributes of the pollution and their impacts
CO5	Able to U**nderstand** Social issues both rural and urban environment
CO6	Able to U**nderstand** About environmental Impact assessment and **Evaluate** the stages involved in EIA

CO-PO Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3		2	-	3		3	-	3	2
CO2	2	-	2		2	-	3		2	-	3	2
CO3	3	-	3		2	-	3		2	-	3	3
CO4	2	-	3		2	-	3		2	-	3	3
CO5	3	-	1		3	-	3		3	-	3	2
CO6	2		2		3		3		3		3	2

Strong: 3 **Moderate: 2** **Weak: 1**

III-Year-I Semester	SUMMER INTERNSHIP	L	T	P	C
PR		0	0	3	1.5

III-Year-II Semester	UNIVERSAL HUMAN VALUES	L	T	P	C
HS3201		3	1	0	3

Course Educational Objective: To become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

UNIT-I: Need, Basic Guidelines, Content and Process for Value Education
'Natural Acceptance' and Experiential Validation- as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer);
Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship;

Understanding the harmony in the society: Resolution, Prosperity, fearlessness and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family, Gratitude as a universal value in relationships.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence, Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature; Understanding Existence as Coexistence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics
Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence

Text Book:

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

COURSE OUTCOMES: At the end of the course, the student will be able to-

CO1: Apply the value inputs in life and profession **(Apply – L3)**

CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body **(Understand – L2)**

CO3: Understand the role of a human being in ensuring harmony in society **(Understand – L2)**

CO4: Understand the role of a human being in ensuring harmony in the nature and existence. **(Understand – L2)**

CO5: Distinguish between ethical and unethical practices (**Apply – L3**)

III-Year-II Semester PC3201	DESIGN AND DRAWING OF STEEL STRUCTURES	L	T	P	C
		3	1	0	3

Prerequisites:

1. Structural Analysis

Course Objectives:

The objective of this course is to:

- Familiarize Students with different types of Connections and relevant IS codes
- Equip student with concepts of design of flexural members
- Understand Design of tension and compression members
- Familiarize students with types of Columns, column bases and their Design
- Familiarize students with Design of Gantry Girder and Roof Trusses

UNIT – I **14 HOURS**

Introduction: Types of steel structures and components; Hot rolled structural steel; Grades of structural steel and Mechanical properties of steel; Loads and Load combinations; Concepts of limit State Design – Limit State of Collapse and Limit State of Serviceability; Plate / local buckling, Concept of Plasticity; Advantages and disadvantages of steel structures

Simple Connections: Behaviour of bolted connections; failures & Limit States of Strength; Design provisions for bolts as per IS 800:2007; Design of plate – plate bolted connections subjected to axial load; Introduction to welding – Types of welds & welded joints; weld defects; Design provisions for welding as per IS 800:2007; Design of welded plate – plate connections subjected to axial load; Advantages and disadvantages of bolted and welded connections.

Eccentric (Bracket) Connections: Bolted connection: Moment in-plane and perpendicular to plane of joint; Welded connection: Moment in-plane and perpendicular to plane of joint

UNIT – II **14 HOURS**

Tension Members: Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007; Design of Tension Members

Compression Members: Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007; Design of Struts and Simple Columns. Design of laced and battened built-up compression members.

UNIT –III **14 HOURS**

Design of Beams: Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits; Design of Laterally Supported and Un-Supported Beams; Design of Simple Beam to Column Joints: Web-Angle connection and seat connection

UNIT – IV **14 HOURS**

Design of Beam-Columns: Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007; Design of beam-column subjected to axial compression and bi-axial bending

Design of Column Splices and Bases: Design of column splices; Design of slab base and gusseted base

UNIT – V **14 HOURS**

Design of Gantry Girder: EOT cranes; Vertical, lateral and longitudinal loads; Impact factors, Design of Gantry girders.

Roof Trusses: Different types of trusses, Design loads – Dead, Live and Wind loads, Load combinations as per IS Codes, Design of simple Tubular roof trusses – purlin – rafter and joints.

NOTE: Welded connections should be used in Units III – V.

The students should prepare the following plates.

Plate 1 Detailing of Welded Lap Joint

Plate 2 Detailing of Beams

Plate 3 Detailing of Built-up Column including lacing and battens,

Plate 4 Detailing of Column bases – slab base and gusseted base

Plate 5 Detailing of steel roof trusses including joint details

FINAL EXAMINATION (END SEMESTER) PATTERN:

The end examination paper should consist of Part A and Part B. PART A consists of two questions (each 24 marks) in Design and Drawing out of which ONE question is to be answered. PART B should consist of five questions of 12m each in design out of which THREE are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXT BOOKS

1) K. S. Sai Ram, Design of Steel Structures, Pearson Education (India), 2020
2) N. Subramanian, Design of Steel Structures, Oxford University Press (India), 2015

REFERENCES / FURTHER READING

1) S. K. Duggal, Limit State Design of steel structures, Tata McGraw-Hill, New Delhi, 2019
2) M. L. Gambhir, Fundamentals of Structural Steel Design, Tata McGraw-Hill, 2013
3) D. Lam et al., Structural Steelwork: Design to Limit State Theory (BS 5950), CRC press, 2004

IS Codes:

1) IS 800:2007, Indian Standard Code for General Construction in Steel, 3rd revision, Indian Standards Institution, New Delhi.
2) IS – 875 Parts I- III, Code of practice for design loads (other than earth quake) for buildings and Structures (Part-1-Part 5), Bureau of Indian standards.
3) Steel Tables

These codes and steel tables are permitted for use in the examinations.

Course Outcomes:

At the end of successful completion of this course, the student will be able to

CO1: Analyze and design welded and bolted connections

CO2: Design Tension members, Simple and Built-up compression members

CO3: Design Laterally-Supported and Laterally-Unsupported Beams

CO4: Design Beam-Columns, Column Splices and Bases

CO5: Analyze, Design and Detail Gantry girder and Roof Trusses

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

UNIT – I

Introduction: Types of steel structures and components; Hot rolled structural steel; Grades of structural steel and Mechanical properties of steel; Loads and Load combinations; Concepts of limit State Design – Limit State of Collapse and Limit State of Serviceability; Plate / local buckling, Concept of Plasticity; Advantages and disadvantages of steel structures

Simple Connections: Behaviour of bolted connections; failures & Limit States of Strength; Design provisions for bolts as per IS 800:2007; Design of plate – plate bolted connections subjected to axial load; Introduction to welding – Types of welds & welded joints; weld defects; Design provisions for welding as per IS 800:2007; Design of welded plate – plate connections subjected to axial load; Advantages and disadvantages of bolted and welded connections.

Eccentric (Bracket) Connections: Bolted connection: Moment in-plane and perpendicular to plane of joint; Welded connection: Moment in-plane and perpendicular to plane of joint

Unit	Module	Micro content
Ia. Simple Connections	Bolted Connections	Failures and limit states of strength; Design provisions
		Design of Plate to Plate Lap Joints - Ordinary bolts or HSFG bolts
		Design of Plate to Plate Double Cover Butt Joint – Ordinary Bolts only
	Welded connections	Introduction – Types of welds and welded joints, weld defects, design provisions, Advantages of bolted and welded connections
		Design of Plate to Plate connection - Butt Weld and Fillet Welds
Ib. Eccentric (Bracket) Connections	Bolted Connections	Moment in-plane of joint and Moment perpendicular to Joint – Ordinary Bolts Only

	Welded connections	Moment in-plane of joint and Moment perpendicular to Joint – Fillet Welds Only

UNIT – II

Tension Members: Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007; Design of Tension Members

Compression Members: Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007; Design of Struts and Simple Columns. Design of laced and battened built-up compression members.

Unit	**Module**	**Micro content**
IIa. Tension Members	Introduction	Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007
	Design of Tension Members (with End Connection)	Design of Single Angle connected to gusset plate – Ordinary bolts / Fillet Welds Connection
		Design of Double Angles connected Gusset Plate – Ordinary bolts / Fillet Welds Connection
IIb. Compression Members	Introduction	Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007
	Design of Struts and Simple Columns	Design of Single Angle connected to gusset plate by one leg (Eccentrically Loaded) – Ordinary bolts / Fillet Welds
		Design of Double Angle connected to gusset plate – Ordinary Bolts / Fillet Welds
		Design of Hollow sections (CHS / SHS / RHS) – End connection by Fillet Welds Only
	Design of Built-Up Compression Members	Laced Column – Two Channels Back to Back – Ordinary bolts / Fillet weld Connection
		Battened Column - Two Channels Back to Back – Ordinary bolts / Fillet weld Connection

Note: Welded Connections Should Only be Used for Units III - V

UNIT – III Design of Beams: Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits; Design of Laterally Supported and Un-Supported Beams; Design of Simple Beam to Column Joints: Web-Angle connection and seat connection

Unit	Module	Micro content
IIIa/b. Design of Beams	Introduction	Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits
	Design of Laterally Supported Beams	Design of simply supported I - beam subjected to simple loading
	Design of Laterally Un-supported Beams	Design of simply supported I - beam subjected to simple loading
	Design of Simple Beam – Column connection	Web – Angle Connection (Fillet Weld Connection Only); Seat Connection (Fillet weld only)

UNIT – IV

Design of Beam-Columns: Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007; Design of beam-column subjected to axial compression and bi-axial bending

Design of Column Splices and Bases: Design of column splices; Design of slab base and gusseted base

Unit	Module	Micro content
IVa. Design of Beam-Columns	Introduction	Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007
	Design of Beam-Column	Design of beam-column subjected to axial compression and bi-axial bending – I or SHS / RHS sections only
IVb. Design of Column Splices and Bases	Column Splices	Columns of same size / different size – Fillet Welded Connection Only
	Column Bases	Slab Base and Gusseted Bases for Simple I section columns Only – Fillet Welded Connection

UNIT – V

Design of Gantry Girder: EOT cranes; Vertical, lateral and longitudinal loads; Impact factors,

combinations as per IS Codes, Design of simple Tubular roof trusses – purlin – rafter and joints.

Unit	Module	Micro Content
Va. Design of Gantry Girder	Introduction	EOT cranes; Vertical, lateral and longitudinal loads; Impact factors
	Design of Gantry Girder	Design of Simply Supported Welded I-section Gantry Girder Only (Laterally Un-supported)
Vb. Design of Roof Trusses	Introduction	Different types of trusses, Design loads – Dead, Live and Wind loads, Load combinations as per IS Codes
	Design of Roof Truss	Design of simple Tubular roof trusses – purlin – rafter – lower chord – web members and joints

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3							2		
CO2	1		3							2		
CO3	1	2	3							2		
CO4	1		3							2		
CO5	2	2	3							2		

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III-Year-II Semester	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	L	T	P	C
PE3201A		3	1	0	3

Course Objectives:

1. To give preliminary concepts of engineering seismology and structural dynamics.
2. To impart concepts of design philosophies for seismic building designs for given loading conditions.
3. Equip student with concepts of Structural Dynamics.
4. Familiarize students with various IS codal provisions for seismic design of buildings, shear walls design and detailing.

UNIT-I: ENGINEERING SEISMOLOGY 8 HOURS

Introduction – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations.

Unit– II: INTRODUCTION TO STRUCTURAL DYNAMICS 10 HOURS

Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Free Vibrations of Single Degree of Freedom (SDOF) systems – Un damped and damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

Unit-III: SEISMIC DESIGN CONCEPTS 12 HOURS

EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) –Shear wall and design of shear wall.

Unit-IV: CODAL DESIGN PROVISIONS 12 HOURS

Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

CODAL DETAILING PROVISIONS: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints

Unit-V: CALCULATION OF EQUIVALENT LATERAL FORCE 14 HOURS

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method – response spectrum method

TEXT BOOKS:

1. 'Earthquake Resistant Design of Structures' -Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi..
2. S.K.Duggal, "Earth Quake Resistant Design of Structures", Oxford university Press, 1st Edition, 2012

REFERENCE BOOKS:

1. Clough & Penzien, “Dynamics of Structures”, 4th Edition, McGraw Hill, International Edition, 2008.

2. Chopra A.K., “Dynamics of Structures”, 5th Edition, Pearson Education, Indian Branch, Delhi, 2007

3. ‘Earthquake Resistant Design of Building Structures’ by Vinod Hosur, Wiley India Ltd.

4. IS Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.

Course Outcomes:

The students will be able to

CO1: ***Understand*** the fundamentals of Engineering Seismology. (Understanding)

CO2: ***Analyse*** the applications with the principles of Structural Dynamics. (Understanding, Analysing)

CO3: ***Apply*** different design methods and analyse the various Seismic designs according to IS standard provisions (Applying, Analysing)

CO4: ***Design*** of buildings subjected to earthquake loads and shear walls. (Designing)

CO5: ***drawing*** the reinforcement detailing of computed seismic designs as per IS codal provisions. (Applying, Analysing)

:

BL – Bloom’s Taxonomy Levels

1- Understanding, 2 – Applying, 3 – Analysing, 4 – Designing, 5 - Drawing

Micro-Syllabus of Earthquake Resistant Design

UNIT-I: ENGINEERING SEISMOLOGY

Introduction – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations.

Unit	Module	Micro content
I: ENGINEERING SEISMOLOGY	Introduction	rebound theory
		plate tectonics
		seismic waves
	Seismology	earthquake size and various scales
		local site effects
		Indian seismicity
		seismic zones of India
		theory of vibrations

Unit– II: INTRODUCTION TO STRUCTURAL DYNAMICS:

Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Free Vibrations of Single Degree of Freedom (SDOF) systems – Un damped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

Unit	Module	Micro content
II: INTRODUCTION	Dynamic analysis	Fundamental objective
		Types of prescribed loadings
		Formulation of the Equations of Motion

DYNAMICS		(SDOF) systems
		Forced vibrations of SDOF systems
		Harmonic excitation
	damping	Un damped and Damped
		Critical damping
		Logarithmic decrement
		Dynamic magnification factor

Unit-III: SEISMIC DESIGN CONCEPTS

EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) –Shear wall and design of shear wall.

Unit	**Module**	**Micro content**
III: SEISMIC DESIGN CONCEPTS	EQ load	EQ load on simple building
		load path
		floor and roof diaphragms
	seismic resistant building	seismic resistant building architecture
		plan configuration
		vertical configuration
		pounding effects
		mass and stiffness irregularities
	Provision of seismic code	Shear wall
		Design of shear walls

Unit-IV: CODAL DESIGN PROVISIONS

Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

CODAL DETAILING PROVISIONS: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – beams, columns and joints

Unit	**Module**	**Micro content**
IV: CODAL DESIGN PROVISIONS	Indian seismic code IS:1893 – 2002	provisions for buildings
		Earthquake design philosophy
		Analysis by seismic coefficient and response spectrum methods
		Displacements and drift requirements
		Provisions for torsion
		Analysis of a multi-storeyed building using Seismic Coefficient method.
	Review of the latest Indian codes IS: 4326 and IS: 13920	Provisions for ductile detailing of R.C buildings
		Beam, column and joints

Unit V: CALCULATION OF EQUIVALENT LATERAL FORCE

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method – response spectrum method

Unit	**Module**	**Micro content**

LATERAL FORCE		Estimation of Natural period of Structure
		Computation of Response acceleration Coefficient
		Zone factor
		Seismic weight
		Response reduction factors
		Seismic Coefficient Method
		response spectrum method

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2									2	
CO2	3	3									2	
CO3	2	2									4	1
CO4	3	4			1						2	1
CO5	5	5			2						3	5

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III-Year-II Semester PE3201B	EARTH RETAINING STRUCTURES	L	T	P	C
		3	1	0	3

Course Objectives:

1. To enable the student to understand the concepts of earth pressures and different theories.
2. To impart the concept of retaining walls, types of failures, stability requirements.
3. To impart the concept of sheet pile wall, cantilever, anchored sheet piles, location and forces in anchors.
4. To enable the student to understand the concepts of soil reinforcement braced cuts and cofferdams.

UNIT-I **10 HOURS**

EARTH PRESSURES

Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

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UNIT– II **10 HOURS**

RETAINING WALLS

Different types - Type of Failures of Retaining Walls– Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT-III **11 HOURS**

SHEET PILE STRUCTURES

Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and fixed earth support methods – Row's moment reduction method – Location of anchors, Forces in anchors.

UNIT-IV **12 HOURS**

SOIL REINFORCEMENT

Reinforced earth - Different components – their functions – Mechanics of reinforced earth – Failure modes-Failure theories – Design of Embakments on problematic soils.

UNIT-V **13 HOURS**

BRACED CUTS AND COFFERDAMS:

Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects– TVA method and Cummins' methods.

TEXT BOOKS:

1. Principles of Foundation Engineering by Braja M. Das.
2. Foundation analysis and design – Bowles, JE – McGraw Hill

REFERENCES:

1. Soil Mechanics in Engineering Practice – Terzaghi, K and Rolph, B. peck 2nd Edn. – John Wiley & Co.,
2. Analysis and Design of Foundations and Retaining Structures, Prakash, S – Saritha Prakashan, Mearut.

Course Outcomes:

The students will be able to

CO1: ***Explain*** – the types of earth pressures and classical theories and computation of pressures in homogenous and layered soils (Understanding, analysing)

CO2:***Understanding***-the types and failure of retaining wall, stability requirements (Understanding, Evaluating)

CO3: ***Analyse*** –Cantilever and anchored sheet piles and evaluating location and forces in anchors (Analysing, Evaluating)

CO4: ***Understanding-*** the concept and mechanism of soil reinforcement and design of embankment (Understanding Applying)

CO5: ***Explain***- the concept of braced cuts and cofferdams (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus **EARTH RETAINING STRUCTURES**

UNIT-I: EARTH PRESSURES

Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

Unit	Module	Micro content
I. Earth pressures	Introduction	Different types of earth pressuresand their coefficients
	Theories of earth pressures	Rankine's theory for Active and Passive earth pressure (concept and problems)
		Coulomb's theory for Active and Passive earth pressure (concept and problems)
	Lateral earth pressures	Computation of Lateral earth Pressure in Homogeneous and Layered soils, problems
	Graphical solutions	Coulomb's theory in active and passive conditions.

UNIT– II: RETAINING WALLS

Different types - Type of Failures of Retaining Walls– Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

Unit	Module	Micro content
II. Retaining walls	Introduction	Types of retaining walls
	Failures of Retaining Walls	Types of failures of Retaining Walls
	Stability of retaining	Stability requirements

<table>
<tr><td></td><td></td><td>Provision of Joints – Relief Shells</td></tr>
<tr><td colspan="3">UNIT-III: SHEET PILE STRUCTURES
Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Row’s moment reduction method – Location of anchors, Forces in anchors.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="4">III. Sheet pile wall structures</td><td>Introduction</td><td>Types of Sheet piles</td></tr>
<tr><td>Cantilever sheet piles</td><td>Cantilever sheet piles in sands and clays (concept and problems)</td></tr>
<tr><td>Anchored sheet piles</td><td>Free earth and Fixed earth support methods (concept and problems)</td></tr>
<tr><td>Row’s moment reduction method</td><td>Location of anchors, Forces in anchors.</td></tr>
<tr><td colspan="3">UNIT-IV: SOIL REINFORCEMENT
Reinforced earth - Different components – their functions – Mechanics of reinforced earth – Failure modes-Failure theories – Design of embankments on problematic soils.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="4">IV. Soil reinforceent</td><td>Introduction</td><td>Reinforced earth - Different components – their functions</td></tr>
<tr><td rowspan="2">Mechanics of reinforced earth</td><td>Failure modes</td></tr>
<tr><td>Failure theories</td></tr>
<tr><td>Design of embankments</td><td>Design of embankments on problematic soils</td></tr>
<tr><td colspan="3">UNIT-V: BRACED CUTS AND COFFERDAMS:
Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – Types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects– TVA method and Cummins’ methods.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="8">V. Braced cuts and Coffer dams</td><td>Introduction</td><td>Concept of braced cuts and coffer dams</td></tr>
<tr><td rowspan="3">Braced cuts</td><td>Lateral Pressure in Braced cuts</td></tr>
<tr><td>Design of Various Components of a Braced cut</td></tr>
<tr><td>Stability of Braced cuts, Bottom Heave in cuts</td></tr>
<tr><td rowspan="4">Cofferdam</td><td>Types of cofferdam</td></tr>
<tr><td>Suitability, merits and demerits</td></tr>
<tr><td>Design of single – wall cofferdams and their stability aspects</td></tr>
<tr><td>TVA method and Cummins’ methods</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-II Semester	INDUSTRIAL WASTE AND WASTE WATER ENGINEERING	L	T	P	C
PE3201C		3	1	0	3

Course Objectives:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries
4. To acquire knowledge on operational problems of effluent treatment plant.

Unit-I: INTRODUCTION **10 HOURS**

General Characteristics of Industrial effluents, Effects on Environment – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation.

Unit– II: TREATMENT OF INDUSTRIAL WASTE WATER **10 HOURS**

Necessity of treatment –Segregation – Process changes – Salvaging–Byproduct Recovery –Ion Exchange, Electro dialysis, Solvent Extraction, Floatation – Removal of Nitrogen and Phosphorus – Boiler water treatment methods and cooling water treatment methods.

Unit-III: FOOD INDUSTRIES **10 HOURS**

Sources, characteristics treatment and recycling of waste water from Sugar, Dairy and Distilleries, Food Processing industries, Aqua industry.

Unit-IV: MAJOR INDUSTRIAL EFFLUENTS **10 HOURS**

Sources, characteristics, treatment and recycling of waste water from Power plants, Oil refineries, Cement and Steel factories.

Unit-V: CHEMICAL INDUSTRIES **10 HOURS**

Sources, characteristics, treatment and recycling of waste water from Paper and pulp, Tanneries, Textiles, Fertilizers and Pharmaceutical industries.

TEXT BOOKS:

1. Rao, M.N. and Dutta, A.K., “Wastewater Treatment”, 3rd Edition, IBH Publishers, 1982.
2. Patwardhan,“Industrial Wastewater Treatment”- PHI learning Pvt. Ltd, 2009.
3. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam, 2019
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rdEdition

REFERENCE BOOKS:

1. Nemerow. N.L., “Liquid Waste from industry – Theories, Practice and Treatment”Addison wisely, 1996.
2. Benefield L.D. and Randall C.D, “Biological Process Designs for Wastewater AdvancedWaste Treatment Methods “Removal Suspended solids – Dissolved solid Treatment”, Prentice Hall Pub. Co., 1980.
3. Metcalf and Eddy. “Wastewater Engineering – Collection, Treatment, Disposal and Reuse”,McGraw Hill Pub. Co., 1995.
4. C. Fred Gurnham” Industrial WasteWater Control”, (Revised for publication January 28,1977) 31 May, 2007.
5. Gurnham, C.F., “Principles of Industrial Waste Water: Wiley; New York, 1955.
6. Gurnham CF (Ed) “Industrial WasteWater Control”; Academic Press; New York, NY 1965.

Course Outcomes:

The students will be able to:

CO1: **Assess** the characteristics of industrial effluents and their effects on the environmentincluding their tolerance limits

CO2: **Describe** the basic principles of industrial waste water treatment by physical methods.

CO3: **Discuss** the sources, characteristics and treatment of food industrial wastes.

CO4: **Identify** the sources, characteristics and treatment of major industrial waste of ThermalPower Plants, Oil Refineries, Steel mills and Cement industries.

CO5: **Identify** the sources, characteristics and treatment of Chemical industrial wastes.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Industrial Waste and Wastewater Engineering

Unit-I: INTRODUCTION

General Characteristics of Industrial effluents, Effects on Environment – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation.

Unit	Module	Micro content
INTRODUCTION	General Characteristics of Industrial effluents	Basic Definitions of industrial effluents
	Effects on Environment	Environmental problems with industrial waste waters

Unit– II: TREATMENT OF INDUSTRIAL WASTE WATER

Necessity of treatment –Segregation – Process changes – Salvaging–Byproduct Recovery –Ion Exchange, Electro dialysis, Solvent Extraction, Floatation – Removal of Nitrogen and Phosphorus – Boiler water treatment methods and cooling water treatment methods.

Unit	Module	Micro content
TREATMENT OF INDUSTRIAL WASTE WATER	Necessity of treatment	Need for Treatment of industrial waste water
		Importance of Treatment of industrial waste water
	Process changes	Different methods
	Removal of Nitrogen and Phosphorus	Different Techniques

Unit-III: FOOD INDUSTRIES

Sources, characteristics treatment and recycling of waste water from Sugar, Dairy and Distilleries, Food Processing industries, Aqua industry.

Unit	Module	Micro content
FOOD INDUSTRIES	Sources	Different industries generating food waste

	Sugar industry	Manufacturing Process and origin, characteristics, effects and treatment methods
	Dairy andDistilleries	Manufacturing Process and origin, characteristics, effects and treatment methods
	Food Processing industries	Characteristics, effects and treatment methods
	Aqua industry	Characteristics, effects and treatment methods

Unit-IV: MAJOR INDUSTRIAL EFFLUENTS

Sources, characteristics, treatment and recycling of waste water from Power plants, Oil refineries, Cement and Steel factories.

Unit	**Module**	**Micro content**
MAJOR INDUSTRIAL EFFLUENTS	Power plants	Manufacturing Process and origin, characteristics, effects and treatment methods
	Oilrefineries	Manufacturing Process and origin, characteristics, effects and treatment methods
	Cement and Steel factories	Manufacturing Process and origin, characteristics, effects and treatment methods

Unit-V: CHEMICAL INDUSTRIES

Sources, characteristics, treatment and recycling of waste water from Paper and pulp, Tanneries, Textiles, Fertilizers and Pharmaceutical industries.

Unit	**Module**	**Micro content**
CHEMICAL INDUSTRIES	Paper and pulp	Sources, characteristics, treatment and recycling of waste water
	Tanneries	Treatment and recycling of waste water
	Textiles	Treatment and recycling of waste water
	Fertilizers and Pharmaceutical industries.	Treatment and recycling of waste water

Mapping

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

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III-Year-II Semester | **ROAD SAFETY ENGINEERING** | **L T P C**

Course Objectives:

1. This module on the fundamental of traffic engineering, Highway safety factors, Road safety improvement strategies are discussed
2. The Analysis of Crash Data and some of the statistics methods to analysis the traffic safety.
3. The accident interrogations & risk involved and role of road safety in planning the urban Infrastructures design is discussed.
4. The Basic physics related to crash reconstruction & Variables involved in crashes are studied
5. The various mitigation measures that to be taken for avoiding the accidents are discussed.

UNIT I **10 HOURS**

Introduction to safety

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

UNIT II **10 HOURS**

Statistical Interpretation and Analysis of Crash Data

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

UNIT III **10 HOURS**

Road Safety Audits

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

UNIT IV **10 HOURS**

Crash Reconstruction

Describe the basic information that can be obtained from the roadway surface, understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

UNIT V **10 HOURS**

Mitigation Measures

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

TEXT BOOKS:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.
2. Towards Safe Roads in Developing country, TRL – ODA, 2004.
3. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
4. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India.

REFERENCES:

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
2. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
3. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities,

5. Fundamentals of Traffic Engineering, Richardo G Sigua
6. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
7. Road Safety by NCHRP.

Course Outcomes:

The students will be able to

CO1: To remember and understand the fundamentals of Road Safety Engineering.

CO2: To investigate & analyze the collective factors for accident involved.

CO3: To understand & investigate road safety audit.

CO4: To understand and apply crash reconstruction process.

CO5: To apply mitigation measures by better designing of roads.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Strength of Materials-I

Unit-I:

Introduction to safety:

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

Unit	Module	Micro content
I. Introduction to safety	Road accidents	Trends, causes, Collision diagrams
	Highway safety factors	Human factors and road user limitations
		Speed and its effect on road safety
		Vehicle factors
	Highway safety in India & Multi-causal dynamic systems approach to safety	Conceptual theory
	Crash Vs Accident	Definition & Difference
	Road safety improvement strategies	Elements of a road safety plan
		Safety data Needs
		Safe vehicle design

Unit– II:

Statistical Interpretation and Analysis of Crash Data:

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

interpretation and analysis of crash data		Recording of crash data
		Accident Investigation and Analysis
	Statistical Interpretation	Statistical testing and the role of chance
		Black Spot Identification and Investigations
	Case studies	A case study on interpretation & analysis of crash data

Unit-III:
Road Safety Audits:
Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

Unit	**Module**	**Micro content**
III. Road Safety Audits	Introduction to RSA	Key elements of road safety audit
		Road safety audits & investigations
		Work zone safety audit
	Crash Investigation & Identification of hazard location	Crash investigation and analysis
		Methods for identifying hazardous road locations
	Case studies	A case study related to road safety audit

Unit-IV:
Crash Reconstruction:
Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

Unit	**Module**	**Micro content**
IV. Crash Reconstruction	Introduction	Basic information obtained from roadway surface
	Basic physics related to crash reconstruction	Speed for various skid, friction, drag, and acceleration scenarios
	Variables involved in crashes	Variables involved in jump and flip crashes
		Variables involved in pedestrian crashes
	Case Studies	A case study related to crash reconstruction

Unit-V:
Mitigation Measures:
Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

Unit	**Module**	**Micro content**
V. Mitigation	Prevention of accidents	Accident prevention by better planning

	Highway operation and accident control measures	Highway Safety Measures during construction
		Highway geometry and safety
		Safety in urban areas
		Public transport and safety
	Safety policy	Making of Road safety policy
		Stakeholders involvement
		Road safety law

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		2								2	
CO2	1	2		2							2	
CO3	2			2							2	1
CO4	3			1							2	
CO5	2		2								2	

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III-Year-II Semester	GROUND WATER DEVELOPMENT & MANAGEMENT	L	T	P	C
PE3201E		3	1	0	3

Course Learning Objectives:

The course is designed to

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

UNIT – I **12 HOURS**

Introduction:
Groundwater in the hydrologic cycle, ground water occurrence, aquifer parameters and their determination, general ground water flow equation.
Well Hydraulics: Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

UNIT – II **12 HOURS**

Well Design:
Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery

UNIT –III **10 HOURS**
Well Construction and Development:
Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT IV **10 HOURS**

Artificial Recharge:
Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.

UNIT – V **10 HOURS**

Groundwater Modelling and Management:
Basic principles of groundwater modelling- Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models.
Concepts of groundwater management, basin management by conjunctive use-case studies.

Text Books:

2. Groundwater Hydrology, Todd D. K., Wiley India Pvt Ltd.,2014.
3. Groundwater Hydrology, Todd D K and L W Mays, CBS Publications,2005.

References:

1. Groundwater Assessment and Management, Karanth K R, Tata McGraw Hill Publishing Co., 1987.
2. Groundwater Hydrology, Bouwer H, McGraw Hill Book Company, 1978.
3. Groundwater Systems Planning and Management, Willis R and W.W.G. Yeh, Prentice Hall Inc., 1986.
4. Groundwater Resources Evaluation, Walton W C, McGraw Hill Book Company, 1978.

Course Outcomes:

The students will be able to

CO1: Estimate aquifer parameters, yield of wells and Analyse radial flow towards wells in confined and unconfined aquifers.
CO2: Design wells and understand the construction practices.
CO3: Determine the process of artificial recharge for increasing ground water potential.
CO4: Take effective measures for controlling saline water intrusion.
CO5: Apply appropriate measures for ground water management.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of GROUND WATER DEVELOPMENT & MANAGEMENT

UNIT – I Introduction:

Groundwater in the hydrologic cycle, ground water occurrence, aquifer parameters and their determination, general ground water flow equation.

Well Hydraulics: Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

Unit	**Module**	**Micro content**
Introduction	Groundwater in the hydrologic cycle	Concept with the help of Sketch
	ground water occurrence	Concept
	aquifer parameters and their determination	Properties and problems
	general ground water flow equation	Concept & Derivation
Well Hydraulics	Steady radial flow in confined and unconfined aquifers	Derivations and simple problems
	Unsteady radial flow in confined and unconfined aquifers	Derivations and simple problems
	Theis solution, Jacob and Chow's methods	Derivations only
	Leaky aquifers	Concepts, Derivation of cases and simple problems

UNIT – II Well Design:

Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery.

<table>
<tr><td rowspan="3">Well Design</td><td>Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection</td><td>Concepts and recommendations</td></tr>
<tr><td>design of collector wells</td><td>Working concepts with the help of sketch and Problems</td></tr>
<tr><td>infiltration gallery</td><td>Working concepts with the help of sketch and Problems</td></tr>
<tr><td colspan="3">UNIT –III Well Construction and Development:
Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="2">Well Construction</td><td>Drilling methods:
rotary drilling,
Percussion drilling.</td><td>Concepts with the help of sketches</td></tr>
<tr><td>installation of well screens:
pull-back method,
open- hole,
bail- down and
wash-down methods</td><td>Concepts with the help of sketches</td></tr>
<tr><td rowspan="4">Well Development</td><td>mechanical surging using compressed air,
high velocity jetting of water,
over pumping and back washing</td><td>Concepts with the help of sketches</td></tr>
<tr><td>well completion</td><td>Concepts with the help of sketches</td></tr>
<tr><td>well disinfection</td><td>Concepts with the help of sketches</td></tr>
<tr><td>well maintenance</td><td>Concepts with the help of sketches</td></tr>
<tr><td colspan="3">UNIT IV Artificial Recharge:
Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge
Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td>Artificial Recharge</td><td>Concept of artificial recharge of groundwater</td><td>Concept with the help of sketch</td></tr>
</table>

	recharge methods: basin method, stream-channel method, ditch and furrow method, flooding method and **recharge well methods**: recharge mounds and induced recharge	Concept with the help of sketch
Saline Water Intrusion	Occurrence of saline water intrusion	Concept and occurence
	Ghyben- Herzberg relation	Derivation and problems
	Shape of interface	Concept with the help of sketch
	control of saline water intrusion	Control measures

UNIT – V Groundwater Modelling and Management:

Basic principles of groundwater modelling- Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models.

Concepts of groundwater management, basin management by conjunctive use-case studies.

Unit	Module	Micro content
Groundwater Modelling	Basic principles of groundwater modelling	Thin cylindrical shells
		Derivation of longitudinal and circumferential stresses
	Analog models viscous fluid models and membrane models, digital models	Concepts and working
	Finite difference and finite element models.	Concepts and working
Groundwater Management	Concepts of groundwater management	Concept
	basin management by conjunctive use	Concepts and working
	Case Studies	

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2		2				1					
CO3	1		2				1					
CO4	2		2									
CO5	2	1	2								1	

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III-Year-II Semester	GREEN TECHNOLOGIES	L	T	P	C
OE3201A		3	1	0	3

Course Learning Objectives:

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO_2 levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

UNIT- I **10 HOURS**

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology. Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry.

UNIT- II **10 HOURS**

Cleaner Production Project Development and Implementation: Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.

Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III **10 HOURS**

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

UNIT -IV **10 HOURS**

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V **10 HOURS**

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and market-driven initiatives. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok 3. 'Non-conventional Energy Sources' by Rai G.D.

REFERENCES:

1. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.

2. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.

3. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.

4. 'Solar Energy' by Sukhatme S.P.

5. 'Waste Energy Utilization Technology' by Kiang Y. H.

III-Year-II Semester OE3201B	ALTERNATIVE ENERGY SOURCES	L	T	P	C
		3	1	0	3

Course Objectives:

To impart the necessity of finding alternative energy sources for automobiles. To understand merits and demerits, performance characteristics of various sources of fuels and their comparison.

Unit-I: **10 HOURS**

INTRODUCTION: Need for non-conventional energy sources. Energy alternative: solar, photo-voltaic, Hydrogen, Bio mass, Electrical - their merits and demerits.

Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion, Applications to automobiles.

Unit– II: **10 HOURS**

ENERGY FROM BIO MASS: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations -Merits and demerits performance characteristics and their comparison.

Unit-III: **10 HOURS**

HYDROGEN ENERGY: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting, production of hydrogen- Electrolysis of water, Thermal decomposition of water, Thermo-chemical production, Biochemical production.

Unit-IV: **10 HOURS**

HYDROGEN FUEL: Storage and transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in engine and their comparison.

ELECTRIC AUTOMOBILES: Design considerations, limitations, Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

Unit-V: **10 HOURS**

ELECTRIC AUTOMOBILES: Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price, material requirement traction motors and types.

TEXT BOOKS:

1. Non-conventional Sources of Energy, G.D. Rai, Khanna Publications.
2. Electric Automobiles, William Hamilton,PHI.
3. Alternative Fuel Technology, Erjavec and Arias, CengageLearning.

REFERENCE BOOKS:

1. Solar Energy, S.P. Sukhatme, Tata McGrawHill.
2. Energy Technology, S. Rao & B.B. Larulekar, KhammaLab.
3. Principles of Solar Engineering, Frank Kreith& Jan F. Krieder, McGrawHill.
4. Solar Energy -thermal Process, J.A. Duffie&W.A. Beckman, McGrawHill.

Course Outcomes:

The students will be able to

CO1: Understand solar photo-voltaic conversion and working principles.

CO3: Understand the production of hydrogen energy

CO4: Design and study of future possibilities of electric automobiles.

CO5: Understand the utilization of energy in various forms.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Alternative Energy Sources

Unit-I: INTRODUCTION: Need for non-conventional energy sources. Energy alternative: solar, photo-voltaic, Hydrogen, Bio mass, Electrical - their merits and demerits.

Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion, Applications to automobiles.

Unit	Module	Micro content
Ia. Introduction	Classification of Energy sources	Based on Traditional use
		Based on long-term availability
		Based on origin
	Common forms of energy	Mechanical Energy
		Thermal Energy
		Electrical Energy
		Chemical Energy
	Merits and Demerits	Conventional energy sources (Non-Renewable Energy sources)
		Non-Conventional Energy sources (Renewable energy sources)
	Need for Non-Conventional energy sources	
Ib. Energy Alternative	Merits and De-merits	Solar energy
		Solar-photo voltaic
		Bio-mass
		Electricity
		Hydrogen
Ic. Classification of solar energy collectors	Non- concentrating type solar collector	Solar water heater, solar air heaters
	Concentrating type solar collector	Parabolic trough collector, Mirror strip reflector, Fresnel lens collector, Flat plate collectors with adjustable mirrors, compound parabolic concentrator
Id. Solar energy storage systems	Thermal energy storage	Sensible heat, latent heat
	Electrical energy storage	Capacitor, inductor, battery storage
	Chemical energy storage	Chemical, thermo chemical
	Mechanical energy storage	Pumped hydro electric storage, compressed air
	Electro –magnetic energy storage	Energy storage vie superconducting magnets
Id. Photo-voltaic	Principle, working, construction	N type semiconductor, P type semi conductor, p-n

Unit– II: ENERGY FROM BIO MASS: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations -Merits and demerits performance characteristics and their comparison.

Unit	Module	Micro content
IIa. Introduction	Introduction	Biomass definition
		Sources of biomass
		Photosynthesis, Photosynthetic oxygen production
		Energy Plantation
IIb. Energy conversion technologies	Direct combustion	Incineration process
	Thermo chemical conversion	Gasification, Pyrolysis Process
	Bio-chemical conversion	Fermentation, anaerobic digestion of biomass
IIc. Bio gas Production	anaerobic digestion of biomass	Factors effecting generation of gas
IId. bio gas plants	Classification of bio gas plants, applications, advantages and disadvantages	Continuous, batch type, Floating drum and fixed dome type bio gas plants. Comparison of floating drum and fixed dome type bio gas plant. Site selection for bio gas plants.

Unit-III: HYDROGEN ENERGY: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting, production of hydrogen- Electrolysis of water, Thermal decomposition of water, Thermo-chemical production, Biochemical production.

Unit	Module	Micro content
IIIa. Introduction	Introduction	Properties of hydrogen
		Sources of hydrogen
IIIb. Production of hydrogen	Electrolysis or electrolytic production of hydrogen	Tank type electrolyzer, filter press electrolyzer
	Thermo-chemical methods	Westinghouse electrochemical thermal sulphur cycle, Ispra mark 13 cycle, Iodine-Sulphur cycle
	Solar energy methods	Biophotolysis, photoelectrolysis

Unit-IV: HYDROGEN FUEL: Storage and transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in engine and their comparison.

ELECTRIC AUTOMOBILES: Design considerations, limitations, Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

Unit	Module	Micro content
IVa. Hydrogen fuel	storage	Compressed gas storage, liquid storage, line packing, underground storage, metal hydrides
	Transportation	Pipe lines, liquid hydrogen transportation, metal hydride transportation
	Utilization of hydrogen energy	Residential uses, industrial uses, road vehicles, air craft applications, electric power generation

IVb. Electric Automobiles	Introduction	Design considerations, limitations, Opportunities for improvement Batteries, problems, Future possibilities, capacities, types, material requirement.
	Future possibilities, capacities	Future possibilities, capacities
	Types, material requirement.	types, material requirement.
Unit-V: ELECTRIC AUTOMOBILES: Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price, material requirement traction motors and types.		
Unit	**Module**	**Micro content**
Va. Electric Automobiles	Electric cars	Applications, major parts, battery charging
Vb. HVAC	HVAC	Requirements, comparative use of fuel and energy, Impact on urban air quality, impact on price, material requirement traction motors and types.
	Availability of energy for recharging; Impacts on use of fuel and energy	Availability of energy for recharging; Impacts on use of fuel and energy
	Impact on urban air quality, impact on price	Impact on urban air quality, impact on price
Vc. Traction motors	Traction motors	Material requirement traction motors and types.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2						2					
CO2	2						2					
CO3	2						2					
CO4	1		2				2					
CO5	2						2					

III-Year-II Semester	ELEMENTS OF CIVIL ENGINEERING	L	T	P	C
OE3201C		3	1	0	3

Course Objectives:

The objectives of this course are to make students to learn about

1. Basics of Civil Engineering concepts
2. The surveying, elevations and mapping
3. The construction materials and elements
4. Water resource development

Unit-I **12 HOURS**

Scope of Civil Engineering: **Introduction**: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management.

Surveying: Introduction: Surveying and levelling, Object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.

Unit-II **14 HOURS**

Compass surveying:

Types and uses of compass, Bearings, Whole Circle Bearings, and Reduced Bearings, Computation of angles; Meridians; declinations and dip of needle; Local attraction; compass surveying field work.

Elevation measurements:

Levelling, object and uses, terms used in levelling, levelling instruments, methods of levelling, recording and methods of reducing, errors in levelling, contours; characteristics and applications.

Modern Tools of Surveying and Mapping:

Introduction to Theodolite, Electronic Distance Measurement Instruments, Total Station, Global Positioning System, Remote Sensing and Geographic Information System.

Unit-III **10 HOURS**

Construction Materials Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non-Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass, Plastic, Conducting, Magnetic, and Miscellaneous Materials.

Unit-IV **10 HOURS**

Elements of Building Construction:

Planning: Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings.

Construction: Classification of buildings based upon occupancy and structure, Design Loads, Common building components, their functions, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

Unit-V **10 HOURS**

Water Resources Development Elementary:

Hydrology, Sources of water, Watershed Development, water requirements and its conservation, Hydraulic Structures of Storage, Water Conveyance System: Canals; Water Conduits.

TEXT BOOKS:

1. Surveying Vol. I & II, Dr. B. C. Punamia Laxmi Publication, Delhi

2. Building Construction, Dr. B. C. Punamia Laxmi Publication, Delhi

3. Engineering Material, Dr. S.C. Rangwal, Charotar Pub. House

4. Irrigation Engineering and Hydraulic Structures, Santoshkumar Garg, : Khanna Publishers Delhi

5. Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition

REFERENCE BOOKS:

1. Civil Engineering Material, Jakson and Dhir, ELBS Publishing London

2. Civil Engg. Drawing, S. C. Rangwal, Charotar Pub. House Anand

III-Year-II Semester	GEO-SPATIAL TECHNOLOGIES	L	T	P	C
OE3201D		3	1	0	3

Course Objectives:

1. To understand the fundamentals of GIS and Coordinate systems
2. To study about data acquisition and data management process.
3. To impart knowledge about the data modeling and GIS analysis and its functions
4. To deal with the various applications of GIS in Civil Engineering
5. To give an introduction about remote sensing and its applications

UNIT –I **10 HOURS**

Introduction – Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT –II **10 HOURS**

Data Acquisition: Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital Elevation Data.

Data Management: Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

UNIT –III **12 HOURS**

Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

UNIT –IV **12 HOURS**

Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V **12 HOURS**

Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

TEXT BOOKS:

1. Demers, M.N, (2013). *'Fundamentals of Geographic Information Systems'* Wiley India Pvt. Ltd,.
2. Burrough, P. A., and McDonnell R. A. (1998). *Principles of Geographical Information Systems.* Oxford University Press, New York.
3. Kang-tsung Chang. (2006). *Introduction to Geographical Information Systems.* Tata

REFERENCE BOOKS:

1. Sabins F.F. Jr. (1978). *Remote Sensing Principles and Interpretations.* W.H. Freeman and Company, San Francisco.
2. Tor Bernhardsen. (2002). *Geographical Information System.* Wiley India (P) Ltd., Third Edition, New Delhi.
3. Hoffman-Wellenhof, B, et al. (1997). *GPS Theory and Practice.* Fourth Edition, Springer Wein, New York.
4. Lilysand T.M., and Kiefer R.W. (2002). *Remote Sensing and Image Interpretation*. John Wiley and Sons, Fourth Edition, New York.
5. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). *An Introduction to Geographic Information Technology.* I.K. International Publishing House (P) Ltd, New Delhi.

COURSE OUTCOMES:

The students will be able to

CO1: To understand and remember the concepts of GIS, Projections and Coordinate systems

CO2: To classify and explain various data acquisition and data management techniques.

CO3: To study, model and analyze various data collected.

CO4: To apply the knowledge of GIS in Civil Engineering stream

CO5: To understand the concepts of Remote sensing and its applications.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro- Syllabus of Geo-Spatial Technology

UNIT –I

Introduction **–** Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

Unit	Module	Micro content
Ia. Introduction	Introduction to GIS	Fundamentals of GIS
		History of GIS
		Components of GIS
Ib. Projections and Coordinate Systems	Maps, Projections and Coordinate system	Map definitions
		Representations of point, line, polygon, common coordinate system
		Geographic coordinate system
		Map projections, transformations, map analysis.

UNIT –II

Data Acquisition: Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and

Data Management: Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

Unit	Module	Micro content
IIa. Data Acquisition	Data types	Spatial data
		Non-Spatial data
	Data Format	Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital Elevation Data.
IIb. Data Management	Data Management	Data Storage and Maintenance, Data Compression, Data Quality and Standards
	Precision, Accuracy and Error	Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

UNIT –III

Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

Unit	Module	Micro content
IIIa. Data modelling	Data analysis	Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay
	Data model	Vector Data Model, Raster Data Model, Digital Elevation Model.
	Cost and Path Analysis and Knowledge Based System.	Conceptual theory
IIIb. GIS Analysis and Functions	Organizing and maintenance of data	Organizing data for analysis, analysis function, maintenance and analysis of spatial data
	GIS Analysis	Buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

UNIT –IV

Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

IV. Applications of GIS	Applications	Environmental and Natural Resource Management, Soil and Water Resources, Agriculture
		Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management
	GIS and GPS	GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

Unit	**Module**	**Micro content**
V. Introduction to remote sensing	Introduction	General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing
		Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors
	Characteristics	Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites
	Applications	Watershed Modeling, Environmental Modeling, Urban Planning and Management

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2										2	
CO2	2			2							2	
CO3	2	2		2							2	
CO4	2				1						2	1
CO5	2				1						2	1

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III-Year-II Semester	STAAD LABORATORY	L	T	P	C
PC3201L		0	0	3	1.5

Course Objectives:

To analyze and design various structures using STAAD Pro / STAAD Foundation softwares.

LIST OF EXPERIMENTS

1. Analysis of Continuous Beam
2. Analysis of Plane Frame
3. Analysis and Design of 3-D RC Frame subjected to gravity loading.
4. Analysis and Design of Beam-Supported RC Slab
5. Analysis and Design of 2-D Steel Truss
6. Analysis and Design of 3-D Steel Truss
7. Analysis and Design of RC Box Culvert
8. Analysis and Design of Steel Pre-Engineered Building Frame
9. Analysis and Design of Isolated Column Footing
10. Analysis and Design of Raft Footing

Note: A minimum of 7 experiments must be dealt

Course Outcomes:

At the end of the course the students can able to
CO1: Analyze continuous beam and plane frame
CO2: Analyze and design 3-D RC frames for gravity loading.
CO3: Analyze and design RC Slabs, Box Culverts and Footings.
CO4: Analyze and design steel trusses
CO5: Analyze and design Steel Pre-Engineered Building Frame.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2		3				2	2		
CO2	1	2	2		3				2	2		
CO3	1	2	3		3				2	2		1
CO4	1	2	3		3				2	2		1
CO5	1	2	3		3				2	2		1

	PSO1	PSO2	PSO3
CO1	1	1	
CO2	1	2	
CO3	1	2	1
CO4	1	2	1
CO5	1	2	1

III-Year-II Semester	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
PC3202L		0	0	3	1.5

Course Outcomes:

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

CO1: Identify index properties of soils for classification purposes

CO2: Estimate the soil permeability

CO3: Determine the settlement characteristics of soils

CO4: Determine the compaction characteristics of soils

CO5: Estimate the strength parameters of soils

Note: A minimum of **10** experiments are to be performed from the following

List of Experiments:

1. Sieve Analysis
2. Sedimentation Analysis
3. Specific Gravity Test
4. Field density- Core cutter and Sand Replacement Methods
5. Atterberg's Limits.
6. Permeability of soil using Constant Head test and Variable Head test
7. Compaction Test
8. CBR Test
9. Consolidation Test (Demonstration)
10. Unconfined Compression Test
11. Direct Shear Test.
12. Vane Shear Test
13. Triaxial Test(UU)

TEXT BOOK/REFERENCE

Laboratory manual prepared by Civil Engineering Department

REFERENCES:

1. IS 2720 all parts.
2. IS 9198-1979, Specification for compaction hammer for soil testing.
3. IS:10074-1982, Specification for compaction mould assembly for light and heavy compaction test for soils.
4. Braja.M.Das, "Geotechnical Engineering Handbook", Cengage Learning, 1st Edition, 2014.

Mapping

Mapping	PO1	PO4	PO10
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

TEXT BOOK:

1. American Public Health Association, "Standard Methods for Analysis of Water and Wastewater", APHA, Washington, 1992.
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi, 2010.
3. Laboratory Manual developed by Civil Engineering Department.

III-Year-II Semester	SKILL ADVANCED COURSE 2 REVIT ARCHITECTURE AND ENERGY ANALYSIS	L	T	P	C
SAC3201A		1	0	2	2

Course objectives:
The main objectives are
1. Learn the usage of Revit software for planning
2. Learn the 3D modeling of buildings
3. Learn the Energy analysis of a building using Revit software

Course Outcomes:
Upon successful completion of the course, the student will be able to
CO1: To understand the importance of Revit Software in planning and Design of Buildings
CO2: To Plan and model various types of buildings
CO3: To analyze the buildings in Insight for Energy analysis

List of Experiments:
18. Draw the Plan, Section and Elevation and 3D modeling of a two bed room house
19. Draw the Plan, section and Elevation and 3D modeling of a MIG house
20. Draw the Plan, Section and Elevation and 3D modeling of an Educational building
21. Plan, Section and Elevation and 3D modeling of a Hotel/Motel building
22. Plan, Section and Elevation and 3D modeling of a Hospitals/Dispensaries building
23. Draw the 3D modelof a given Layout using Revit
24. To allot various Energy Parameters base on room to a modeled building
25. To analyze the building using Insight plugin from REVIT
26. To modify the existing building for better energy efficiency
27. To convert the model to gbxml and to analyze the building in Green building studios

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1		1	1						2	2		
CO2	2	2	2		1	1						2	2		
CO3	2	2	2		1	1						2	2		
CO4	2	2	2		1	1						2	2		

III-Year-II Semester	SKILL ADVANCED COURSE 2	L	T	P	C
SAC3201B	OPEN ROADS	1	0	2	2

Course Outcomes:

CO1: The course covers different elements from Transportation Engineering

CO2: In this course, the student will be able to analyze the various cross sectional elements in Road/pavement construction.

CO3: Students will be able to design the various elements in pavement design.

CO4: Students will be able to design and model the sewerage networks.

List of Experiments:

1. Automate the drawing production.
2. Create horizontal & vertical alignments, profiles and cross sections.
3. Model and analyze the terrains
4. Model and analyze the earthwork.
5. Model, Analyze and design of storm water and sanitary sewer networks.

*****

CO-PO Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3					2		1	2		
CO2	2	3		2								
CO3	3	3	3	2			1		1	1		
CO4	3	3	3	2					2	1		

CO-PSO Matrix:

	PSO1	PSO2	PSO3
CO1	3		
CO2	2	3	
CO3	3		2
CO4	3		2

1 – Slight (Low)	2 – Moderate (Medium)	3 – Substantial (High)	"-" – No relation

III-Year-II Semester	ENTREPRENEURIAL SKILLS DEVELOPMENT	L	T	P	C
MC3201		2	0	0	0

Course Objective:

1. To impart the basic knowledge of entrepreneurship skills for better understanding of entrepreneurial scenario.
2. To understand the knowledge of theories of entrepreneurship and to motivate students to become entrepreneur.
3. To identify opportunities in starting own ventures.
4. To understand and plan business model for a start up.
5. To analyze the role of government and non government institutions in supporting entrepreneurial activities.

Course Outcomes: After completion of the course, students will be able to

CO 1: The basics of entrepreneurship skills for better understanding of entrepreneurial scenario are understood.

CO 2: Apply Knowledge of theories of entrepreneurship and to identify entrepreneurial opportunities for women.

CO 3: identify opportunities supporting entrepreneurship.

CO 4: analyze the milestones and related challenges in developing new venture.

CO 5: Understand government role supporting entrepreneurship.

Unit 1

Foundation of Entrepreneurship 10 hrs

Concept and Need of Entrepreneurship; Characteristics and types of Entrepreneurship; Charm of becoming Entrepreneur; Entrepreneurial decision process; Entrepreneurship as a career; Entrepreneurship as style of management; Changing role of Entrepreneur; Entrepreneurial traits, factors effecting Entrepreneur.

Unit 2

Theories of Entrepreneurship and Entrepreneurial motivation 12 Hrs

Influences of Entrepreneurship development; external Influences of Entrepreneurship development; Socio – cultural, political and economical, personal entrepreneurial success and failure: reason and remedies, women entrepreneurs: challenges and achievements of women entrepreneurs.

Meaning of Entrepreneurial motivation; motivation cycle or process; theories of Entrepreneurial motivation; Entrepreneurial motivational factors; Changes in Entrepreneurial motivation

Unit 3

Opportunities Identification and Selection 10 Hrs

Need for opportunities identification and selection; Environmental Dynamics and Changes; Business Opportunities in various sectors; Identification of Business opportunities, and Opportunity selection.

Unit 4

Business Planning Process 10 Hrs

The business plan as an entrepreneurial tool; Elements of business planning; Objectives; Market analysis; Development of product/idea; Marketing, Finance, organization and management; Ownership; Critical risk contingencies of the proposal; Scheduling and milestones.

Unit 5

Entrepreneurial Development and Government 10 Hrs

Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed schemes and challenges, Government initiatives and inclusive entrepreneurial growth.

<u>TEXT BOOKS:</u>

1. Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.
2. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
3. P.Narayana Reddy, Entreprenurship, Cengage Learning, New Delhi,2010.
4. Steven Fisher, Ja-nae Duane, The startup equation – A visual guide book for building your startup, Indian edition, McGraw Hill Education India Pvt. Ltd. 2016.
5. Arya Kumar: "Entrepreneurship", Pearson, Publishing House, New Delhi, 2012.
6. VSP Rao, Kuratko: "Entrepreneurship', Cengage Learning, New Delhi, 2011.
7. K.Ramachandran: "Entrepreneurship Development", TMH, New Delhi, 2012.
8. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 2009.
9. Dollinger: Entrepreneurship, Pearson, 2009.

<u>REFERENCE BOOKS:</u>

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage, 2012.
3. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya

4. AnajanRai Chaudhuri, Managing new ventures, concepts and cases, Prentice Hall International, 2010.
5. Rajeev Roy: Entrepreneurship, Oxford university press, New Delhi, 2010.

Web Resources:

1. https://nptel.ac.in/courses/110105067/50
2. http://www.yourarticlelibrary.com/project-management/5-methods-of-project-appraisalexplained/40771
3. https://springhouse.in/government-schemes-every-entrepreneur/
4. http://nptel.ac.in/courses
5. https://www.tutorialspoint.com/
6. https://www.ediindia.org/
7. http://www.quickmba.com/entre/

UNIT I **10hrs**

Foundation of Entrepreneurship

Concept and Need of Entrepreneurship, Characteristics and types of Entrepreneurship, Charm of becoming Entrepreneur, Entrepreneurial decision process, Entrepreneurship as a career, Entrepreneurship as style of management, Changing role of Entrepreneur, Entrepreneurial traits, factors effecting Entrepreneur.

Unit	Module	
Unit I	Concept and Need of Entrepreneurship	Introduction to Entrepreneurship – Meaning and definition of Entrepreneurship.
	Characteristics and types of Entrepreneurship, Charm of becoming Entrepreneur	Characteristics of Entrepreneurship
		Types of Entrepreneur
		Charms of becoming entrepreneurs
	Entrepreneurial decision process	Steps of Entrepreneurial decision process
	Concepts of Entrepreneurship	Entrepreneurship as a career
		Entrepreneurship as style of management
		role of Entrepreneur
		Entrepreneurial traits
		Factors effecting Entrepreneur.

UNIT - II

Theories of Entrepreneurship and Entrepreneurial motivation 12 Hrs

Influences of Entrepreneurship development, external Influences of Entrepreneurship development, Socio – cultural, political and economical, personal entrepreneurial success and failure, reason and remedies, women entrepreneurs, challenges and achievements of women entrepreneurs. Meaning of Entrepreneurial motivation, motivation cycle or process, theories of Entrepreneurial motivation,

Unit II	Influences of Entrepreneurship development	Factors influencing entrepreneurship
		external Influences of Entrepreneurship development
		Socio – cultural, political and economical
	personal entrepreneurship	personal entrepreneurial success and failure, reason and remedies
	women entrepreneurship	Concept of women entrepreneurs
		Functions of women entrepreneurs
		Challenges/ problems of challenges
		achievements of women entrepreneurs
	Entrepreneurial motivation	Meaning of Entrepreneurial motivation
		Nature of Motivation
	Motivation cycle or process	Motives, Goals, Behavior
	Theories of Entrepreneurial motivation	Maslow's need Hierarchy theory, Mcclelland's need for achievement theory
	Entrepreneurial motivational factors	Internal and External factors
	Changes in Entrepreneurial motivation	Changes in Entrepreneurial motivation

Unit III

Opportunities Identification and Selection 10 Hrs

Need for opportunities identification and selection; Environmental Dynamics and Changes; Business Opportunities in various sectors; Identification of Business opportunities, and Opportunity selection.

Unit III	Need for opportunities identification and selection	What do you mean by opportunity? Need for and significance of opportunities identification and selection
	Environmental Dynamics and Changes	Constituents or Dimensions of Business Environment
		Economic Environment in India
		Impact of Environmental Dynamics on Changes for Business Enterprises
		Types of Business Environment
	Business Opportunities in various sectors	Tourism, Automobile, Textiles, Social ventures, Software, Engineering goods Franchising, Education and training, food processing, Ayurveda and traditional medicine, organic farming, media, packaging, Floriculture, toys, Health care sector, Biotechnology, Energy solutions, recycling business.
	Identification of Business opportunities	Idea Generation, Opportunity/Product Identification
	Opportunity selection	Process of Opportunity selection

Unit IV

Business Planning Process 10 Hrs

The business plan as an entrepreneurial tool; Elements of business planning; Objectives; Market

Ownership; Critical risk contingencies of the proposal; Scheduling and milestones.		
UNIT IV	Business Planning	The business plan as an entrepreneurial tool
		Elements and objectives
		Market analysis
		Development of product/idea
		Marketing, Finance, organization and management
		Ownership
		Critical risk contingencies of the proposal; Scheduling and milestones.
Unit V **Entrepreneurial Development and Government 10 Hrs** Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed schemes and challenges, Government initiatives and inclusive entrepreneurial growth.		
Unit V	Role of Central Government	Role of Central Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed schemes and challenges
	Role of State Government	Role of Central Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed schemes and challenges
	Government initiatives.	Government initiatives and inclusive entrepreneurial growth.

IV-Year-I Semester PC4101	ESTIMATION SPECIFICATION & CONTRACTS	L	T	P	C
		3	1	0	3

Course Objectives:

The objective of this course is to enable the students to:

1. Understand the quantity calculations of different components of the building.
2. Understand the rate analysis of different quantities of the building components.
3. Learn various specifications and components of the buildings.

Unit-I:

General items of work in Building – Standard Units, Principles of working out quantities for – detailed and abstract estimates –Approximate methods of Estimating.

Unit– II:

Detailed Estimation of Buildings using Individual wall method and center line method.

Unit-III:

Rate Analysis – Working out data for various items of work–over head and contingent charges.

Unit-IV:

Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

Unit-V:

Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings –Standard specifications for different items of building construction.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of SIX questions from Units 1,3,4,5 out of which THREE are to be answered (60% Weightage) & ONE mandatory question (40% Weightage) from Unit 2.

TEXT BOOKS:

1. Estimating and Costing, B.N. Dutta, UBS publishers, 2000.
2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. Construction Planning and Technology, Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. Estimating and Costing, G.S.Birdie.

REFERENCE BOOKS:

1. Standard Schedule of rates and standard data book, Public worksdepartment.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works –B.I.S.
3. Estimation, Costing and Specifications, M. Chakraborthi; Laxmipublications.
4. National Building Code

Course Outcomes:

The students will be able to

CO1: prepare a Rough Cost Estimate for sanction or Approval of a Project/building.

CO2: determine the quantities of different components of buildings.

CO3: determine the quantity of Earthwork for Canals & Roads and prepare BBS.

CO4: find the cost of various building components/Items of work.

CO5: capable of finalizing the value of structures**.**

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

Unit-I:

General items of work in Building – Standard Units, Principles of working out quantities for detailed and abstract estimates –Approximate methods of Estimating.

Unit	Module	Micro content
	General items of work in Building and their Units	Earthwork Excavation, PCC, Brickwork in Foundation and Plinth, RCC, Brickwork in Superstructure, DPC, Flooring, etc..
	Principles of working out quantities	Principles
	detailed and abstract estimates	Concepts giving the Tabular forms
	Approximate methods of Estimating.	Methods and problems

Unit– II:

Detailed Estimation of Buildings using individual wall method and center line method.

Unit	Module	Micro content
	Individual wall method	Concepts and problems
	Centre Line Method	Concepts and problems

Unit-III:

Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

Unit	Module	Micro content
Earthwork	Roads	Different Methods and Problems
	Canals	Different Cases and Problems
	Bar Bending Schedule	Concepts and Problems

Unit-IV:

Rate Analysis – Working out data for various items of work–over head and contingent charges.

Unit	Module	Micro content
Rate Analysis	Working out data for various items of work	Concepts and problems
	Over head and contingent charges.	Concepts

Unit-V:

Unit	Module	Micro content
	Contracts	Types of contracts
		Contract Documents
		Conditions of contract
	Valuation of buildings	Methods of Valuation and Problems (simple)
	Specifications	Different items of work

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	1	-	-	-	-	1	-	1
CO2	3	1	-	-	1	-	-	1	1	2	-	1
CO3	3	1	-	-	1	-	-	1	1	-	-	1
CO4	3	1	-	-	2	-	-	1	1	3	-	1
CO5	2	2	-	2	2	-	-	1	2	-	-	1

IV-Year-I Semester	WATER RESOURCES ENGINEERING	L	T	P	C
PC4102		3	1	0	3

Course Objectives:

The course is designed to:

- Introduce hydrologic cycle and its relevance to Civil engineering
- make the students understand physical processes in hydrology and, components of the hydrologic cycle
- Appreciate concepts and theory of physical processes and interactions
- Learn measurement and estimation of the components hydrologic cycle.
- Provide an overview and understanding of Unit Hydrograph theory and its analysis
- Understand flood frequency analysis, design flood, flood routing
- Appreciate the concepts of groundwater movement and well hydraulics

Unit-I:

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, raingauge 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– II:

Abstractions from Precipitation: Initial abstractions.
Evaporation: factors affecting, measurement, reduction
Evapotranspiration: factors affecting, measurement, control
Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

Unit-III:

Runoff: Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph Analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph (UH), assumptions, derivation of UH, UH of different durations, principle of superposition and S-hydrograph methods, limitations and applications of UH, synthetic UH, instantaneous UH.

Unit-IV:

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (PMF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

Unit-V:

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation-steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

TEXT BOOKS:

1. Engineering Hydrology, Jayarami Reddy, P., Laxmi Publications Pvt. Ltd., (2013), New Delhi
2. Engineering Hydrology Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013),New Delhi.
3. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P) Ltd.

REFERENCES:

1. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers.
2. Applied hydrology, Chow V. T., D. R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.
3. Water Resources Engineering, Mays L.W, Wiley India Pvt. Ltd, (2013).

Course Outcomes:

The students will be able to

CO1: ***quantify*** the major sources of precipitation and Develop Intensity – Duration- Frequency curve & Depth – Area Duration curves and carry out rainfall frequency analysis. (Analysing)

CO2: ***quantify*** various abstractions and apply the concepts to several practical areas of engineering hydrology (Understanding, Applying)

CO3: e***stimate*** the runoff and ***develop*** Unit Hydrographs and Synthetic Unit Hydrograph. (Applying, Analysing)

CO4: ***estimate*** flood magnitude and carry out flood routing (Applying, Analysing)

CO5: ***determine*** aquifer parameters and yield of wells (Analysing)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus

Unit-I:

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, raingauge 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	Module	Micro Content
1a) Introduction	Introduction	• Engineering hydrology and its applications, Global Water Budget and India's Water Budget • Hydrologic cycle with Diagrammatic representation, Horton's representation and Flow chart representation. • Hydrological data-Sources of data.
1b) Precipitation	Types and forms	• Formation of Precipitation, Type of precipitation – Cyclonic, Convective and Orographic, Forms of Precipitation – Drizzle, Rain, Glaze, Sleet, Snow, Hail, Dew
	Measurement	• Non-Recording Type Rain gauges, recording type rain gauges (Tipping bucket type, Weighing Bucket

		network recommendations, problem on optimum number of rain gauges as per Indian Standards
	Analysis and Interpretation of Rainfall Data	• Presentation of rainfall data – Chronological Chart, Bar Diagram and Ordinate Graph, Moving average Curve, rainfall mass curve and rainfall hyetograph. • Average depth of rainfall over an area- Arithmetic Mean Method, Thiessen Polygon Method, Isohyetal Method with problems. • Continuity and consistency of rainfall data - Estimation of missing Precipitation Records – Arithmetic Average Method, Normal Ratio Method, Inverse Distance Method, Double Mass Curve with problems. • Frequency of rainfall - Frequency analysis for dependable rainfall. • Intensity-Duration-Frequency (IDF) curves - Procedure, • Depth-Area-Duration (DAD) curves - Procedure, • Probable Maximum Precipitation (PMP), design storm
Unit– II: **Abstractions from Precipitation:** Initial abstractions. **Evaporation:** factors affecting, measurement, reduction **Evapotranspiration:** factors affecting, measurement, control **Infiltration:** factors affecting, Infiltration capacity curve, measurement, infiltration indices.		
Abstractions from Precipitation	Abstractions from Precipitation	Initial abstractions.

	Evaporation	• Definition, Evaporation Process
		• Factors affecting,
		• Measurement –
		    o Estimation of evaporation by Empirical Equations – Meyer's Equation, Rohwer's Equation, by Water balance Method, by Energy Balance Method
		    o Atmometers – Livingstone Atmometer, Piche Atmometer
		    o Evaporation Pans – Sunken Pan, Floating Pan, Surface Pan, ISI Standard Pan,
		    o Pan Coefficient
		• Reduction –
		    o Volume of water lost due to evaporation
		    o Methods to Reduce Evaporation Losses - Reducing Surface Area, Mechanical Covers, Chemical Films

	Evapotranspiration	• Definitions of Transpiration and ET • Factors affecting ET • Measurement – Lysimeters and Field Plots, Empirical Equation – Penman Equation, • ET control
	Infiltration	• Factors affecting, • Infiltration capacity curve, measurement – Tube infiltrometer, Double Ring Infiltrometer, Infiltrometer with adjustable depth of flooding, Rainfall Simulations

<table>
<tr><td></td><td></td><td>Ampt Equation and estimation of parameters of these models.
• Infiltration indices – Relationship between Rianfall-runoff and infiltration, Φ –Index (with problems) and W - Index.</td></tr>
<tr><td colspan="3">Unit-III:
Runoff: Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.
Hydrograph Analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph (UH), assumptions, derivation of UH, UH of different durations, principle of superposition and S-hydrograph methods, limitations and applications of UH, synthetic UH, instantaneous UH.</td></tr>
<tr><td rowspan="6">Runoff</td><td>Catchment characteristics</td><td>• Area, Stream Order, Stream Density, Drinage Density, Relief, Slope, Length, Shape, hypsometric Curve;
• Factors affecting runoff, components.</td></tr>
<tr><td>Computation</td><td>• Empirical formulae, tables and curves – Binnie’s Percentages, Barlow Tables, Koshla’s Formula and Inglis and DeSouza Formula</td></tr>
<tr><td>Stream gauging</td><td>• Measurement of Stage - Staff Gauge, Float Gauge Recorder, Bubble Gauges,
• Measurement of Velocity – Current Meters, Floats, Direct Method- Area Velocity Method, Moving Boat Method, Ultrasonic Method, Electromagnetic Method, by dilution technique and Indirect methods.</td></tr>
<tr><td>Rating curve</td><td>• Stage - Discharge Relationship, Permanent Control and Shifting Control and Unsteady-Flow Effect</td></tr>
<tr><td>Flow mass curve</td><td>• Calculation of Storage Volume</td></tr>
<tr><td>Flow duration curve</td><td>• Procedure to obtain and its characteristics</td></tr>
<tr><td>Hydrograph Analysis</td><td>Hydrograph Analysis</td><td>• Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph,
• Unit hydrograph (UH), assumptions, derivation of UH,
• UH of different durations, principle of superposition
• S-hydrograph methods,
• limitations and applications of UH,
• Synthetic UH – Snyder’s Method and problems and
• Instantaneous UH</td></tr>
<tr><td colspan="3">Unit-IV:
Floods: Causes and effects, frequency analysis- Gumbel’s and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (PMF), flood control methods and management.
Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.</td></tr>
<tr><td>Floods</td><td>Floods</td><td>• Causes and effects,
• frequency analysis- Gumbel’s and Log-Pearson type</td></tr>
</table>

		Maximum Flood (PMF), and • Flood control methods and management.
Flood Routing	Flood Routing	• Hydrologic routing, • Channel and reservoir routing-Muskingum and Puls methods of routing (with problems).

Unit-V:
Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

Groundwater	Groundwater	• Occurrence, types of aquifers, • aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, • types of wells, • Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers (with problems), • Yield of a open well-recuperation test (with problems).

CO-PO Matrix:

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

CO-PSO Matrix:

	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	1	-	-
CO3	-	3	-
CO4	-	-	3
CO5	2	2	-

IV-Year-I Semester	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
PE4102A		3	1	0	3

Course Objectives:

1. Familiarize Students with concepts of prestressing
2. Equip student with different systems and devices used in prestressing
3. Understand the different losses of prestress including short and long term losses
4. Familiarize students with the analysis and design of prestressed concrete members under flexure, shear and torsion

Unit-I: Basic Concepts of Prestressing and Prestressing Systems

Basic concepts of Prestressing- History- Advantages and Applications of Prestressed Concretes, High Strength Concrete- Permissible Stresses, Shrinkage, Creep, Deformation Characteristics, High strength Steel- Types, Strength- Permissible Stresses- Relaxation of Stress, Cover Requirements.

Unit– II: Prestressing Systems and Analysis of Prestressing

Prestressing Systems- Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems,

Analysis of Prestress - Basic Assumptions in Analysis of prestress and design, Analysis of prestress, Resultant Stresses at a section- pressure line- Concepts of load balancing- Stresses in Tendons, Cracking moment.

Unit-III: Losses of Pre-stressing

Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes -Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation stress in steel, slip in anchorage, differential shrinkage- bending of members and frictional losses- Total losses allowed for design

Unit-IV: Design of Beams for flexure, shear and Torsion

Design for Flexural resistance- Types of flexural failure – Code procedures- Design of sections for flexure- Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion.

Unit-V: Deflection of Members and End Zone of Members

Deflection- Control of deflections- Factors influencing Deflection- Prediction of short term and long term deflections.

Transfer of Prestress in pre tensioned members- Transmission length- Bond stresses- end zone reinforcement- Codal provisions-

Transfer of Prestress in Post tensioned members Anchorage zone Stresses in Post tensioned members- Stress distribution in end block- Anchorage Zone reinforcement.

TEXT BOOKS:

1. Prestressed Concrete, N. Krishna Raju, Tata McGraw hill
2. Prestressed Concrete, S. Ramamrutham

REFERENCE BOOKS:

1. Prestressed Concrete, P. Dayaratnam
2. Prestressed Concrete, T. Y. Lin & Burns, Wiley Publications

Course Outcomes:

CO2: Understand different methods of prestressing and analysing the section under loading condition

CO3: Estimate the effective prestress including the short and long term losses

CO4: Analyze and design of prestressed concrete beams under flexure, Shear and Torsion

CO5: Estimate the short and long term deflection and able to understand the transfer of presterss pre-tensioning and post tensioning members

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

Unit-I: SIMPLE STRESSES AND STRAINS

Elasticity and plasticity (Definitions) – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section-simple problems – composite bars (Concept and problems) – Temperature stresses (Concept only-no problems).

Strain energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications

Unit	Module	Micro content
Ia. Elasticity and plasticity	stress – strain diagram for mild steel	Elasticity and plasticity , Types of stresses and strains
		Hooke's law ,Working stress, factor of safety
	Elastic moduli	Young's modulus
		Shear modulus
		Bulk modulus
		Relation between them
	Stress- strain diagram for mild steel	stress – strain diagram for mild steel
	Bars of varying cross-section and composite bars	Concept and problems (simple)
	Temperature stresses	Concept only
Ib. Strain energy	Resilience, Gradual, sudden, impact and shock loadings – simple applications.	Definitions
		Derivation of gradual and sudden loading
		Problems

Unit– II: SHEAR FORCE AND BENDING MOMENT

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads (simple problems), uniformly distributed load, uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit	Module	Micro content
IIa/ IIb. Shear Force And Bending Moment	Introduction	Definition of beam, Types of beams
		Concept of shear force and bending moment
	Beams (simply supported , cantilever and	Point loads
		Uniformly Distributed Load
		Uniformly Varying Load

	Point of contra flexure and relation between load , SF and BM	Point of contra flexure and relation between load , SF and BM

Unit-III: FLEXURAL STRESSES AND SHEAR STRESSES

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T Angle and Channel sections – Design of simple beam sections.

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

Unit	Module	Micro content
IIIa. Flexural Stresses	Introduction	Theory of simple bending, assumptions Neutral axis
	Derivation of bending equation	M/I =f/y = E/R
		Determination of bending stresses
	Section modulus	Rectangular, circular sections (Solid and Hollow), I,T Angle and Channel sections
		Design of simple beams sections.
IIIb. Shear Stresses	Introduction	Derivation and assumptions
	Shear stresses distribution	Rectangular, circular, triangular, I, T and angle sections.

Unit-IV: TORSION OF CIRCULAR SHAFTS AND SPRINGS

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: – Assumptions made in the theory of pure torsion – Torsion moment of resistance – Polar section modulus – Power transmitted by shafts (concept and problems) – Combined bending and torsion and end thrust (Concept only-no problems).

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple –springs in series and parallel (concept only).

Unit	Module	Micro content
IVa. Torsion of Circular Shafts	Introduction	Theory of pure torsion, derivation and assumptions
		Polar moment of inertia and torsion moment of resistance
	Power transmitted by shafts	Power transmitted by shafts (concept and problems
		Combined bending and torsion and end thrust (Concept only).
IVb. Springs	Introduction	Types of springs
	Deflection	Close coiled helical spring under axial pull and axial couple
		Open coiled helical spring axial pull and axial couple
		springs in series and parallel (concept only)

Unit-V: THIN CYLINDERS AND THICK CYLINDERS

volume of thin cylinders.

Thick Cylinders: Introduction Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders.

Unit	Module	Micro content
Va. Thin Cylinders	Introduction	Thin cylindrical shells
		Derivation of longitudinal and circumferential stresses
	Strains	Hoop strain
		Longitudinal strain
		Volumetric strain
		changes in diameter, and volume of thin cylinders.
Vb. Thick Cylinders	Introduction	Lame's theory for thick cylinders
	Derivation	Hoop stresses
		Radial stresses
		Thick cylinders (simple problems)
		Compound cylinders (simple problems)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	-	1	-	-	-	-	-	1	-	-
CO4	3	3	2	1	2	-	-	1	1	3	1	1
CO5	3	2	1	1	2	-	-	1	1	-	1	1

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IV-Year-I Semester	SPECIAL GEOTECHNICAL CONSTRUCTION	L	T	P	C
PE4102B		3	1	0	3

Course Outcomes:

At the end of the course the student will be able to:
CO1: Assess the foundation practices on expansive soils
CO2: Illustrate the mechanism of the soil nailing system
CO3: Perform the methods of stabilization of expansive soils
CO4: Design a Gabion wall
CO5: Design a stone column

UNIT-I

Foundation Practices in Expansive Clays – Sand cushion – Belled Piers – CNS layer technique

Under – reamed pile foundations – Construction techniques – design specifications – Load - carrying capacity in compression and uplift of single and multi – under-reamed piles in clays and sands – granular pile Anchors.

UNIT-II

STONE COLUMNS: Design: basic design parameters – diameter, pattern/ configuration, spacing, replacement ratio, stress concentration factor, backfill, critical column length, failure mechanisms, load analysis, Priebe's Method.

UNIT-III

SOIL NAILING:

Introduction to soil nails, advantages, features, and limitations of a soil nail retaining system, applications, suitability of ground conditions for soil nailing, types of soil nails and their behavior, construction sequence of soil nailed slopes, rigs for installation of nails, drilling soil nail bores, placing nails, grouting the nails, categories of slope facing, fundamental mechanism and potential failure of a soil nail wall, nail-ground interaction, nail-ground-facing interaction (pullout resistance).

UNIT-IV

GABION WALLS: Applications, design philosophy and failure mechanisms, general design principles, key design analysis, materials used, specifications, installation procedure, stability analysis.

UNIT-V

Design of reinforced earth slopes: Basal reinforcement for construction on soft clay soils, construction of steep slopes with reinforcement layers on stable foundation soil, different slope stability analysis, erosion control on slopes using geosynthetics.

TEXTBOOKS:

1. Das B.M., Shukla S.K., Earth Anchors, 2nd Ed., J. Ross Publishing, 2013.
2. Barksdale R.D., Bachus R.C., Design and construction of stone columns, Federal Highway

REFERENCES:

1. Hsai Yang Fang, Foundation Engineering Handbook, 2nd Edition, Chapman & Hall, 1991

Inst. of Civil Engrs., Specification for piling and embedded retaining walls, 2nd Edition, Thomas Telford, 2007.

2. IS:15284-2003 Indian standard code of practice for design and construction for ground improvement guidelines. Part 1: Stone columns, Bureau of Indian Standards, 2003.

3. Lazarus White, Modern Underpinning - Development, Methods and Typical Examples, 4th Edition, Read Books, 2008.

4. Malcolm Puller, Deep Excavations: A practical manual, 2nd Edition, Thomas Telford,2003.

5. Priebe H.J., Vibro Replacement—Design Criteria and Quality Control, ASTM STP 1089— Deep foundation improvements-Design, Construction and Testing, 1991.

6. Thornburn S., Littlejohn G.S., Underpinning and Retention, 1st Edition, SpringerScience, 1993.

IV-Year-I Semester PE4102C	SOLID WASTE MANAGEMENT	L	T	P	C
		3	1	0	3

Course Objectives:

The course is designed to:

- Appreciate the impact of urbanization on catchment hydrology.
- Understand the importance of short duration rainfall runoff data for urban hydrology studies.
- Learn the techniques for peak flow estimation for storm water drainage system design.
- Understand the concepts in design of various components of urban drainage system.
- Learn some of the best management practices in urban drainage.
- Understand the concepts of preparation master urban drainage system.

Unit-I:

INTRODUCTION: Urbanization and its effect on water cycle – urban hydrologic cycle – Trends in urbanization – Effect of urbanization on hydrology

Unit– II:

PRECIPITATION ANALYSIS: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

Unit-III:

APPROACHES TO URBAN DRAINAGE: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and stormwater reuse, major and minor systems.

Unit-IV:

**ELEMENTS OF DRAINAGE SYSTEMS:: ** Open channel, underground drains, appurtenances, pumping, and source control.

Unit-V:

ANALYSIS AND MANAGEMENT: Stormwater drainage structures, design of stormwater network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for stormwater management.

TEXT BOOKS:

1. Manual on Drainage in Urbanised area, Geiger W. F., J Marsalek, W. J. Rawls and F.C. Zuidema, (1987 - 2 volumes), UNESCO,
2. Urban Hydrology, Hall M J (1984), Elsevier Applied Science Publisher.
3. Hydrology – Quantity and Quality Analysis, Wanielista M P and Eaglin (1997), Wiley and Sons
4.Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling, Akan A.O and R.L. Houghtalen (2006), Wiley International.

REFERENCES:

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

IV-Year-I Semester PE4102D	PAVEMENT ANALYSIS AND DESIGN	L T P C 3 1 0 3

Course Objectives:

5. Familiarize Students with concepts of pavement design.
6. Equip student with different pavement deflection measurement techniques.
7. Understand the different types of stresses developed in the pavements.
8. Familiarize students with the analysis and design of flexible pavements, rigid pavements and overlays also.

Unit-I: Pavement Types, Wheel Loads and Design Factors

Definition of Pavement and Types-Comparison of Highway pavements-Wheel Loads- Tyre pressure, Contact pressure, Design Factors: Traffic and Loading, Environment, Materials, Failure criteria, Reliability.

Unit– II: Stresses in Pavements

Layered System Concepts: One Layer System: Boussinesq Theory- Two Layer Theory: Burmister's Theory -Three Layer System. Stresses in Rigid Pavements - Relative Stiffness of Slabs, Modulus of Sub grade Reaction - Stresses due to Warping, Stresses due to Friction, Stresses due to Load, IRC Recommendations.

Unit-III: Pavement Design

IRC Method of Flexible Pavement Design, AASHTO Method of Flexible Pavement Design, IRC Method for Rigid Pavements, use of Geosynthatics in pavements.

Unit-IV: Pavement Inventories

Serviceability Concepts, Visual Rating, Pavement Serviceability Index, Roughness Measurements, Measurement of Distress Modes Cracking, Rutting, Rebound Deflection using Benkleman Beam Deflection Method, Load Man Concept, Skid Resistance Measurement.

Unit-V: Deflection measurements and Design of Overlay

Beam Deflection Method, Pavement Distress Rating Technique. Design of Overlays by Benkelmen Beam Deflection Methods as per IRC – 81 - 1997 – pavements on problematic soils.

TEXT BOOKS:

3. Yoder and Witzorack, "Principles of Pavement Design", John Willey and Sons.
4. Yang, H. Huang, "Pavement Analysis and Design", Prentice Hall Publication, Englewood Cliffs, New Jersy.

REFERENCE BOOKS:

1. Ralps Hass and Hudson, W.R. " Pavement Management System" Mc-Graw Hill Book Company.
2. IRC codes of practice.

Course Outcomes:

The students will be able to

CO1: Analyze the various design factors required for design of pavements

CO2: Apply the concept of different types of stresses developed due to wheel loads and temperature variations.

CO3: Estimate the thickness of pavements by design methods

CO4: Estimate the measurement and analysis of Roughness measurements and pavement distress

CO5: Apply the concept of pavement deflection estimation.

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IV-Year-I Semester PE4102E	URBAN HYDROLOGY	L	T	P	C
		3	1	0	3

Course Objectives:

The course is designed to:

- Appreciate the impact of urbanization on catchment hydrology.
- Understand the importance of short duration rainfall runoff data for urban hydrology studies.
- Learn the techniques for peak flow estimation for storm water drainage system design.
- Understand the concepts in design of various components of urban drainage system.
- Learn some of the best management practices in urban drainage.
- Understand the concepts of preparation master urban drainage system.

Unit-I:

INTRODUCTION: Urbanization and its effect on water cycle – urban hydrologic cycle – Trends in urbanization – Effect of urbanization on hydrology

Unit– II:

PRECIPITATION ANALYSIS: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

Unit-III:

APPROACHES TO URBAN DRAINAGE: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and stormwater reuse, major and minor systems.

Unit-IV:

ELEMENTS OF DRAINAGE SYSTEMS:: Open channel, underground drains, appurtenances, pumping, and source control.

Unit-V:

ANALYSIS AND MANAGEMENT: Stormwater drainage structures, design of stormwater network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for stormwater management.

TEXT BOOKS:

1. Manual on Drainage in Urbanised area, Geiger W. F., J Marsalek, W. J. Rawls and F.C. Zuidema, (1987 - 2 volumes), UNESCO,
2. Urban Hydrology, Hall M J (1984), Elsevier Applied Science Publisher.
3. Hydrology – Quantity and Quality Analysis, Wanielista M P and Eaglin (1997), Wiley and Sons
4. Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling, Akan A.O and R.L. Houghtalen (2006), Wiley International.

REFERENCES:

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

IV-Year-I Semester	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	C
PE4103A		3	1	0	3

Prerequisites:

1. Design and Drawing of Steel Structures

Course Objectives:

The objective of this course is to:

- Familiarize Students with different types of framed connections
- Equip student with concept of plastic analysis
- Impart knowledge on design of gantry girder and plate girders
- Familiarize student with various types of building systems
- Expose students to composite design

UNIT – I

Framed Connections: Classification of simple and moment resistant connections**;** Web – Angle connection; Stiffened seat connection; Beam-Beam splice and End plate connection.

UNIT – II

Plastic Analysis: Yielding and Plasticity; Idealized stress-strain curve; Methods and theorems; Ultimate load; Load factor; plastic hinge; plastic section modulus; Shape factor; Analysis of three span continuous beam, Analysis of single storey non-sway and sway portal frames

UNIT – III

Gantry Girder: EOT cranes; Loads on Gantry Girders; Load combinations; Design of Simply Supported Gantry Girder.

Plate Girder: Un-stiffened and stiffened plate girders; Behaviour of transversely stiffened plate girders – Buckling, Post-Buckling and Collapse stages; Simple Post-Critical method and Tension-Field method; Design provisions as per IS 800:2007; Design of transversely stiffened plate girder

UNIT –IV

Single Storey Building Frames: Sway and Non-sway frames; Effective length of columns as per Annexure-D of IS 800:2007 for portal frames.

Pre-Engineered Buildings: Introduction; Dead, Live and Wind load calculation for Gable Frames; Design of Tapered Rafter and Column Members.

Multi Storey Building Frames: Types of frames; Types of floors; Effective length of columns in multi-storey building frames: Braced and Un-braced; Determination of gravity loads on beams and columns.

UNIT – V

Horizontal Shear and Vertical separation of slab; Limit State of Serviceability; Design of composite beam.

The students should prepare the following plates.

Plate 1 Detailing of Framed Connections
Plate 2 Detailing of Gantry Girder
Plate 3 Detailing of Plate Girder,
Plate 4 Detailing of Pre-Engineered Building Frame
Plate 5 Detailing of Composite Beam

FINAL EXAMINATION PATTERN:

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

TEXT BOOKS

1) N. Subramanian, Design of Steel Structures, Oxford University Press (India), 2015
2) K. S. Sai Ram, Design of Steel Structures, Pearson Education (India), 2020

REFERENCES / FURTHER READING

1) Teaching Resource for Structural Steel Design, INSDAG
2) L. J. Morris and D.R. Plum, Structural Steel Work Design to BS 5950, Prentice-Hall, 1996
3) D. Lam et al., Structural Steelwork: Design to Limit State Theory (BS 5950), CRC press, 2004

IS Codes:

1) IS 800:2007, Indian Standard Code for General Construction in Steel, 3rd revision, BIS, New Delhi.
2) IS 875 Parts I- III, Code of practice for design loads (other than earth quake) for buildings and Structures, BIS, New Delhi.
3) IS 456 – 2000, Plain and Reinforced Concrete – Code of Practice, BIS
4) IS 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete, BIS, New Delhi.
4) Steel Tables

These codes and steel tables are permitted for use in the examinations.

Course Outcomes:

At the end of successful completion of this course, the student will be able to

CO1: Analyze and design Framed Connections

CO2: Carryout plastic analysis of continuous beams and portal frames

CO3: Analyze, Design & Detail Gantry Girder and Plate Girder

CO4: Gain practical knowledge on Conventional and Pre-Engineered building systems

CO5: Design Composite Beams as per limit state design and provide Detailing

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

UNIT – I

Framed Connections: Classification of simple and moment resistant connections**;** Web – Angle connection; Cleat and Seat Angle connection; Fin-plate connection and End plate connection.

Unit	Module	Micro content
I. Framed Connections	Introduction	Classification of simple and moment resistant connections
	Web-Angle Connection	Beam-column web-angle connection using fillet welding or ordinary bolts
	Stiffened Seat connection	Stiffened seat connection using fillet welding
	Beam – Beam splice	Beam-beam / Plate girder splices using Fillet welding or HSFG bolts or Ordinary bolts
	End plate connection	Moment-Resistant End plate connection using combined welding and bolting

UNIT – II

Plastic Analysis: Yielding and Plasticity; Idealized stress-strain curve; Methods and theorems; Ultimate load; Load factor; plastic hinge; plastic section modulus; Shape factor; Analysis of three span continuous beam, Analysis of single storey non-sway and sway portal frames

Unit	Module	Micro content
II. Plastic Analysis	Introduction	Yielding and Plasticity; Idealized stress-strain curve; Methods and theorems; Ultimate load; Load factor; plastic hinge; plastic section modulus; Shape factor
	Analysis of Continuous Beam	Analysis of three span continuous beam subjected to udl / concentrated loads
	Analysis of Frames	Analysis of Non-sway and Sway Portal Frames

UNIT – III

Gantry Girder: EOT cranes; Loads on Gantry Girders; Load combinations; Design of Simply Supported Gantry Girder.

Plate Girder: Un-stiffened and stiffened plate girders; Behaviour of transversely stiffened plate girders – Buckling, Post-Buckling and Collapse stages; Simple Post-Critical method and Tension-Field method; Design provisions as per IS 800:2007; Design of transversely stiffened plate girder

Unit	Module	Micro content
III. a. Gantry Girder	Introduction	EOT cranes; Loads on Gantry Girders; Load combinations;
	Design of Gantry Girder	Design of Simply supported gantry girder
III.b. Plate Girder	Introduction	Un-stiffened and stiffened plate girders; Behaviour of transversely stiffened plate girders – Buckling, Post-Buckling and Collapse stages; Simple Post-Critical method and Tension-Field method, Design

	Design of Plate girder	Design of Transversely stiffened plate girder subjected to static loading using Tension-Field Method

UNIT –IV

Single Storey Building Frames: Sway and Non-sway frames; Effective length of columns in portal frames as per Annexure-D of IS 800:2007.

Pre-Engineered Buildings: Introduction; Dead, Live and Wind load calculation for Gable Frames; Design of Tapered Rafter and Column Members.

Multi Storey Building Frames: Types of frames; Types of floors; Effective length of columns in multi-storey building frames: Braced and Un-braced; Determination of gravity loads on beams and columns.

Unit	Module	Micro content
IV.a. Single Storey Building Frames	Introduction	Sway and Non-sway Frames
	Effective length of columns in portal frames	Calculation of effective length of columns as per Annexure-D of IS 800:2007

IV. b. Pre-Engineered Building	Introduction	Introduction – Framing, bracing, roof and wall material
	Load calculation	Dead, Live and Wind load calculation for Gable Frames
	Design of Tapered Rafter and Column Members	Design of Tapered Rafter and Column Members
IV. c. Multi-Storey Building Frames	Introduction	Types of frames; Types of floors
	Effective length of columns	Effective length of columns in multi-storey building frames: Braced and Un-braced
	Load Calculation	Determination of Gravity loads acting on beams and columns of two storey frame

Unit	Module	Micro Content
V. Limit State Design of Composite Beam (As per IS 456:2000 and IS 800:2007)	Introduction	Methods of construction; Shear Connectors; Limit State of Collapse: Flexure, Horizontal Shear and Vertical separation of slab; Limit State of Serviceability
	Design Problem	Design of composite beam – propped

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3							2		
CO2	1	2	1									
CO3	1	3	3							3		
CO4	1	2	2							2		
CO5	1	2	3							2		

	PSO1	PSO2	PSO3
CO1	3	1	
CO2	1		1
CO3	2	2	2
CO4	2	2	1
CO5	2	2	2

IV-Year-I Semester PE4103B	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	1	0	3

Course Learning Objectives:

The objective of this course is:

1. To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remolded and in-situ soils by adopting different techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geotextiles and geosynthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose, and effects ofgrouting.

SYLLABUS:

UNIT- I

In situ densification methods- in situ densification of granular soils- vibrationat the ground surface and at depth, impact at the ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT -II

Dewatering – sumps and interceptor ditches – single and multi-stage well points – vacuum well points – horizontal wells – criteria for the choice of filler material around drains – electro osmosis

UNIT- III

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

UNIT- IV

Geosynthetics – geotextiles – types – functions, properties and applications – geogrids, geomembranes, and gabions - properties and applications.

UNIT-V

Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – postgrout tests

TEXTBOOKS:

1. 'Ground Improvement Techniques' by Purushotham Raj, LaxmiPublications, New Delhi.
2. 'Ground Improvement Techniques' by Nihar Ranjan Patro, VikasPublishing House (P) Limited, New Delhi.
3. 'An introduction to Soil Reinforcement and Geosynthetics' byG.L.Siva Kumar Babu, Universities Press.

REFERENCE BOOKS:

1. 'Ground Improvement' by MP Moseley, Blackie Academic andProfessional, USA.
2. 'Designing with Geo-synthetic's by RM Koerner, Prentice Hall.

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Course Outcomes:

a. By the end of the course, the student should be able to possess knowledge of various methods of ground improvement and their suitability to different field situations.
b. The student should be in a position to design a reinforced earth embankment and check its stability.
c. The student should know the various functions of Geo-synthetics and their applications in Civil Engineering practice.
d. The student should be able to understand the concepts and applications of grouting.

Micro Syllabus-Soil Mechanics

UNIT-I:

In situ densification methods- in situ densification of granular soils- vibration at the ground surface and at depth, impact at the ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

Unit	Module	Micro content
In situ densification methods	insitu densification methods in granular soils	vibration at ground surface, impact at ground surface, vibration at depth, impact at depth- Theory
	insitu densification methods in cohesive soils	preloading technique, vertical and sand drains, wick and geo drains, stone columns-- Theory

Unit– II:

Dewatering – sumps and interceptor ditches – single and multi-stage well points – vacuum well points – horizontal wells – criteria for the choice of filler material around drains – electro osmosis

Unit	Module	Micro content
Dewatering systems	Dewatering methods	sumps and interceptor ditches
		single and multistage well points
		vacuum and horizontal wells
		electro-osmosis
	criteria for the choice of filler material	criteria for selection of fill material around drains

Unit-III:

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

Unit	Module	Micro content
Stabilization of soils	Methods of soil stabilizations	mechanical stabilization
		cement stabilization
		lime stabilization
		bituminous stabilization
		polymer stabilization
	use of industrial wastes	use of industrial wastes like fly ash and granulated blast furnace slag.

Unit-IV:

Geosynthetics – geotextiles – types – functions, properties and applications – geogrids, geomembranes, and gabions - properties and applications.

Unit	Module	Micro content
Geosynthetics	geotextiles	types – functions, properties and applications
	geogrids	
	geomembranes	
	gabions	properties and applications

Unit-V: Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – postgrout tests

Unit	Module	Micro content
Grouting in soils	Basics of grouting	Objectives, applications
	methodsof grouting	Permeation, Jet grouting, fracture, compaction, vacuum grouting
	Grouting stages	Ascending and descending stages
	hydraulic fracturing	Soils and rocks

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2										2	
CO2	2	2		2										2	
CO3	2	2		2									2		1
CO4	2	2		2									1		
CO5	2	2		2									2	2	
CO6	2	2		2										2	

PE4103C	ASSESSMENT	3	1	0	3

Course Objectives:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To pre-requisites for ISO 14001certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

UNIT I

Basic concept of EIA:

Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base mapClassification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA

UNIT II

E I Methodologies:

Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis - EIS and EMP

UNIT III

Impact of Developmental Activities and Land use:

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives- application of remote sensing and GIS for EIA. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT IV

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment advantages of Environmental Risk Assessment

UNIT V

EIA notification by Ministry of Environment and Forest (Govt. of India):

Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

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

REFERENCES:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice HallPublishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. ,Katania& Sons Publication., NewDelhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

IV-Year-I Semester	TRANSPORTATION ECONOMICS	L	T	P	C

Course Objectives:

1. Understand the concept of investment policies.
2. Equip student with different types of transportation systems in urban and regional levels.
3. Understand the concept cost analysis and traditional economical analysis.
4. Familiarize students with the concept of Quality Management.

UNIT-I TRANSPORT ECONOMICS AND ANALYSIS:

Review of Engineering Economics and Microeconomics, Welfare Theory and Equilibrium Conditions, Goals and Objectives, Principles of Economic Analysis. Discounted Cash Flows: Analysis of User Costs and Benefits, RUCS Models for Costs and Benefits, Methods of Economic Analysis; Suitability, Analysis for Null Alternative

UNIT-II INVESTMENT POLICIES AND PRICING:

Average Cost, Marginal Cost, Allocation of Resources within Transport Sectors, Financing of Transport Sectors, Transport Investment Policies - Pricing Policies. Issues in transport policy: Budgeting, Non-user Impact Analysis, Analysis of Related Endeavour, Monitoring and Continuous Evaluation Strategies, Case Studies.

UNIT-III SYSTEM SELECTION, EVALUATION:

Framework of Evaluation, Transport Planning Evaluation at Urban and Regional levels, Other Evaluation Procedures - Traditional Economic Analysis, Achievement Matrices, Factor Profiles, Plan Ranking, Introduction to Mathematical Programming, Case Studies.

UNIT-IV COST ANALYSIS:

Life cycle cost analysis: Factors consider for Life Cycle Cost Analysis; Data requirements for highway project feasibility analysis, establishment of Technical/ Economic/ Financial feasibility of a highway project, Social Benefits, Role of HDM in feasibility studies.

UNIT-V TQM IN HIGHWAY PROJECTS:

Need for TQM, TQM Principles, Phases in TQM - Conceptual stage to Operations staqe, TQM in Traffic & Transportation projects, Case Studies.

TEXT BOOKS:

1. Highway investment in Developing countries - Thomas Telford Ltd., Institute of Civil Engineers
2. Winfrey R, Economic Analysis for Highways - International Text Book Co., Pennsylvania

REFERENCE BOOKS:

5. Road User Cost Study - Final Report - Central Road Research Institute, New Delhi
6. Dickey, J.W. - Road Project Appraisal for Developing countries, John Wiley and Sons.
7. lan Heggie, Transport Engineering Economics,

Course Outcomes:

The students will be able to

CO1: Analyze the concept of Economic analysis and user costs.

CO2: Apply different types of costs and allocation of resources.

CO3: Estimate the transport planning techniques and different types of costs.

CO4: Analyze the concept of life cycle cost analysis.

CO5: Estimate the techniques to obtain total quality management in a highway project.

*****

IV-Year-I Semester	IRRIGATION AND HYDRAULIC	L	T	P	C

Course Objectives:

The course is designed to:

- Introduce the types of irrigation systems
- Introduce the concepts of planning and design of irrigation systems
- Discuss the relationships between soil, water and plant and their significance in planning an irrigation system
- Understand design methods of erodible and non-erodible canals
- Know the principles of design of hydraulic structures on permeable foundations
- Know the concepts for analysis and design principles of storage and diversion head works
- Learn design principles of canal structures

Unit-I:

IRRIGATION: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, standards of quality for irrigation water, crop rotation.

Unit– II:

CANALS: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

Unit-III:

CANAL STRUCTURES:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall.

Regulators: Head and cross regulators, design principles

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage.

River Training: Objectives and approaches.

Unit-IV:

DIVERSION HEAD WORKS: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

Unit-V:

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

Dams: Types of dams, selection of type of dam, selection of site for a dam.

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.

Earth Dams: Types, causes of failure, criteria for safe design,

Spillways: Types, design principles of Ogee spillways, Energy dissipation below spillways-stilling basin and its appurtenances.

TEXT BOOKS:

2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers.

REFERENCES:

1. Irrigation and Water Resources Engineering, Asawa G L (2013), New Age International Publishers
2. Irrigation Water Resources and Water Power Engineering, Modi P N (2011), Standard Book House, New Delhi

IV-Year-I Semester	GREEN BUILDINGS	L	T	P	C

Course Objectives:

1. This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.
2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings
3. To give a fuller understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.
4. To highlight the importance of Environmental Management as well as Environmental Impact Assessment methods in Energy efficient buildings.

Syllabus

UNIT I : Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.

UNIT II: Renewable Energy sources that can be used in Green Buildings – Conventional and Non Conventional Energy, Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy, Photovoltaics, Rainwater Harvesting Climate and Energy, Macro and Microclimate. Indian Examples.

UNIT III: Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, rouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.

UNIT IV: Infiltration and ventilation, Natural ventilation in commercial buildings, passive cooling, modelling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rain water.

UNIT V: Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED, GRIHA & IGBC Certification for buildings. Ecohomes, Sustainable architecture and urban design – principles of environmental architecture, Benefits of green buildings – Energy Conservation Building code - NBC -Case Studies – Green Buildings in Auroville and Dakshina Chitra, Tamil Nadu, India

TEXT BOOKS:

1. William T. Meyer., Energy Economics and Building Design., New York: McGraw- Hill, Inc Indian Green Building Council

REFERENCE BOOKS:

1. Public Technology, Inc. (1996). Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc., Washington, DC.
2. Sim Van Der Ryn, Stuart Cowan, “Ecological Design”, Island Press (1996).
3. Dianna Lopez Barnett, William D. Browning,”A Primer on Sustainable Building”, Rocky Mountain Green Development Services.
4. The HOK Guidebook to Sustainable Design, Sara Mendler and William Odell, John Wiley.
5. David A. Gottfried, Sustainable Building Technical Manual., Public Technology Inc
6. Richard D. Rush, . Building System Integration Handbook., New York: John Wiley & Sons
7. Ben Farmer & Hentie Louw., Companion to Contemporary Architectural Thought, London & New

8. Peter Noever (ed)., Architecture in Transition: Between Deconstruction and New Modernism., Munich: Prestel.

Course Outcomes:

The students will be able to

CO1: Understand why buildings should be made energy efficient.

CO2: Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaics, and Ground source heat pumps, and their adaption to green building concepts.

CO3: Understand the concepts of Site and Climate, Building Form, Building Fabric

CO4: Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation.

CO5:Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge management strategies too.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Strength of Materials-I

Unit-I: Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.

Unit	**Module**	**Micro content**
Introduction to green buildings	Introduction to green buildings	Green Buildings within the Indian Context
		Green building and its relevance
		Green Building Rating Systems in India
		Types of Energy
		Energy Efficiency and Pollution
		Better Buildings
		Reducing energy consumption
		Low energy design

Unit– II:

Renewable Energy sources that can be used in Green Buildings – Conventional and Non Conventional Energy, Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy, Photovoltaics, Rainwater Harvesting, Climate and Energy, Macro and Microclimate. Indian Examples.

Unit	Module	Micro content
II	Renewable Energy sources that can be used in Green Buildings	Conventional Energy
		Non Conventional Energy
	Solar Energy	Passive Solar Heating
		Passive Solar collection
		A passive solar energy strategy
	Wind and other renewable	Photovoltaics
		Solar Photovoltaic Systems
		Types of Solar PV Generating System
	Rainwater Harvesting	Artificial ground water recharge
		Roof top rainwater harvesting
		Harvesting in limited rainfall areas
		Rainwater harvesting for plotted/group housing developments
	Climate and Energy	Climate and Energy
	Macro and Microclimate	Site and Micro Climate
		MACRO CLIMATE
		MICRO CLIMATE
		Micro Climate – Effect of local terrain and Buildings
		IMPROVING MICRO CLIMATE THROUGH DESIGN
		Factor affecting micro climate

Unit-III:

Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, rouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.

Unit	Module	Micro content
III	Building Forms	Building Form Development Plan
		Building Form, Orientation and Shading
		Envelope Optimization
	Thermal Performance	Enhancement of thermal performance of walls
		Types of thermal insulation materials:

Unit-IV:

Infiltration and ventilation, Natural ventilation in commercial buildings, passive cooling, modelling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rain water.

Unit	Module	Micro content
IV	Infiltration and ventilation	Infiltration
		Passive Cooling Techniques
	Lighting	Lighting
		Day lighting
		Day lighting and Controls

		Rainwater Harvesting
		Window design for natural ventilation
		SKYLIGHT

Unit-V: Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED, GRIHA & IGBC Certification for buildings. Ecohomes, Sustainable architecture and urban design – principles of environmental architecture, Benefits of green buildings – Energy Conservation Building code - NBC -Case Studies – Green Buildings in Auroville and Dakshina Chitra, Tamil Nadu, India

Unit	**Module**	**Micro content**
V	Environmental assessment methods for buildings (LEED, BREEAM, HQE)	LEED (Leadership in Energy and Environmental Design
		BREEAM (Building Research Establishment Environmental Assessment)
	Three primary rating systems for Green buildings in India	Green Rating for Integrated Habitat Assessment (GRIHA)
		Indian Green Building Council (IGBC)
		Bureau of Energy Efficiency (BEE)
	energy efficiency of a building	energy efficiency of a building
		energy efficiency in buildings importance
		Determining a building's energy performance Energy use indicators
		Five Principles of an environmental architecture
		The Energy Conservation Building Code

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2					1	3		2	1		
CO2	2					1	3		2	1		1
CO3	2		3				3		2	1		2
CO4	2		3			2	3		2	1		2
CO5	2					1	3		2	1		1

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IV-Year-I Semester OE4101B	ENVIRONMENTAL POLLUTION & CONTROL	L	T	P	C
		3	1	0	3

Course Objectives:
1. To introduce the concepts of Air Pollution.
2. To introduce the concepts of Air Pollution and its control methods.
3. To impart the knowledge of the Solid Waste generation problem.
4. To familiarize the best practices for management of solid wastes adopted at the service provider level.
5. To elucidate noise pollution problems and emphasize the necessity to control them.

UNIT I

Air Pollution

Definitions, scope, significance and episodes – Types of pollutants, their sources and impacts (on plants, animals, materials) – Classifications, natural & artificial, primary & secondary, point &non point, linear & areal sources, stationary & mobile – Sampling and analysis of air pollutants – Ambient air quality standards by WHO (World Health Organization) & CPCB (Central Pollution Control Board). **(8hrs)**

Air Pollution Meteorology

Properties of atmosphere: heat, pressure, wind forces, moisture and relative humidity – Lapse rates – Influence of terrain and meteorological phenomena on plume behavior and air quality – Wind rose diagrams, plume rise models. **(5hrs)**

UNIT II

Air Pollution Control and Monitoring

Control of particulates: control at sources, process changes, equipment modifications – Design and operation of control equipments, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators – Control of gases like SOx , NOx , CO and HC, Air-fuel ratio, computation and control of products of combustion – Monitoring of SPM, SO2 , NOx and CO, Stack Monitoring for flue gases. **(11hrs)**

UNIT III

Solid Waste Generation and Collection

Characteristics – types, sources, and properties of solid waste – Generation, typical generation rates, estimation of solid waste quantities, factors that affect generation of wastes – Collection services, types of collection systems, determination of vehicle and labour requirement and transportation of solid waste – Transfer stations, transfer means and methods. **(10hrs)**

UNIT IV

Solid Waste Management and Disposal

Engineered systems for solid waste management (refuse, reduce, reuse, recover, recycle) – Reuse of solid waste materials, processing techniques, materials recovery system, recovery of biological, thermal conversion products and recovery of energy from conversion products – Recycling of segregated waste materials – Ultimate Disposal of solid waste (Land filling, incineration, composting). **(10hrs)**

UNIT V

Noise Pollution and Control

Sources of noise pollution, impacts of noise, measurement of noise and permissible limits of noise, control methods of noise pollution, The Noise Pollution (Regulation and Control) Rules, 2000 as per CPCB. **(7hrs)**

TEXT BOOKS:

1. Air Pollution, M.N.Rao, H.V.N.Rao, 1st Edition, McGraw Hill Education.
2. Solid and Hazardous Waste Management, M.N.Rao, Razia Sultana, 1st Edition, BS Publications.
3. Noise Pollution and Its Control,H.C.Bhatia, 1st Edition, Atlantic Publisher

REFERENCES:

1. Advanced Air and Noise Pollution Control, Lawrence K.Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
2. Municipal Solid Waste Management, P.Jayarama Reddy, 1st Edition, B.S.Publications.

E- RESOURCES:

1. Environmental Pollution and Control, 4th ed. by J. Jeffrey Peirce, P. Aarne Vesilind, Ruth F. Weiner
https://www.bbau.ac.in/dept/UIET/TCE-033%20%20epdf.pub_environmental-pollution-and-control.pdf
2. ENVIRONMENTAL POLLUTION - CONTROL MEASURES
https://www.bbau.ac.in/dept/UIET/Study%20Materials%20for%20TCE-0.pdf

Course Outcomes:

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

CO1: Evaluate the ambient air quality based on the analysis of air pollutants and relate the polluting plume behavior with weather data.

CO2: Identify suitable control methods depending on the severity and type of air pollution.

CO3: Classify solid wastes and identify suitable collection and transfer mechanisms.

CO4: Suggest suitable solid waste management methods based on the nature of solid waste and the quantities to be handled.

CO5: Identify the sources of noise pollution and suggest methods for mitigating the problem.

Micro-Syllabus of Environmental Pollution and Its Control

Unit-I

Air Pollution

Definitions, scope, significance and episodes – Types of pollutants, their sources and impacts (on plants, animals, materials) – Classifications, natural & artificial, primary & secondary, point &non point, linear & areal sources, stationary & mobile – Sampling and analysis of air pollutants – Ambient air quality standards by WHO (World Health Organization) & CPCB (Central Pollution Control Board).

Air Pollution Meteorology

Properties of atmosphere: heat, pressure, wind forces, moisture and relative humidity – Lapse rates – Influence of terrain and meteorological phenomena on plume behavior and air quality – Wind rose diagrams, plume rise models.

Unit	Module	Micro content
Air Pollution	Introduction	Definitions, scope, significance and episodes
	Types of pollutants	sources and impacts
	Classification	natural & artificial, primary & secondary, point &non point, linear & areal sources, stationary & mobile
	Sampling and analysis of air pollutants	Different sampling and analysis techniques
	Air quality standards	WHO (World Health Organization) & CPCB(Central Pollution Control Board)
Air Pollution Meteorology	Properties of atmosphere	heat, pressure, wind forces, moisture and relative humidity
	Lapse rates	Types of Lapse rates
	Plume behavior	Types of plume behavior
	Air quality models	Plume rise models Wind rose diagrams

Unit-II

Air Pollution Control and Monitoring

Control of particulates: control at sources, process changes, equipment modifications – Design and operation of control equipments, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators – Control of gases like SOx , NOx , CO and HC, Air-fuel ratio, computation and control of products of combustion – Monitoring of SPM, SO2 , NOx and CO, Stack Monitoring for flue gases.

Unit	Module	Micro content
Air Pollution Control and Monitoring	Control of particulates	control at sources, process changes, equipment modifications
	Control equipments	Settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators
	Control equipments	Design and operation

		combustion
	Monitoring of gases pollutants	SPM, SO_2 , NOx and CO
	Stack Monitoring	Flue gases

UNIT III

Solid Waste Generation and Collection

Characteristics – types, sources, and properties of solid waste – Generation, typical generation rates, estimation of solid waste quantities, factors that affect generation of wastes – Collection services, types of collection systems, determination of vehicle and labour requirement and transportation of solid waste – Transfer stations, transfer means and methods.

Unit	Module	Micro content
Solid Waste Generation and Collection	Characteristics	Solid waste Characteristics
	Solid waste	Types, sources, and properties
	Solid waste Generation	Typical generation rates
		Estimation of solid waste quantities
		Factors that affect generation of wastes
	Solid waste Collection	Collection services
		Types of collection systems
		Determination of types of vehicles
		Labor requirement
		Transportation of solid waste
	Solid waste Transfer	Transfer stations
		Different means of transfer and methods

UNIT IV

Solid Waste Management and Disposal

Engineered systems for solid waste management (refuse, reduce, reuse, recover, recycle) – Reuse of solid waste materials, processing techniques, materials recovery system, recovery of biological, thermal conversion products and recovery of energy from conversion products – Recycling of segregated waste materials – Ultimate Disposal of solid waste (Land filling, incineration, composting).

Unit	Module	Micro content
Solid Waste Management and Disposal	solid waste management	refuse, reduce, reuse, recover, recycle
	Reuse of solid waste	Types of processing techniques
	Materials recovery	Recovery of biological, thermal conversion products and recovery of energy from conversion products
	Recycling	segregated waste materials
	Ultimate Disposal of solid waste	Land filling, incineration, composting

UNIT V

Noise Pollution and Control

Sources of noise pollution, impacts of noise, measurement of noise and permissible limits of noise, control methods of noise pollution, The Noise Pollution (Regulation and Control) Rules, 2000 as per CPCB.

Unit	Module	Micro content
Noise Pollution and Control	Noise Pollution	Sources
		Impacts of noise
		Measurement of noise
		Permissible limits of noise
	Noise Pollution Control	Control methods of noise pollution
		Regulation and Control Rules, 2000 as per CPCB

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1			1	1					
CO2	1			Tekl;		1	3					
CO3	1	1	1	1		1	1					
CO4	1					1	1	1	1	1		
CO5	1						1				1	

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OE4102A		3	1	0	3

Course Objectives:

The objective of this course is to enable the students to:

1. To import concepts of safety w.r.t construction Industry
2. To understand various hazards in construction industry and preventive measures
3. To learn safety operation of construction machinery
4. To learn techniques to distinguish civil structures safety
5. To understand fire safety principles

UNIT-I

Accidents Causes And Management Systems: Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activities, preconstruction meeting - design aids for safe construction – permits to work quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training.

UNIT-II

Hazards Of Construction And Prevention: Excavations, basement and wide excavation, trenches, shafts – scaffolding, types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling –tunneling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water – road works – power plant constructions – construction of high rise buildings.

UNIT-III

Working At Heights: Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings, requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection, safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.

UNIT-IV

Construction Machinery: Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors – concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, hoisting cranes – use of conveyors and mobile cranes – manual handling.

UNIT-V

Safety In Demolition Work: Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

TEXT BOOKS:

1. 'Safety in the Build Environment' by Jnathea D.Sime, London, 1988.
2. 'Reliability Maintenance and Safety Engineering, by Gupta A K, Laxmi Publications, New Delhi.

1. 'Construction hazard and Safety Hand book' by Hudson, R., Butter Worth's, 1985.
2. 'Construction Safety Hand Book' by V. J. Davies and K. Thomasin, Thomas Telford Ltd., London, 1990.
3. 'Handbook of OSHA Construction Safety and Health' by Charles D. Reese & James V. Edison.

Course Outcomes:

The students will be able to

CO1: Develop management plans to prevent accidents in construction industry.

CO2: Prepare plans to safe guard workers in construction of high risk buildings.

CO3: Ensure safety while operating construction machinery.

CO4: Outline safety plans for demolition of buildings.

CO5: Prepare fire safety plans for a given building.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

UNIT-I **Accidents Causes And Management Systems**		
Unit	**Module**	**Micro content**
	Accidents Causes	Problems impeding safety in construction industry. Causes of fatal accidents.
		Types and causes of accidents related to various construction activities. Human factors associated with these accidents.
	Management Systems	Construction Regulations. Contractual Clauses. Pre contract activities. Preconstruction meeting. Design Aids For Safe Construction. Permits to work. Quality Assurance in construction. Compensation. Recording of accidents and safety measures. Education and training.
UNIT-II **Hazards of Construction and Prevention**		
Unit	**Module**	**Micro content**
		Excavations, basement and wide excavation, trenches, shafts
		scaffolding, types, causes of accidents, scaffold inspection checklist
		erection of structural frame work, dismantling
		tunneling – blasting, pre blast and post blast inspection
		confined spaces – working on contaminated sites –

		construction of high rise buildings.
UNIT-III **Working At Heights**		
Unit	**Module**	**Micro content**
		Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders-
		Scaffoldings, requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection, safety belts, safety nets, fall arrestors,
		controlled access zones, safety monitoring systems
		working on fragile roofs, work permit systems, height pass
		Accident case studies
UNIT-IV **Construction Machinery**		
Unit	**Module**	**Micro content**
		Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes,
		crane inspection checklist - builder's hoist, winches, chain pulley blocks
		use of conveyors – concrete mixers, concrete vibrators
		safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines
		hoisting cranes – use of conveyors and mobile cranes – manual handling
UNIT-V **Safety In Demolition Work**		
Unit	**Module**	**Micro content**
		Safety in demolition work, manual, mechanical, using explosive
		keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition
		Indian standard - trusses, girders and beams
		first aid – fire hazards and preventing methods
		Interesting experiences at the construction site against the fire accidents.

CO-PO Mapping:

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

IV-Year-I Semester OE4102B	SMART CITIES	L	T	P	C
		3	1	0	3

Course Objectives:

4. To understand the concepts of urban consultation and good urban governance techniques
5. To identify the needs of stakeholders, issues in slums and informal sector
6. To study the methods of planning process, related Acts & policies
4. To gain knowledge of innovation economy, urban infrastructure & governance
5. Learning various methods/techniques for the development of smart cities

UNIT - I

Understanding Inclusive Planning:

Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiarity, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; liveable cities.

UNIT - II

Stakeholders profile and needs, access to shelter, services and livelihoods:

Urban Poor, Informal Sector, Gender, Children, Elderly, Disabled, Displaced people, etc.; Slums - dimensions, causative factors, determinants, location characteristics of settlements; Informal sector - growth, characteristics, functions, economic contributions, linkages with formal sector, impact on Urban Development.

UNIT - III

Participatory Planning Process and Policies, Programmes and Legislation:

Methods, role of stakeholders (including civil society organizations), etc.; Related Acts, Five year plans, policies and programmes at various levels.

UNIT - IV

Smart Cities:

Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge-intensive companies); Urban Infrastructure (Transport, Energy/ Utilities, protection of the environment and safety); Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life)

UNIT - V

Planning interventions:

Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations; urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization.

TEXT BOOKS:

1. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London
2. William J. V. Neill (2004); "Urban Planning and cultural identity"; Routledge, London
3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi
4. Smart Cities Atlas: Western and Eastern Intelligent Communities (Springer Tracts in Civil Engineering) by Eleonora Riva Sanseverino , Raffaella Riva Sanseverino & Valentina Vaccaro

REFERENCES:

1. UN-Habitat; "Inclusive and sustainable urban planning: a guide for municipalities"; Vol-3: Urban Development Planning (2007); United Nations Human Settlements Programme
2. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); "Remaking the city: Social science perspective on urban design"; State University of New York Press, Albany
3. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
4. "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development (http://indiansmartcities.in/downloads/CONCEPT_NOTE_3.12.2014_AND_LATEST_.pdf)
5. Google books and publications on inclusive urban planning (https://www.google.co.in/search?q=inclusive+urban+planning&btnG=Search+Books&tbm=bks&tbo= 1&gws_rd=ssl)
6. MoUD, GOI Website (http://indiansmartcities.in/site/index.aspx)

Course Outcomes:

The students will be able to

CO1: To remember and understand the concept of inclusive planning.

CO2: To investigate & analyze the needs, shelter, services & livehood.

CO3: To understand & apply various Acts, policies, programmes & legislation.

CO4: To understand the concepts of innovation economy, urban infrastructure & Governance.

CO5: To understand & apply various techniques for developing a smart city.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro- Syllabus of Road Safety Engineering

UNIT-I:

Understanding Inclusive Planning:

Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiarity, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; liveable cities.

Unit	Module	Micro content
I. Understanding Inclusive Planning	Introduction	Definition and components
	Urban consultations	Basic principles of urban consultation
		Process of urban consultation
		Urban strategic planning
	Good urban governance	Subsidiarity, equity, efficiency, transparency and accountability
	Civic engagement and citizenship	Theory
		Security

		Liveable cities

UNIT – II:

Stakeholders profile and needs, access to shelter, services and livelihoods:
Urban Poor, Informal Sector, Gender, Children, Elderly, Disabled, Displaced people, etc.; Slums - dimensions, causative factors, determinants, location characteristics of settlements; Informal sector - growth, characteristics, functions, economic contributions, linkages with formal sector, impact on Urban Development

Unit	Module	Micro content
II. Stakeholders profile and needs, access to shelter, services and livelihoods	Key factors	Urban Poor, Informal Sector, Gender, Children, Elderly, Disabled, Displaced people, etc
	Slums	Dimensions, causative factors, determinants, location characteristics of settlements
	Informal sector	Growth, characteristics, functions, economic contributions
		Linkages with formal sector
		Impact on Urban Development

UNIT – III:

Participatory Planning Process and Policies, Programmes and Legislation:
Methods, role of stakeholders (including civil society organizations), etc.; Related Acts, Five year plans, policies and programmes at various levels.

Unit	Module	Micro content
III. Participatory Planning Process and Policies, Programmes and Legislation	Methods	Various methods for participatory planning process
	Role of stakeholders	Various roles of stakeholders including civil society organizations
	Related Acts	Five year plans
		Policies and programmes at various levels

UNIT- IV:

Smart Cities:
Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge-intensive companies); Urban Infrastructure (Transport, Energy/ Utilities, protection of the environment and safety); Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life)

Unit	Module	Micro content
IV. Smart Cities	Innovation economy	Innovation in industries, clusters, districts of a city
		Knowledge workforce: Education and employment
		Creation of knowledge-intensive companies

		Protection of the environment and safety
	Governance	Administration services to citizens
		Participatory and direct democracy
		Services to the citizen, quality of life

UNIT – V:

Planning interventions:

Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations; urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization.

Unit	**Module**	**Micro content**
V. Planning interventions	Techniques	Inclusive zoning
		Development and building regulations
		Slum Improvement
	Drafting strategic urban development plans	Objectives and key actors
		Planning framework for actions
		Process of drafting the plan
		key considerations
	Urban design and decision-making	Theory
	Facilities to provided & management	City transport for all
		Water supply and sanitation
		Urban disaster management, management through decentralization

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2						1	1			1
CO2	1	2				2		1	1			1
CO3	1	1	1					1	1	1		1
CO4	2	2	1			2	3				2	1
CO5	2	2	1			2	1				1	1

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IV-Year-I Semester SAC4101A	BENTLEY PRO-STRUCTURES	L	T	P	C
		1	0	2	2

Course Objectives:

1. **Learn** the usage of software for analysis & design
2. **Create** geometries using pre-processor
3. **Analyze** and Interpret the results using post processor
4. **Design & Detailing** of structural elements using IS Codes

Course Outcomes:

At the end of the course the students can able
CO1: To analyze & design the determinate & indeterminate Beams
CO2: To analyze & design the determinate & indeterminate Frames and Truss
CO3: To analyze & design the RCC & Steel structures for various loads
CO4: To learn the designing & detailing concepts of structural elements

LIST OF EXPERIMENTS

1. Recollecting the concepts of Structural Analysis & Design
2. Introduction to the Software
3. Analysis & Design of simple beams
4. Analysis & Design of continuous beams
5. Analysis & Design of simple 2D frames
6. Analysis & Design of simple 2D truss
7. Analysis & Design of simple 3D frames
8. Gravity Analysis & Design of multi-storey building (by referring IS Codes)
9. Analysis of multi-storey building subjected to lateral loads (WL & EL)
10. Analysis & Design of Electrical Towers subjected to wind loads
11. Design & Detailing of determinate R.C frames
12. Design & Detailing of indeterminate R.C frames
13. Design & Detailing of determinate Steel frames
14. Design & Detailing of indeterminate Steel frames

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1				1	2		
CO2	2	2	1	2	1				1	2		
CO3	2	2	2	2	1				1	2		1
CO4	2	2	2	2	1				1	2		

	PSO1	PSO2	PSO3
CO1	2		
CO2	2		
CO3	2		2
CO4	2		

*****

IV-Year-I Semester SAC4101B	IIT PAVE	L T P C 1 0 2 2

Course Outcomes:

CO1: The course covers relevant topics from Transportation Engineering and gives you an insight on various topics in detail.

CO2: In this course, the student will be able to understand the various topics and terminologies used in Ground Improvement Techniques.

CO3: The course covers the basic terminologies, application, and testing procedures of Geo-synthetics on various topics in detail.

List of Experiments:

6. Analyze and design reinforced pavements.
7. Analysis of allowable stresses and strains.
8. Design of flexible pavement as per IRC method
9. Applications of Geo-synthetics.
10. Core concept of unreinforced pavements

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CO-PO Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3					2		1	2		
CO2	2	3		2								
CO3	1	3	2	2			1		1			

CO-PSO Matrix:

	PSO1	PSO2	PSO3
CO1	3		
CO2	2	3	
CO3	3		

1 – Slight (Low)	2 – Moderate (Medium)	3 – Substantial (High)	"-" – No relation

IV-Year-I Semester SAC4101C	TEKLA	L T P C 1 0 2 2

L	T	P	C
1	0	2	2

Course Objectives:

The Main Objective is:

To develop skills to use Tekla software to design and modeling of Railway bridge and built-up compression members.

List of Experiments:

1. Design of Connections.
2. Modeling and design of Built-up compression members.
3. G+1 braced Buildings
4. G+1 unbraced Buildings
5. Modeling of Railway bridge

Course Outcomes:

The students will be able to

CO1: Model Built-up compression members, railway bridge, G+1 Braced and unbraced buildings.

C02: Design connections and built-up compression members.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3		3							
CO2		3	3		3							

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IV-Year-II Semester	MAJOR PROJECT PROJECT WORK, SEMINAR, AND INTERNSHIP IN INDUSTRY	L	T	P	C
PROJ4201		0	0	0	12