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)

VVIT

VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

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

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 activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures 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 form 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.

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

c. Out of the five skill courses; (i) two shall be skill-oriented courses from the same domain and shall be completed in second year (ii) Of the remaining 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 V^{th} 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 credit courses.

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, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests).

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 are as per the norms of the academic regulations. After successful completion, students shall submit a summer internship technical report to the concerned department and 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 semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Chief 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

viii. Illustration of Computation of SGPA and CGPA

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

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

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

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 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

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.

20. Industrial Collaborations (Case Study)

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 be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any	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

	person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears 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 remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

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

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]	NC	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	BS1101	Mathematics-I	3	0	0	3
2	BS1102	Engineering Physics	3	0	0	3
3	HS1101	Communicative English	3	0	0	3
4	ES1101	Engineering Graphics	1	0	4	3
5	ES1102	Problem Solving using C	3	0	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	0	0	3
2	BS1202	Engineering Chemistry	3	0	0	3
3	ES1201	Basic Electrical & Electronics Engineering	3	0	0	3
4	ES1202	Building Materials and Construction	3	0	0	3
5	ES1203	Engineering Mechanics	3	0	0	3
6	ES1201L	Civil Workshop Practice Lab	1	0	3	1.5
7	BS1202L	Engineering Chemistry Lab	0	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	0	0	3
2	PC2101	Strength of Materials	3	0	0	3
3	PC2102	Fluid Mechanics	3	0	0	3
4	PC2103	Surveying	3	0	0	3
5	PC2104	Concrete Technology	3	0	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	0	0	3
2	PC2201	Transportation Engineering	3	0	0	3
3	PC2202	Structural Analysis	3	0	0	3
4	PC2203	Hydraulics & Hydraulic Machinery	3	0	0	3
5	PC2204	Environmental Engineering	3	0	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	0	0	3
2	PC3101	Soil Mechanics	3	0	0	3
3	PC3102	Design and Drawing of Concrete Structures	3	0	0	3
4	OE3101	Open Elective-I	3	0	0	3
5	PE3101	Professional Elective-I	3	0	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	0	0	3
2	PC3201	Design and Drawing of Steel Structures	3	0	0	3
3	PE3201	Professional Elective-II	3	0	0	3
4	PE3202	Professional Elective-III	3	0	0	3
5	OE3201	Open Elective-II	3	0	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	0	0	3
2	PC4102	Water Resources Engineering	3	0	0	3
3	PE4102	Professional Elective-IV	3	0	0	3
4	PE4103	Professional Elective-V	3	0	0	3
5	OE4101	Open Elective- III	3	0	0	3
6	OE4102	Open Elective- IV	3	0	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	Finite Element Analysis
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 Strucutres

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	0	2	4
2	Surveying	3	0	2	4
3	Environmental Engineering	3	0	2	4
4	Quantity Surveying	3	0	2	4
5	Construction Technology and Management	3	0	2	4
6	Environmental Pollution and Control	3	0	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

SYLLABUS

I-Year-I Semester BS1101	Mathematics-I	L	T	P	C
		3	0	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 $x^nV(x)$ - 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.
CO4	apply double integration techniques in evaluating areas bounded by region.
CO5	learn important tools of calculus in higher dimensions. Students will become familiar with 2-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 $\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}$ be a function of $'x'$
		Integrating factor, if $\frac{\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}}{M}$ 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 $x^nV(x)$ - Method of Variation of Parameters.
Applications: LCR circuit – Simple harmonic motion

Unit	**Module**	**Micro content**
3a. & 4a. Linear differential equations of higher order	Homogeneous equations of higher order with constant coefficients	Finding the Complementary function
	Non-homogeneous equations of higher order with constant coefficients	Particular integral of the type $'e^{ax}'$
		Particular integral of the type $'\sin ax' \ (or) \ 'x\cos ax'$
		Particular integral of the type x^n
		Particular integral of the type $'e^{ax}\,V(x)'$
		Particular integral of the type $'x^nv(x)'$
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
9b. & 10b. Applications	Evaluation of Triple Integrals	Triple integrals
	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 BS1102	ENGINEERING PHYSICS	L	T	P	C
		3	0	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.

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

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, 6th 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 (qualitative) & N – slits(qualitative)	Fraunhofer diffraction due to double slit (qualitative)
		Fraunhofer diffraction due to grating (N- slits) (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	Introduction and Principle of holography

	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 & Hysteresis	Domain concept of Ferromagnetism
		Hysteresis Curve
		Soft and hard magnetic materials classification based on Hysteresis Curve
		Applications of magnetic materials
IIIb. Dielectrics	Introduction& definitions	Introduction to dielectrics
		Dielectric polarization, Dielectric polarizability, susceptibility
		Dielectric constant
	Types of polarizations	Electronic polarization (Quantitative)
		Ionic polarization (Quantitative)
		Orientational polarizations (Qualitative)
	Internal field& Claussius – Mossotti's equation	Lorentz Internal fields in solids
		Clausius-Mossotti's equation
		Frequency dependence of polarization
		Applications of Dielectrics

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.

Unit	Module	Micro content
IVa. Acoustics	Introduction & Reverberation	Introduction to acoustics
		Definition of Reverberation
		Definition of Reverberation time
	Sabine's formula & absorption	Sabine's formula derivation
		Absorption coefficient
		Determination of Absorption coefficient
	Factors affecting acoustics of buildings	Basic requirements for acoustically good halls
		Factors affecting acoustics of buildings and their remedies
IVb. Ultrasonics	Properties &Production of ultrasonics	Introduction and Properties of Ultrasonics
		Production of ultrasonics by Magnetostriction method
		Production of ultrasonics by Piezoelectric method
	Non-Destructive Testing	Non-Destructive Testing using Pulse echo system
		Non-Destructive Testing through transmission and reflection modes
	Different scanning techniques	A - Scan
		B - Scan
		C - Scan
		Applications of Ultrasonics
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.		
Unit	**Module**	**Micro content**
V.ELASTICITY	Stress & strain	Introduction to Elasticity, Stress & Strain
		Stress & Strain curve (Behavior of a wire under increasing load)
		Generalized Hooke's law
	Different types of moduli and their relations	Young's modulus, Bulk modulus, Rigidity modulus and Poisson's ratio
		Relations among Young's, Bulk and Rigidity moduli
	Bending of beams	Bending of beams
		Bending moment of a beam
		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	**Communicative English**	**L**	**T**	**P**	**C**
HS1101		**3**	**0**	**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**
Detailed Study: The Future of Work?
Theme: Working Together
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)**
CO5	take notes while listening to a talk/lecture to answer questions **(explain, relate, outline, complete -L3)**

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/

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
CO4									2	3		1
CO5									2	3		1

I-Year-I Semester ES1101	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3

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}
CO4	Use the knowledge of sectional views and Development of Solid Surfaces in Real time 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 ES1102	Problem Solving using C	L	T	P	C
		3	0	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** Storage classes – auto, static, extern, register. Pre-processor statements **Data Files**: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and 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
		structures and functions, pointers to structures, self-referential 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 HS1101L	COMMUNICATIVE ENGLISH LAB	L	T	P	C
		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.
B. Listening: Identifying the main idea of a talk or a conversation

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
6. "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman
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; 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

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

Speaking

16. https://www.talkenglish.com/
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 BS1102L	ENGINEERING PHYSICS LAB	L	T	P	C
		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	L	T	P	C
ES1103L	(Common to All Branches)	0	0	3	1.5

Course Objectives:

1. Apply the principles of C language in problem solving.
2. To design flowcharts, algorithms and knowing how to debug programs.
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.

3. Write a program in C to sort elements of array in ascending order.

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.

2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

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	0	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)
CO3	Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations (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, 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.

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**	Finite difference tables	Forward, backward & central difference tables
		Errors in polynomials

difference tables	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 operators**	Unequal spaced data & relation between various operators	Lagrange's interpolation formula
		Relation between various operators (Shift, forward, backward, central, average & differential operators)
UNIT-3: Numerical integration and solution of ordinary difference equations: 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	**Module**	**Micro content**
5a. & 6a. **Numerical integration**	Numerical Integration	Trapezoidal rule
		Simpson's $1/3^{rd}$ rule
		Simpson's $3/8^{th}$
	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 – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

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 BS1202	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	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, deterioration of cement.

UNIT-IV: FUELS 13 HOURS

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 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	**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 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	**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
	Calomel Electrode	
	Glass 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
Corrosion control methods	Cathodic protection	Sacrificial anodic protection, impressed cathodic 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**

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	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 corrosion, caustic embrittlement
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	Purification of water,	Steps involved in purification of water –

water	Reverse osmosis and Electro dialysis.	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)

I-Year-II Semester	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C
ES1201		**3**	**0**	**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 1 DC & AC Circuits: **14 HOURS**

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 2 DC Machines: **13 HOURS**

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]

Unit 3 AC Machines:	**13 HOURS**
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 4 Semiconductor Devices:	**13 HOURS**
Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.	
Unit 5 Bipolar Junction Transistors:	**12 HOURS**
Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.	

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

CO1	Apply concepts of KVL/KCL in solving DC circuits. (Apply, Find, Solve)
CO2	Choose correct machine for a specific application. (Understand, Apply)
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 [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]

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 $V_{\gamma,}$. 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
5.b OP-Amp basic	Basics of OP-amp & characteristics	Block diagram of OP-AMP (Qualitative treatment)
		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)

I-Year-II Semester ES1202	BUILDING MATERIALS AND CONSTRUCTION	L	T	P	C
		3	0	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}
CO3	Recognize the importance of lime and cement as building materials. {Understand level, KL2}
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.

Unit	Module	Micro content
IIa/ IIb. Building Materials-II	Tiles	Types of Tiles- Common Tiles, Encaustic tiles
		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
		Manufacturing of Artificial Hydraulic Lime
		Uses of 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

Unit-V: BUILDING SERVICES AND FINISHES

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 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					
CO3	1		2		3							
CO4	1				3							

CO5	1				3							

I-Year-II Semester ES1203	ENGINEERING MECHANICS	L	T	P	C
		3	0	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)**
CO3	Interpret the centroids, centers of gravity and moments of inertia of simple geometric shapes 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 using analytical method only)**
		Equilibrium of spatial 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 cone

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

Mapping	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
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	CO4

	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	
V	**Plumbing** 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.	**CO5**

***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)

Reference Books:

A 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	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C
ES1203L		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.
CO3.	Perform speed control of DC shunt motor.
CO4.	Perform the half wave and full wave rectifier.

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
MC1201

CONSTITUTION OF INDIA

L	T	P	C
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	0	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:
1. https://www.freebookcentre.net/maths-books-download/Linear-Algebra-A-free-Linear-Algebra-Textbook-and-Online-Resource.html

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	Verify Cayley-Hamilton theorem for given matrix A and

	theorem	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: Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.		
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 PC2101	Strength of Materials	L	T	P	C
		3	0	0	3

Pre-Requisites: Knowledge in Engineering Mechanics.

Preamble: This course introduces students to some basic mathematical ideas and tools which are at the core course of CSE. It introduces the concepts of number theory, graph theory and set theory.

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 transmitted by shafts – Combined bending and torsion and end thrust.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under 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	stress – strain	Elasticity and plasticity , Types of stresses and

plasticity	diagram for mild steel	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
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
	Section modulus	Rectangular, circular sections (Solid and Hollow), I,T Angle and Channel sections
		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 PC2102	FLUID MECHANICS	L	T	P	C
		3	0	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 conditions. (Analyze)
CO5	Apply various devices to measure the flow in pipes and tanks. (Apply)

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 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	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	Euler's Equation	Derivation

Dynamics	Bernoulli's equation along a stream line	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	flow measurement	Derivation using the small orifice
		Derivation using the large orifice
		numerical problems.
	velocity of flow	Derivation using Pitot tube
		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 PC2103	SURVEYING	L	T	P	C
		3	0	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 declination & Local attraction. Application of compass in the field work. Know the Concept of traversing & its applications. (Remembering, Understanding & Applying)
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 errors
	Tape corrections	Absolute length, temperature, 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.

Unit	Module	Micro content
IIIa/IIIb.Levelling and Contouring	Definitions in levelling, Methods of levelling, Levelling instruments, Temporary adjustments of a level	Definitions in levelling
		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.

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).

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	0	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.
Unit-V: MIX DESIGN10 HOURS 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.

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 Ingredients & its Properties	Cements & Admixtures	Portland cement: history ,manufacturing process
		Chemical composition of cement, bouge's 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
		Initial and final Setting times of concrete
		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
		Relation between creep & time – Nature of creep
		Shrinkage: types: plastic, dry, autogenous, 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	**STRENGTH OF MATERIALS LAB**	**L**	**T**	**P**	**C**
PC2101L		**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			
CO5	3						2		2			

II-Year-I Semester SOC2101	ADVANCED AUTO CAD	L	T	P	C
		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 MC2101	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	0

Course objectives:

The main objective is

1. 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 **13 HOURS**

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.

UNIT – II: Ecosystems, Biodiversity, and its Conservation13 HOURS

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.

UNIT – III: Environmental Pollution and Solid Waste Management **12 HOURS**

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.

UNIT – IV: Social Issues and the Environment **14 HOURS**

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.

UNIT – V: Human Population and the Environment **13 HOURS**

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.

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

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. And able to U**nderstand** About environmental Impact assessment and **Evaluate** the stages involved in EIA

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

Reference books:

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.

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

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

CO1	Understand basic operations in Python {Understand level, KL2}
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.
IIb. Control Flow	**Control Flow**	if, if-elif-else, For, While, Break, Continue, Pass

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.

Unit	Module	Micro content
IIIa.Data Structures	Data Structures	Lists - Operations, Slicing,
		tuples
		sets
		Dictionaries
		Sequences and list comprehensions
IIIb. Functions	Functions	Defining Functions, Calling Functions, Passing Arguments
		Keyword Arguments, Default Arguments, arbitrary arguments
		Recursive and Anonymous Functions
		Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Unit-IV: MODULES, PYTHON PACKAGES, LIBRARIES

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	**Module**	**Micro content**
IVa/ IVb. Modulues, Python, Packages, Libraries	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-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		
Unit	**Module**	**Micro content**
Va/Vb.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 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	0	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

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

CO1	Plan highway network for a given area and design highway geometrics (**Understand & 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 Alignment - Design of super elevation and extra widening; Design of transition curves	Design of horizontal Alignment (Design speed, horizontal 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 Joints – IRC method

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

<table>
<tr><td colspan="3">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</td></tr>
<tr><th>Unit</th><th>Module</th><th>Micro content</th></tr>
<tr><td rowspan="10">5. Introduction To Railway Engineering & Track Geometric Design</td><td rowspan="3">Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints</td><td>Permanent way definition, Ideal requirements of permanent way, Components (Rails, Sleepers, Ballast) and their functions</td></tr>
<tr><td>Rail Fastenings – Creep of Rails</td></tr>
<tr><td>Theories related to creep (Wave theory, Percussion Theory, Drag Theory) – Adzing of Sleepers</td></tr>
<tr><td rowspan="3">Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve</td><td>Sleeper density, Problems on sleeper density, Rail joints</td></tr>
<tr><td>Alignment – Engineering Surveys - Gradients</td></tr>
<tr><td>Cant and Negative Super elevation, associated problems</td></tr>
<tr><td rowspan="2">Safe speed on curves – Transition curve – Compound curves – Reverse curves</td><td>Cant Deficiency, Degree of Curve, Relation between degree and radius of curve</td></tr>
<tr><td>Safe speed on curves, Problems on maximum permissible speed on curves</td></tr>
<tr><td rowspan="3">Extra clearance on curves – widening of gauge on curves – vertical curves</td><td>Transition curve – Compound curves – Reverse curves</td></tr>
<tr><td>Extra clearance on curves</td></tr>
<tr><td>Widening of gauge on curves</td></tr>
<tr><td></td><td>Vertical curves</td></tr>
</table>

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 PC2203	STRUCTURAL ANALYSIS	L	T	P	C
		3	0	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) including support settlements.

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	0	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
CO3	Able to establish relationship among the variables in any natural phenomena and predict design parameters of the prototype using similitude.
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	**Non-Uniform Flow in Open Channels**	Difference between Gradually varied flow and rapid varied flow

Channels		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.

Unit	Module	Micro content
IIa/IIb. Boundary Layer Theory	**Boundary Layer Theory**	Formation of Boundary layer
		Characteristics of Boundary along the thin flat plate
		Mechanism of Separation of Boundary layer
		Control measures for separation of boundary layer
		Drag - Lift – Types – Empirical formulae
		Flow around the cylindrical object
		Magnus effect

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.

Unit	Module	Micro content
IIIa/IIIb.Hydraulic Similitude	Hydraulic Similitude	Dimensional analysis using Rayligh's and Buckingham method
		Different types of hydraulic models
		Dimensionless numbers
		Relationship between varies variables of model and prototypes

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.

Unit	Module	Micro content
IVa. Basics of Turbo Machinery	Basics of Turbo Machinery	Impact of jet on stationary, moving and inclined curved vanes – velocity triangles
		Angular momentum principle
IVa. Hydraulic Turbines	Hydraulic Turbines	Difference between Pelton and Francis Turbine
		Working principle, velocity triangle and work done

		Different types of efficiencies
		Draft tube – functional significance of draft tube
		Relationship between the unit variables
		Performance characteristics curves of the turbines

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.

Unit	Module	Micro content
Va/Vb.Pumps	Pumps	Working principle and efficiencies of centrifugal pump
		Minimum starting speed of the pump
		Specific speed – empirical formula and its significance
		Performance characteristics curves of the pumps
		Difference between reciprocating pump and centrifugal pump
		Working principle and work done of reciprocating pump
		Slip and its practical significance

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	0	0	3

Pre-Requisites: Chemistry, Environmental Science, Fluid Mechanics, Hydraulics & Hydraulic Machinery

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 handling in sewage treatment.

Unit–1: WATER DEMANDS-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 of water supply – Requirements – Detection of leakages – Selection of pump – Economical diameter of pumping main.
Unit–2: TREATMENT OF WATER AND DISTRIBUTION: 13 HOURS Water treatment, conventional treatment flow diagram – Sedimentation types – Principles – Design factors – Coagulation – Design of Clariflocculator – Filtration – Slow, Rapid gravity filters and Pressure filters – Design principles-Disinfection – Theory of Chlorination – Distribution systems – Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipe method. Valves – Other appurtenances.
Unit–3: WASTEWATER MANAGEMENT: 13 HOURS Introduction: Wastewater treatment system – Definitions of terms – Collection and conveyance of sewage – Sewage flow rates – Storm water – Characteristics of sewage – Cycles of decay – BOD – COD – Ultimate disposal of sewage – self-purification of rivers – sewage farming
Unit–4: DESIGN OF SEWERS AND PRIMARY TREATMENT: 13 HOURS Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment: -Screens – Grit chamber – Sedimentation tanks – Design principles. Septic tanks and Imhoff tanks-rural latrines – House plumbing – Appurtenances.
Unit–5: SECONDARY BIOLOGICAL TREATMENT: 13 HOURS Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Low cost 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** the quality and quantity of water requirements for a city
CO2	**Design** of different treatment units and distribution systems for water supply
CO3	**Analyze** the characteristics, collection, conveyance and disposal of wastewater

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,2nd Edition1998, 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,New Delhi,2007.
6. P.N.Modi,"SewageTreatmentDisposal&WastewaterEngineering",StandardBookHouse,2016.
7. Manualonsewerageandsewagetreatment,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 Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewagetreatment–Primarytreatment:-Screens–Gritchamber–Sedimentationtanks– 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
		Longitudinal strain
		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 defining any function.

c) Install any package using (pip) and list all the available functions using dir() function.

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

PC2202L

BUILDING PLANNING AND DRAWING

L	T	P	C
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

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
SOC2201

DIGITAL LAND SURVEYING

L	T	P	C
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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