

# **KONGU ENGINEERING COLLEGE**

(Autonomous Institution Affiliated to Anna University, Chennai)

**PERUNDURAI ERODE – 638 060**

**TAMILNADU INDIA**



Estd : 1984

## **REGULATIONS, CURRICULUM & SYLLABI - 2018**

**(CHOICE BASED CREDIT SYSTEM AND  
OUTCOME BASED EDUCATION)**

**(For the students admitted during 2018 - 2019 and onwards)**

## **BACHELOR OF ENGINEERING DEGREE IN CIVIL ENGINEERING**

**DEPARTMENT OF CIVIL ENGINEERING**





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**KONGU ENGINEERING COLLEGE  
PERUNDURAI ERODE – 638 060  
(Autonomous)**

**INSTITUTE VISION**

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

**INSTITUTE MISSION**

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

**QUALITY POLICY**

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

**DEPARTMENT OF CIVIL ENGINEERING**

**VISION**

To become a center of excellence to meet the global challenges in the diversified field of Civil Engineering.

**MISSION**

Department of Civil Engineering is committed to:

MS1:	impart quality Education through effective teaching learning methods
MS2:	encourage students to pursue research activities and to collaborate with industries to promote consultancy activities.
MS3:	develop engineers who can participate in the technical advancement and social upliftment of the society

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

Graduates of Civil Engineering will

PEO1:	Analyze, design and execute projects based on the fundamental knowledge of Civil Engineering
PEO2:	Implement feasible solution to overcome societal problems using professional knowledge which results in sustainability
PEO3:	Exhibit professional and ethical attitude, good communication skills and pursue life-long learning skills needed for a successful professional career



**MAPPING OF MISSION STATEMENTS (MS) WITH PEOs**

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	2
MS2	2	3	3
MS3	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

**PROGRAM OUTCOMES (POs)**

Graduates of Civil Engineering will:

- 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)**

Graduates of Civil Engineering will:	
<b>PSO1</b>	Understand the requirement of the industry and perform effectively with professional skills.
<b>PSO2</b>	Apply advanced and innovative techniques and methodologies in Civil Engineering Practices.

**MAPPING OF PEOs WITH POs AND PSOs**

<b>PEO\PO</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	1	1		3	3	3	3	1			3	2
PEO2	3	3	3	3	2		1	1	2	1	3	3	3	3
PEO3						3	2	3		3			3	2

1 – Slight, 2 – Moderate, 3 – Substantial



**KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060**

**(Autonomous)**

**REGULATIONS 2018**

**(Revision: 4)**

**CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION**

**BACHELOR OF ENGINEERING (BE) / BACHELOR OF TECHNOLOGY (BTech)**

**DEGREE PROGRAMMES**

**These regulations are applicable to all candidates admitted into BE/BTech Degree programmes from the academic year 2018 – 2019 onwards.**

**1. DEFINITIONS AND NOMENCLATURE**

In these Regulations, unless otherwise specified:

- i. “University” means ANNA UNIVERSITY, Chennai.
- ii. “College” means KONGU ENGINEERING COLLEGE.
- iii. “Programme” means Bachelor of Engineering (BE) / Bachelor of Technology (BTech) Degree programme
- iv. “Branch” means specialization or discipline of BE/BTech Degree programme, like Civil Engineering, Information Technology, etc.
- v. “Course” means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Mathematics, Physics etc.
- vi. “Credit” means a numerical value allocated to each course to describe the candidate’s workload required per week.
- vii. “Grade” means the letter grade assigned to each course based on the marks range specified.
- viii. “Grade point” means a numerical value (0 to 10) allocated based on the grade assigned to each course.
- ix. “Principal” means Chairman, Academic Council of the College.
- x. “Controller of Examinations” means authorized person who is responsible for all examination related activities of the College.
- xi. “Head of the Department” means Head of the Department concerned of the College.



## 2. PROGRAMMES AND BRANCHES OF STUDY

The following programmes and branches of study approved by Anna University, Chennai and All India Council for Technical Education, New Delhi are offered by the College.

Programme	Branch
BE	Civil Engineering
	Mechanical Engineering
	Electronics and Communication Engineering
	Computer Science and Engineering
	Electrical and Electronics Engineering
	Electronics and Instrumentation Engineering
	Mechatronics Engineering
	Automobile Engineering
BTech	Chemical Engineering
	Information Technology
	Food Technology

## 3. ADMISSION REQUIREMENTS

### 3.1 First Semester Admission

The candidates seeking admission to the first semester of the eight semester BE / BTech Degree Programme:

Should have passed the Higher Secondary Examination (10 + 2) in the academic stream with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III subjects of the study conducted by the Government of Tamil Nadu or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

They should also satisfy other eligibility conditions as prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

### 3.2 Lateral Entry Admission

The candidates who hold a Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of BE / BTech in relevant branches of study.

(OR)



The candidates who hold a BSc degree (10+2+3 stream) with mathematics as one of the subjects at the BSc level from a recognised University are eligible to apply for Lateral entry admission to the third semester of BE / BTech. Such candidates shall undergo two additional Engineering course(s) in the third and fourth semesters as prescribed by the College.

They should satisfy other eligibility conditions prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

#### 4. STRUCTURE OF PROGRAMMES

##### 4.1 Categorisation of Courses

The BE / BTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc. that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Humanities and Social Sciences (HS) including Management Courses
- ii. Basic Science (BS) Courses
- iii. Engineering Science (ES) Courses
- iv. Professional Core (PC) Courses
- v. Professional Elective (PE) Courses
- vi. Open Elective (OE) Courses
- vii. Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship in Industry or elsewhere
- viii. Audit Courses (AC)
- ix. Mandatory Courses (MC)

##### 4.2 Credit Assignment

###### 4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training / Internship Periods	1

The minimum number of credits to complete the programme shall vary from 168 to 173 as per the chosen programme of study.





### **4.3 Employability Enhancement Courses**

A candidate shall be offered with the employability enhancement courses like project work, professional skills training/industrial training, comprehensive test & viva, industrial training, internship and entrepreneurs/start ups during the programme to gain/exhibit the knowledge/skills.

#### **4.3.1 Professional Skills Training/Industrial Training/ Entrepreneurs/Start Ups**

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase I in fifth semester and phase II in sixth semester including vacation periods and each phase can carry two credits.

(OR)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in sixth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in sixth semester. He/She shall attend Professional Skills Training Phase I in fifth semester and can earn two credits.

(OR)

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during BE/BTech programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training I or Professional Skills Training II. The area in which the candidate wants to initiate a start up may be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

#### **4.3.2 Comprehensive Test and Viva**

The overall knowledge of the candidate in various courses he/she studied shall be evaluated by (i) conducting comprehensive tests with multiple choice questions generally with pattern similar to GATE and/or (ii) viva-voce examination conducted by a panel of experts assigned by the Head of the department. The members can examine the knowledge of the candidate by asking questions from various domains and the marks will be assigned based on their answers. This course shall carry two credits.

#### **4.3.3 Internships**

The curriculum enables a candidate to go for full time projects through internship during a part of seventh semester and/or entire final semester and can earn credits vide clause 7.6 and clause 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work I Phase II in the first two months from the commencement of the seventh semester under fast track mode. The balance credits required to complete the seventh semester shall be earned by the candidate through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.



A candidate is permitted to go for full time projects through internship during eighth semester. Such candidate shall earn the minimum number of credits required to complete eighth semester other than project through either approved Value Added Courses / Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

#### **4.4 Value Added Courses / Online Courses / Self Study Courses**

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

**4.4.1 Value Added Courses:** Value Added courses each with One / Two credits shall be offered by the college with the approval from respective Board of Studies. A candidate can earn a maximum of six credits through value added courses during the entire duration of the programme.

**4.4.2 Online Courses:** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.

**4.4.3 Self Study Courses:** The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following due approval procedure. Self study course is limited to one per semester.

**4.4.4** The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.

**4.4.5** A candidate can earn a maximum of 30 credits through all value added courses, online courses and self study courses.

#### **4.5 Flexibility to Add or Drop Courses**

**4.5.1** A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

**4.5.2** From the first to eighth semesters the candidates have the option of registering for additional elective courses or dropping of already registered additional elective courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed eight.

**4.6** Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

**4.7** The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.



**4.8** The medium of instruction, examinations and project report shall be English.

## **5. DURATION OF THE PROGRAMME**

**5.1** A candidate is normally expected to complete the BE / BTech Degree programme in 8 consecutive semesters/4 Years (6 semesters/3 Years for lateral entry candidate), but in any case not more than 14 semesters/7 Years (12 semesters/6 Years for lateral entry candidate).

**5.2** Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.

**5.3** The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

## **6. COURSE REGISTRATION FOR THE EXAMINATION**

**6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.

**6.2** The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.

**6.3** If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

## **7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS**

**7.1** The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Professional Skills Training / Industrial Training, Internship and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:



Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination Marks
1.	Theory	50	50
2.	Theory cum Practical	The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.	
3.	Practical / Professional Skills Training / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work I Phase I / Mandatory Course/ Industrial Training/Universal Human Values	100	---
4.	Project Work I Phase II / Project Work II/ Internships	50	50
5.	Value Added Course	The distribution of marks shall be decided based on the credit weightage assigned	
6.	All other Courses		

**7.2** Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, internships and entrepreneurships/start ups shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

### **7.3 Theory Courses**

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.



**7.3.1** The assessment pattern for awarding continuous assessment marks shall be as follows:

Sl. No.	Type	Max. Marks	Remarks
1.	Test - I	30	Average of best two
	Test - II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
Total		50	Rounded off to the one decimal place

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

**7.3.2** A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).

**7.3.3** The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters every year.

#### **7.4 Theory Cum Practical Courses**

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

#### **7.5 Practical Courses**

For all practical courses the continuous assessment shall be for 100 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidates' records maintained.



**7.5.1** The apportionment of continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course.

Type	Max. Marks	Remarks
Assessment based on rubrics for each experiment	50	Absolute Mark System
Assessment Test	50	
Total	100	Rounded off to one decimal place

**7.6 Project Work II / Project Work I Phase II**

**7.6.1** Project work shall be assigned to a single candidate or to a group of candidates not exceeding 4 candidates in a group. The project work is mandatory for all the candidates.

**7.6.2** The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

**7.6.3** The continuous assessment and end semester examination marks for Project Work II/ Project Work I Phase II and the Viva-Voce Examination shall be distributed as below:

Continuous Assessment (Max. 50 Marks)						End Semester Examination (Max. 50 Marks)			
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max. 30 Marks)		Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)		
Rv. Com	Super visor	Review Committee (excluding Super visor)	Super visor	Review Committee (excluding Super visor)	Super visor	Ext. Exr.	Super visor	Exr.1	Exr.2
0	0	10	10	15	15	20	10	10	10

**7.6.4** The Project Report prepared according to approved guidelines and duly signed by the Supervisor shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.

**7.6.5** If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.

**7.6.6** The end semester examination of the project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and supervisor of the project work.



**7.6.7** If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.6.

**7.6.8** A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

**7.7 Project Work I Phase I/Industrial Training**

The evaluation method shall be same as that of the Project Work II as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6 and 7.6.7. The marks distribution is given below:

Continuous Assessment (Max. 100 Marks)								
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max.. 30 Marks)		Review III (Max. 50 Marks)		
						Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)	
Review Committee	Super visor	Review Committee (excluding supervisor)	Super visor	Review Committee (excluding supervisor)	Super visor	Review Committee	Super visor	Review Committee
0	0	10	10	15	15	20	10	20

If a candidate fails to secure 50 % of the continuous assessment marks in this course, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted.

**7.8 Professional Skills Training**

Phase I training shall be conducted for minimum of 80 hours in 4<sup>th</sup> semester vacation and during 5<sup>th</sup> semester. Phase II training shall be conducted for minimum of 80 hours in 5<sup>th</sup> semester vacation and during 6<sup>th</sup> semester. The evaluation procedure shall be approved by the Principal.

**7.9 Comprehensive Test and Viva**

A candidate can earn 2 credits by successfully completing this course. The evaluation procedures shall be approved by the Principal.

**7.10 Entrepreneurships/ Start ups**

A start up/business model may be started by a candidate individually or by a group of maximum of three candidates during the programme vide clause 4.3.1. The head of the department concerned shall assign a faculty member as a mentor for each start up.

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and two credits in sixth semester respectively and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.



### **7.11 Projects through Internships**

Each candidate shall submit a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work II as per clause 7.6.

### **7.12 Value Added Course**

Minimum of two assessments shall be conducted during the value added course duration by the offering department concerned.

### **7.13 Online Course**

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

### **7.14 Self Study Course**

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

### **7.15 Audit Course**

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.





### **7.16 Universal Human Values**

The course imparting the human values shall be taught for all candidates who have joined in various branches of all BE/BTech programmes. This course shall carry a maximum of 100 marks and shall be evaluated through continuous assessment tests only vide clause 7.1. The candidate(s) can earn 2 credits by successfully completing this course. Two continuous assessment tests will be conducted and the average marks will be taken for the GPA and CGPA calculations.

## **8. REQUIREMENTS FOR COMPLETION OF A SEMESTER**

**8.1** A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

**8.1.1** Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.

**8.1.2** A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurship/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

**8.1.3** In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

**8.1.4** A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

**8.1.5** Candidate's progress is satisfactory.

**8.1.6** Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

**8.2.** The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

**8.3** The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester and satisfy the attendance requirements.

## **9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION**



- 9.1** A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.
- 9.2** When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.
- 9.3** A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

## **10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS**

- 10.1** A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.
- 10.2** The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.
- 10.3** The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.
- 10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.
- 10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

## **11. PROVISION FOR BREAK OF STUDY**

- 11.1** A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination.



A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.

- 11.2** The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.
- 11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.
- 11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- 11.6** If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

## **12. PASSING REQUIREMENTS**

- 12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 45 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- 12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.
- 12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

**13. REVALUATION OF ANSWER SCRIPTS**

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

**14. SUPPLEMENTARY EXAMINATION**

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

**15. AWARD OF LETTER GRADES**

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

The Grade Point Average (GPA) is calculated using the formula:

$$\text{GPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester



Kongu Engineering College, Perundurai, Erode – 638060, India  
and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

## 16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the BE / BTech Degree provided the candidate has

- i. Successfully completed all the courses under the different categories, as specified in the regulations.
- ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
- iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2018 (vide clause 11.3)
- iv. No disciplinary action pending against him / her.

## 17. CLASSIFICATION OF THE DEGREE AWARDED

### 17.1 First Class with Distinction:

**17.1.1** A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50

(OR)

**17.1.2** A candidate who joins from other institutions on transfer and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Submission of equivalent course list approved by the respective



- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 9.00

### **17.2 First Class:**

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry candidates) within ten consecutive semesters (eight consecutive semesters for lateral entry candidates) excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.

### **17.3 Second Class:**

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

**17.4** A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

## **18. MALPRACTICES IN TESTS AND EXAMINATIONS**

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

## **19. AMENDMENTS**

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BE / BTech programme.

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CURRICULUM BREAKDOWN STRUCTURE										
Summary of Credit Distribution										
Category	Semester								Total number of credits	Curriculum Content (% of total number of credits of the program)
	I	II	III	IV	V	VI	VII	VIII		
HS	3	4		1	2		3		13	07.56
BS	11	11	4	4					30	17.44
ES	7	3	7						17	09.88
PC		3	13	19	17	13			65	37.79
PE						3	9	3	15	08.72
OE					4	4	3	3	14	08.14
EC					2	4	6	6	18	10.47
<b>Semesterwise Total</b>	<b>21</b>	<b>21</b>	<b>24</b>	<b>24</b>	<b>25</b>	<b>24</b>	<b>21</b>	<b>12</b>	<b>172</b>	<b>100.00</b>

  

Category	Abbreviation
Lecture hours per week	L
Tutorial hours per week	T
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week	P
Credits	C

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18EGT11	English for Communication I	3	0	0	3	I
2.	18EGT21	English for Communication II	3	0	0	3	II
3.	18VEC11	Value Education	2	0	1	1	II
4.	18EGL31	English for Workplace Communication	0	0	2	1	IV
5.	18GET51	Universal Human Values	2	0	0	2	V
6.	18MBT71	Engineering Economics and Management	3	0	0	3	VII
<b>Total Credits to be earned</b>						<b>13</b>	
BASIC SCIENCE (BS)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18MAC11	Mathematics I	3	1*	2*	4	I



2.	18PHC11	Applied Physics	3	0	2*	3.5	I
3.	18CYC11	Applied Chemistry	3	0	2*	3.5	I
4.	18MAC21	Mathematics II	3	1*	2*	4	II
5.	18PHC21	Materials Science in Civil Engineering	3	0	2*	3.5	II
6.	18CYC21	Chemistry of Building Materials	3	0	2*	3.5	II
7.	18MAC31	Mathematics III	3	1*	2*	4	III
8.	18MAC41	Statistics and Numerical Methods	3	1*	2*	4	IV
		<b>Total Credits to be earned</b>				<b>30</b>	

**ENGINEERING SCIENCE (ES)**

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18GET11	Introduction to Engineering	3	0	0	3	I
2.	18MEC11	Engineering Drawing	2	0	2	3	I
3.	18MEL11	Engineering Practices Laboratory	0	0	2	1	I
4.	18CSC11	Problem Solving and Programming	2	0	2	3	II
5.	18CET31	Engineering Geology	3	0	0	3	III
6.	18CET32	Engineering Mechanics for Civil Engineers	3	1	0	4	III
		<b>Total Credits to be earned</b>				<b>17</b>	

**EMPLOYABILITY ENHANCEMENT COURSES (EC)**

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I	0	0	0	2	V
2.	18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	0	0	0	2	VI
3.	18GEP71	Comprehensive Test and Viva	0	0	0	2	VII
4.	18CEP61	Project Work I Phase I	0	0	4	2	VI
5.	18CEP71	Project Work I Phase II	0	0	8	4	VII
6.	18CEP81	Project Work II	0	0	12	6	VIII
		<b>Total Credits to be earned</b>				<b>18</b>	

**PROFESSIONAL CORE (PC)**

S. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
1.	18CET21	Elements of Civil Engineering	3	0	0	3	II	BG
2.	18CET33	Mechanics of Fluids	3	1	0	4	III	EE





3.	18CET34	Concrete Technology	3	0	0	3	III	CEM
4.	18CET35	Surveying and Geomatics	3	0	0	3	III	CEM
5.	18CEL31	Fluid Mechanics Laboratory	0	0	2	1	III	EE
6.	18CEL32	Concrete Technology Laboratory	0	0	2	1	III	CEM
7.	18CEL33	Surveying Laboratory	0	0	2	1	III	CEM
8.	18CET41	Open Channel Flow	3	0	0	3	IV	EE
9.	18CET42	Mechanics of Materials	3	1	0	4	IV	SE
10.	18CET43	Soil Mechanics	3	0	0	3	IV	GTE
11.	18CET44	Transportation Engineering	3	1	0	4	IV	TE
12.	18CEC41	Building Planning & Practices	2	0	2	3	IV	CEM
13.	18CEL41	Transportation Engineering Laboratory	0	0	2	1	IV	TE
14.	18CEL42	Soil Mechanics Laboratory	0	0	2	1	IV	GTE
15.	18CET51	Foundation Engineering	3	0	0	3	V	GTE
16.	18CET52	Environmental Engineering	3	0	0	3	V	EE
17.	18CET53	Design of RC Elements	3	1	0	4	V	SE
18.	18CET54	Structural Analysis I	3	1	0	4	V	SE
19.	18CEL51	Strength of Materials Laboratory	0	0	2	1	V	SE
20.	18CEL52	Environmental Engineering Laboratory	0	0	2	1	V	EE
21.	18CEL53	Environmental Engineering Design and Drawing	0	0	2	1	V	EE
22.	18CET61	Estimation and Quantity Surveying	3	0	0	3	VI	CEM
23.	18CET62	Design of Steel Structures	3	0	0	3	VI	SE
24.	18CET63	Structural Analysis II	3	1	0	4	VI	SE
25.	18CEL61	Computer Aided Building Information Modelling Laboratory	0	0	2	1	VI	CEM
26.	18CEL62	Structural Engineering Laboratory	0	0	2	1	VI	SE
27.	18CEL63	Computer Aided Structural Design and Detailing Laboratory	0	0	2	1	VI	SE
<b>Total Credits to be earned</b>						<b>65</b>		
<b>PROFESSIONAL ELECTIVE (PE)</b>								
<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Sem</b>	<b>Domain/ Stream</b>
		Elective - I						
1.	18CEE01	Advanced Reinforced Concrete Design	3	0	0	3	VI	SE
2.	18CEE02	Construction Engineering and Management	3	0	0	3	VI	CEM



3.	18CEE03	Solid and Hazardous Waste Management	3	0	0	3	VI	EE
4.	18CEE04	Railway, Airport and Harbour Engineering	3	0	0	3	VI	TE
5.	18CEE05	Ground Improvement Techniques	3	0	0	3	VI	GTE
6.	18CEE06	Remote Sensing and Geographical Information System	3	0	0	3	VI	BG
Elective - II								
7.	18CEE07	Advanced Steel Design	3	0	0	3	VII	SE
8.	18CEE08	Architecture and Town Planning	3	0	0	3	VII	CEM
9.	18CEE09	Environmental Impact Assessment	3	0	0	3	VII	EE
10.	18CEE10	Public Transportation Systems	3	0	0	3	VII	TE
11.	18CEE11	Environmental Geo-technology	3	0	0	3	VII	GTE
12.	18CEE12	Road Safety Management	3	0	0	3	VII	BG
Elective - III								
13.	18CEE13	Design of Prestressed Concrete Structures	3	0	0	3	VII	SE
14.	18CEE14	Sustainable Construction Methods	3	0	0	3	VII	CEM
15.	18CEE15	Air and Noise Pollution Control Engineering	3	0	0	3	VII	EE
16.	18CEE16	Urban Transportation Planning	3	0	0	3	VII	TE
17.	18CEE17	Rock Mechanics	3	0	0	3	VII	GTE
18.	18CEE18	Finite Element Methods	3	0	0	3	VII	BG
19.	18GEE01	Fundamentals of Research	3	0	0	3	VII	GE
Elective - IV								
20.	18CEE19	Earthquake Engineering and Design	3	0	0	3	VII	SE
21.	18CEE20	Construction Equipment and Management	3	0	0	3	VII	CEM
22.	18CEE21	Industrial Waste Management	3	0	0	3	VII	EE
23.	18CEE22	Traffic Engineering and Management	3	0	0	3	VII	TE
24.	18CEE23	Site Investigation and Soil Exploration	3	0	0	3	VII	GTE
25.	18CEE24	Green Building	3	0	0	3	VII	BG
26.	18CEE25	Total Quality Management	3	0	0	3	VII	GE
Elective - V								
26.	18CEE26	Design of Prefabricated structures	3	0	0	3	VIII	SE
27.	18CEE27	Design of Bridges	3	0	0	3	VIII	SE
28.	18CEE28	Distress Monitoring and Rehabilitation of Structures	3	0	0	3	VIII	CEM
29.	18CEE29	Hydrology	3	0	0	3	VIII	WRE



30.	18CEE30	Water Resources and Irrigation Engineering	3	0	0	3	VIII	WRE
31.	18CEE31	Intelligent Transport System	3	0	0	3	VIII	TE
32.	18CEE32	Reinforced Soil Structures	3	0	0	3	VIII	GTE
33.	18CEE33	Disaster Preparedness and Planning	3	0	0	3	VIII	BG
34.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII	GE
<b>Total Credits to be earned</b>						<b>15</b>		

\* Domain/Stream Abbreviations: EE - Environmental Engineering, CT - Construction Technology, SY – Surveying, GTE - Geotechnical Engineering, TE - Transportation Engineering, SE - Structural Engineering, CEM - Construction Engineering and Management, WRE - Water Resources Engineering, BG – Branch General. GE – General Engineering.

#### OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18CEO01	Remote Sensing and its Applications	3	0	2	4	V
2.	18CEO02	Disaster Management	3	1	0	4	VI
3.	18CEO03	Introduction to Smart Cities	3	0	0	3	VII
4.	18CEO04	Environmental Health and Safety	3	0	0	3	VII
5.	18CEO05	Infrastructure Planning and Management	3	0	0	3	VIII
6.	18CEO06	Environmental Laws and Policy	3	0	0	3	VIII

#### OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)

	Course Code	Course Name	L	T	P	C	OFFERED BY
<b>SEMESTER V</b>							
7.	18MAO01	Mathematical Foundations of Machine Learning	3	1	0	4	MATHS
8.	18PHO01	Thin Film Technology	3	1	0	4	PHYSICS
9.	18CYO01	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
10.	18MEO01	Renewable Energy Sources	3	0	2	4	MECH
11.	18MTO01	Design of Mechatronics Systems	3	1	0	4	MTS
12.	18AUO01	Automotive Engineering	3	0	2	4	AUTO
13.	18ECO01	PCB Design and Fabrication	3	0	2	4	ECE
14.	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	ECE
15.	18EEO01	Electrical Wiring and Lighting	3	1	0	4	EEE
16.	18EEO02	Solar and Wind Energy Systems	3	1	0	4	EEE



17.	18EIO01	Neural Networks and Deep Learning	3	1	0	4	EIE
18.	18CSO01	Data Structures and its Applications	3	0	2	4	CSE
19.	18CSO02	Formal Languages and Automata Theory	3	1	0	4	CSE
20.	18CSO03	Computational Science for Engineers	3	1	0	4	CSE
21.	18ITO01	Python Programming	3	0	2	4	IT
22.	18ITO02	Advanced Java Programming	3	0	2	4	IT
23.	18CHO01	Polymer Technology	3	1	0	4	CHEM
24.	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	3	1	0	4	CHEM
25.	18FTO01	Food Processing Technology	3	1	0	4	FT
26.	18FTO02	Baking Technology	3	0	2	4	FT
<b>SEMESTER VI</b>							
27.	18MAO02	Graph Theory and its Applications	3	1	0	4	MATHS
28.	18MAO03	Number Theory and Cryptography	3	1	0	4	MATHS
29.	18CYO02	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
30.	18MEO02	Design of Experiments	3	0	2	4	MECH
31.	18MTO02	Factory Automation	3	0	2	4	MTS
32.	18MTO03	Data Acquisition and Virtual Instrumentation	3	0	2	4	MTS
33.	18AUO02	Autonomous Vehicles	3	1	0	4	AUTO
34.	18ECO03	Principles of Quantum Computing	3	0	2	4	ECE
35.	18EEO03	Energy Conservation and Management	3	1	0	4	EEE
36.	18EIO02	Digital Image Processing and Its Applications	3	1	0	4	EIE
37.	18EIO03	Industrial Automation	3	1	0	4	EIE
38.	18CSO04	Web Engineering	3	0	2	4	CSE
39.	18CSO05	Foundations of Data Analytics	3	1	0	4	CSE
40.	18CSO06	Nature Inspired Optimization Techniques	3	1	0	4	CSE
41.	18CSO07	Introducing Data Science	3	1	0	4	CSE
42.	18ITO03	Java Programming	3	1	0	4	IT
43.	18ITO04	Next Generation Databases	3	1	0	4	IT
44.	18CHO03	Bio Energy Resources	3	1	0	4	CHEM
45.	18CHO04	Fundamentals of Nanoscience and Nanotechnology	3	1	0	4	CHEM
46.	18FTO03	Processing of Milk and Milk Products	3	0	2	4	FT



47.	18FTO04	Processing of Fruits and Vegetables	3	0	2	4	FT
		<b>SEMESTER VII</b>					
48.	18MAO04	Advanced Linear Algebra	3	0	0	3	MATHS
49.	18MAO05	Optimization Techniques	3	0	0	3	MATHS
50.	18PHO02	Structural and Optical Characterization of Materials	3	0	0	3	PHYSICS
51.	18CYO03	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
52.	18MEO03	Fundamentals of Ergonomics	3	0	0	3	MECH
53.	18MEO04	Principles of Management and Industrial Psychology	3	0	0	3	MECH
54.	18MTO04	3D Printing and Design	3	0	0	3	MTS
55.	18MTO05	Drone System Technology	3	0	0	3	MTS
56.	18AUO03	Alternate Fuels for Automobile	3	0	0	3	AUTO
57.	18ECO04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
58.	18ECO05	Principles of Communication Techniques	3	0	0	3	ECE
59.	18EEO04	Micro Grid and Smart Grid	3	0	0	3	EEE
60.	18EEO05	Electrical Safety	3	0	0	3	EEE
61.	18EIO04	Biomedical Instrumentation and Applications	3	0	0	3	EIE
62.	18EIO05	PLC Programming and Its Applications	3	0	0	3	EIE
63.	18CSO08	Artificial Intelligence and its applications	3	0	0	3	CSE
64.	18ITO05	Business Continuity Planning	3	0	0	3	IT
65.	18ITO06	Mobile Application Development	3	0	0	3	IT
66.	18CHO05	Enzyme Engineering	3	0	0	3	CHEM
67.	18CHO06	Nuclear Engineering	3	0	0	3	CHEM
68.	18FTO05	Principles of Food safety	3	0	0	3	FT
69.	18FTO06	Food and Nutrition	3	0	0	3	FT
		<b>SEMESTER VIII</b>					
70.	18MEO05	Safety Measures for Engineers	3	0	0	3	MECH
71.	18MEO06	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
72.	18MTO06	Robotics	3	0	0	3	MTS
73.	18MTO07	Virtual and Augment Reality in Industry 4.0	3	0	0	3	MTS
74.	18AUO04	Automotive Electronics	3	0	0	3	AUTO
75.	18AUO05	Vehicle Maintenance	3	0	0	3	AUTO



76.	18ECO06	Bioinspired Computing Technologies	2	0	2	3	ECE
77.	18EEO06	Electric Vehicle	3	0	0	3	EEE
78.	18EIO06	Measurements and Instrumentation	3	0	0	3	EIE
79.	18EIO07	Graphical Programming using Virtual Instrumentation	3	0	0	3	EIE
80.	18CSO09	Applied Machine Learning	3	0	0	3	CSE
81.	18CSO10	Fundamentals of Blockchain	3	0	0	3	CSE
82.	18CSO11	Fundamentals of Internet of Things	3	0	0	3	CSE
83.	18ITO07	Essentials of Information Technology	3	0	0	3	IT
84.	18ITO08	Virtual and Augmented Reality Frameworks	3	0	0	3	IT
85.	18CHO07	Fertilizer Technology	3	0	0	3	CHEM
86.	18FTO07	Food Ingredients	3	0	0	3	FT
87.	18FTO08	Fundamentals of Food Packaging and Storage	3	0	0	3	FT

**GENERAL OPEN ELECTIVE  
(Common to All BE/BTech branches)**

S.No.	Course Code	Course Title	L	T	P	C	Offering Department	Semester
88.	18GEO01	German Language Level 1	4	0	0	4	ECE	V/ VI/ VII/ VIII
89.	18GEO02	Japanese Language Level 1	4	0	0	4	ECE	V/ VI/ VII/ VIII
90.	18GEO03	Design Thinking for Engineers	3	0	0	3	CSE	VI
91.	18GEO04	Innovation and Business Model Development	3	0	0	3	MTS	VIII
92.	18GEO05	German Language Level 2	4	0	0	4	ECE	V/ VI/ VII/ VIII
93.	18GEO06	German Language Level 3	3	0	0	3	ECE	V/ VI/ VII/ VIII
94.	18GEO07	German Language Level 4	3	0	0	3	ECE	V/ VI/ VII/ VIII
95.	18GEO08	Japanese Language Level 2	4	0	0	4	ECE	V/ VI/ VII / VIII
96.	18GEO09	Japanese Language Level 3	3	0	0	3	ECE	V/ VI/ VII / VIII
97.	18GEO10	Japanese Language Level 4	3	0	0	3	ECE	V/ VI/ VII / VIII
98.	18GEO11	NCC Studies (Army Wing) – I	3	0	2	4	EEE	V/ VI
99.	18GEO12	NCC Studies (Air Wing) – I	3	0	2	4	IT	V / VI

**KEC R2018: SCHEDULING OF COURSES – B.E.(Civil Engineering)****Total Credits: 172**

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	18EGT11 English for Communication I (3-0-0-3)	18MAC11 Mathematics I (3-1*-2*-4)	18PHC11 Applied Physics (3-0-2*-3.5)	18CYC11 Applied Chemistry (3-0-2*-3.5)	18GET11 Introduction to Engineering (3-0-0-3)	18MEC11 Engineering Drawing (2-0-2-3)	18MEL11 Engineering Practices Laboratory (0-0-2-1)				<b>21</b>
II	18EGT21 English for Communication II (3-0-0-3)	18MAC21 Mathematics II (3-1*-2*-4)	18PHC21 Materials Science in Civil Engineering (3-0-2*-3.5)	18CYC21 Chemistry of Building Materials (3-0-2*-3.5)	18CSC11 Problem Solving and Programming (2-0-2-3)	18CET21 Elements of Civil Engineering (3-0-0-3)	18VEC11 Value Education (2-0-1-1)				<b>21</b>
III	18MAC31 Mathematics III (3-1*-2*-4)	18CET31 Engineering Geology (3-0-0-3)	18CET32 Engineering Mechanics for Civil Engineers (3-1-0-4)	18CET33 Mechanics of Fluids (3-1-0-4)	18CET34 Concrete Technology (3-0-0-3)	18CET35 Surveying and Geomatics (3-0-0-3)	18CEL31 Fluid Mechanics Laboratory (0-0-2-1)	18CEL32 Concrete Technology Laboratory (0-0-2-1)	18CEL33 Surveying Laboratory (0-0-2-1)		<b>24</b>
IV	18MAC41 Statistics and Numerical Methods (3-1*-2*-4)	18CET41 Open Channel Flow (3-0-0-3)	18CET42 Mechanics of Materials (3-1-0-4)	18CET43 Soil Mechanics (3-0-0-3)	18CET44 Transportation Engineering (3-1-0-4)	18CEC41 Building Planning and Practices (2-0-2-3)	18CEL41 Transportation Engineering Laboratory (0-0-2-1)	18CEL42 Soil Mechanics Laboratory (0-0-2-1)	18EGL31 English for Workplace Communication (0-0-2-1)		<b>24</b>
V	18CET51 Foundation Engineering (3-0-0-3)	18CET52 Environmental Engineering (3-0-0-3)	18CET53 Design of RC Elements (3-1-0-4)	18CET54 Structural Analysis I (3-1-0-4)	Open Elective I (3-1/0-0/2-4)	18CEL51 Strength of Materials Laboratory (0-0-2-1)	18CEL52 Environmental Engineering Laboratory (0-0-2-1)	18CEL53 Environmental Engineering Design and Drawing (0-0-2-1)	18GEL51 / 18GEI51 Professional Skills Training I / Industrial Training I (0-0-0-2)	18GET51 Universal Human Values (2-0-0-2)	<b>25</b>
VI	18CET61 Estimation and Quantity Surveying (3-0-0-3)	18CET62 Design of Steel Structures (3-0-0-3)	18CET63 Structural Analysis II (3-1-0-4)	Professional Elective I (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	18CEL61 Computer Aided Building Information Modelling Lab (0-0-2-1)	18CEL62 Structural Engineering Lab (0-0-2-1)	18CEL63 Computer Aided Structural Design and Detailing Lab (0-0-2-1)	18GEL61/ 18GEI 61 Professional Skills Training II / Industrial Training II (0-0-0-2)	18CEP61 Project Work I Phase I (0-0-4-2)	<b>24</b>
VII	18MBT71 Engineering Economics and Management (3-0-0-3)	Professional Elective II (3-0-0-3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	Open Elective III (3-0-0-3)	18GEP71 Comprehensive Test and Viva (0-0-0-2)	18CEP71 Project Work I Phase II (0-0-8-4)				<b>21</b>
VIII	Professional Elective V (3-0-0-3)	Open Elective IV (3-0-0-3)	18CEP81 Project Work II (0-0-12-6)								<b>12</b>



### MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	18EGT11	English for Communication I						✓			✓	✓	✓	✓		
1	18MAC11	Mathematics I	✓	✓	✓	✓	✓									
1	18PHC11	Applied Physics	✓	✓	✓	✓										
1	18CYC11	Applied Chemistry	✓	✓	✓	✓										
1	18GET11	Introduction to Engineering	✓	✓	✓	✓		✓	✓					✓		
1	18MEC11	Engineering Drawing	✓	✓	✓	✓						✓	✓	✓		
1	18MEL11	Engineering Practices Laboratory	✓	✓	✓	✓	✓				✓	✓	✓	✓		
2	18EGT21	English for Communication II						✓			✓	✓	✓	✓		
2	18MAC21	Mathematics II	✓	✓	✓		✓									
2	18PHC21	Materials Science in Civil Engineering	✓	✓	✓	✓										
2	18CYC21	Chemistry of Building Materials	✓	✓	✓	✓			✓							
2	18CSC11	Problem Solving and Programming	✓	✓	✓	✓	✓					✓				
2	18CET21	Elements of Civil Engineering	✓	✓	✓			✓							✓	✓
2	18VEC11	Value Education						✓		✓				✓		
3	18MAC31	Mathematics III	✓	✓	✓	✓	✓									
3	18CET31	Engineering Geology	✓	✓	✓			✓	✓					✓	✓	✓
3	18CET32	Engineering Mechanics for Civil Engineers	✓	✓	✓			✓						✓	✓	✓
3	18CET33	Mechanics of Fluids	✓	✓	✓			✓						✓	✓	✓
3	18CET34	Concrete Technology	✓	✓	✓			✓	✓					✓	✓	✓
3	18CET35	Surveying and Geomatics	✓	✓	✓			✓						✓	✓	✓
3	18CEL31	Fluid Mechanics Laboratory	✓	✓	✓	✓		✓			✓			✓	✓	✓
3	18CEL32	Concrete Technology Laboratory	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓
3	18CEL33	Surveying Laboratory	✓	✓	✓	✓		✓		✓	✓			✓	✓	✓
4	18MAC41	Statistics and Numerical Methods	✓	✓	✓	✓	✓									
4	18CET41	Open Channel Flow	✓	✓	✓			✓						✓	✓	✓





Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18CET42	Mechanics of Materials	✓	✓	✓			✓						✓	✓	✓
4	18CET43	Soil Mechanics	✓	✓	✓			✓						✓	✓	✓
4	18CET44	Transportation Engineering	✓	✓	✓			✓						✓	✓	✓
4	18CEC41	Building Planning and Practices	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
4	18CEL41	Transportation Engineering Laboratory	✓	✓	✓	✓		✓			✓			✓	✓	✓
4	18CEL42	Soil Mechanics Laboratory	✓	✓	✓	✓		✓			✓			✓	✓	✓
4	18EGL31	English for Workplace Communication									✓	✓		✓		
5	18CET51	Foundation Engineering	✓	✓	✓			✓				✓		✓	✓	✓
5	18CET52	Environmental Engineering	✓	✓	✓			✓						✓	✓	✓
5	18CET53	Design of RC Elements	✓	✓	✓			✓				✓		✓	✓	✓
5	18CET54	Structural Analysis I	✓	✓	✓			✓				✓		✓	✓	✓
5	18CEL51	Strength of Materials Laboratory	✓	✓	✓	✓		✓		✓	✓			✓	✓	✓
5	18CEL52	Environmental Engineering Laboratory	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓
5	18CEL53	Environmental Engineering Design & Drawing	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓
5	18GEL51 / 18GEI 51	Professional Skills Training I / Industrial Training I	✓	✓				✓	✓		✓	✓	✓	✓		
5	18GET51	Universal Human Values						✓	✓	✓	✓	✓				
6	18CET61	Estimation and Quantity Surveying	✓	✓	✓			✓						✓	✓	✓
6	18CET62	Design of Steel Structures	✓	✓	✓			✓				✓		✓	✓	✓
6	18CET63	Structural Analysis II	✓	✓	✓			✓				✓		✓	✓	✓
6	18CEL61	Computer Aided Building Information Modelling Laboratory	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
6	18CEL62	Structural Engineering Laboratory	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓
6	18CEL63	Computer Aided Structural Design and Detailing Laboratory	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
6	18GEL61 / 18GEI61	Professional Skills Training II / Industrial Training II	✓	✓				✓	✓		✓	✓	✓	✓		
6	18CEP61	Project Work I Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18MBT71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18GEP71	Comprehensive Test and Viva	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
7	18CEP71	Project Work I Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18CEP81	Project Work II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Elective Courses														
6	18CEE01	Advanced Reinforced Concrete Design	✓	✓	✓			✓				✓		✓	✓	✓
6	18CEE02	Construction Engineering and Management	✓	✓	✓			✓				✓	✓	✓	✓	✓
6	18CEE03	Solid and Hazardous Waste Management	✓	✓	✓			✓							✓	✓
6	18CEE04	Railway, Airport and Harbour Engineering	✓	✓	✓			✓						✓	✓	✓
6	18CEE05	Ground Improvement Techniques	✓	✓	✓			✓						✓	✓	✓
6	18CEE06	Remote Sensing and Geographical Information System	✓	✓	✓			✓				✓		✓	✓	✓
7	18CEE07	Advanced Steel Design	✓	✓	✓			✓						✓	✓	✓
7	18CEE08	Architecture and Town Planning	✓	✓	✓			✓	✓					✓	✓	✓
7	18CEE09	Environmental Impact Assessment	✓	✓	✓			✓	✓	✓				✓	✓	✓
7	18CEE10	Public Transportation Systems	✓	✓				✓						✓	✓	✓
7	18CEE11	Environmental Geo-technology	✓	✓	✓			✓	✓					✓	✓	✓
7	18CEE12	Road Safety Management	✓	✓	✓			✓						✓	✓	✓
7	18CEE13	Design of Prestressed Concrete Structures	✓	✓	✓			✓						✓	✓	✓
7	18CEE14	Sustainable Construction Methods	✓	✓	✓			✓						✓	✓	✓
7	18CEE15	Air and Noise Pollution Control Engineering	✓	✓	✓			✓	✓					✓	✓	✓
7	18CEE16	Urban Transportation Planning	✓	✓	✓			✓						✓	✓	✓
7	18CEE17	Rock Mechanics	✓	✓	✓			✓						✓	✓	✓
7	18CEE18	Finite Element Methods	✓	✓	✓			✓						✓	✓	✓
7	18GEE01	Fundamentals of Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18CEE19	Earthquake Engineering and Design	✓	✓	✓			✓						✓	✓	✓
7	18CEE20	Construction Equipment and Management	✓	✓				✓						✓	✓	✓
7	18CEE21	Industrial Waste Management	✓	✓	✓			✓	✓	✓				✓	✓	✓
7	18CEE22	Traffic Engineering and Management	✓	✓	✓			✓						✓	✓	✓
7	18CEE23	Site Investigation and Soil Exploration	✓	✓	✓			✓						✓	✓	✓
7	18CEE24	Green Building	✓	✓	✓			✓	✓					✓	✓	✓



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18CEE25	Total Quality Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18CEE26	Design of Prefabricated structures	✓	✓	✓			✓				✓		✓	✓	✓
8	18CEE27	Design of Bridges	✓	✓	✓			✓						✓	✓	✓
8	18CEE28	Distress Monitoring and Rehabilitation of Structures	✓	✓	✓			✓						✓	✓	✓
8	18CEE29	Hydrology	✓	✓	✓			✓						✓	✓	✓
8	18CEE30	Water Resources and Irrigation Engineering	✓	✓	✓			✓						✓	✓	✓
8	18CEE31	Intelligent Transport System	✓	✓				✓						✓	✓	✓
8	18CEE32	Reinforced Soil Structures	✓	✓	✓			✓						✓	✓	✓
8	18CEE33	Disaster Preparedness and Planning	✓	✓	✓			✓						✓	✓	✓
8	18MBE49	Entrepreneurship Development		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Open Elective Courses														
5	18MAO01	Mathematical Foundations of Machine Learning	✓	✓	✓	✓	✓									
5	18PHO01	Thin film Technology	✓	✓	✓											
5	18CYO01	Corrosion Science and Engineering	✓	✓	✓	✓										
5	18MEO01	Renewable Energy Sources	✓	✓	✓	✓			✓			✓		✓		
5	18MTO01	Design of Mechatronics Systems	✓	✓	✓	✓	✓							✓		
5	18AUO01	Automotive Engineering	✓	✓	✓		✓									
5	18ECO01	PCB Design and Fabrication	✓	✓	✓	✓	✓				✓					
5	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	✓	✓	✓	✓	✓				✓					
5	18EEO01	Electrical Wiring and Lighting	✓	✓	✓	✓	✓	✓								
5	18EEO02	Solar and Wind Energy Systems	✓	✓	✓	✓										
5	18EIO01	Neural Networks and Deep Learning	✓	✓	✓	✓	✓									
5	18CSO01	Data Structures and its Applications	✓	✓	✓	✓	✓									
5	18CSO02	Formal Languages and Automata Theory	✓	✓	✓	✓										
5	18CSO03	Computational Science for Engineers	✓	✓	✓	✓	✓									
5	18ITO01	Python Programming			✓		✓									
5	18ITO02	Advanced Java Programming			✓		✓									



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	18CHO01	Polymer Technology	✓	✓												
5	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	✓	✓	✓	✓	✓									
5	18FTO01	Food Processing Technology	✓	✓	✓	✓										
5	18FTO02	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
6	18MAO02	Graph Theory and its Applications	✓	✓	✓											
6	18MAO03	Number Theory and Cryptography	✓	✓	✓		✓									
6	18CYO02	Instrumental Methods of Analysis	✓	✓	✓	✓										
6	18MEO02	Design of Experiments	✓	✓	✓	✓	✓						✓	✓		
6	18MTO02	Factory Automation	✓	✓	✓	✓	✓	✓			✓	✓		✓		
6	18MTO03	Data Acquisition and Virtual Instrumentation	✓	✓	✓	✓	✓				✓	✓		✓		
6	18AUO02	Autonomous Vehicles	✓	✓	✓											
6	18ECO03	Principles of Quantum Computing	✓	✓	✓	✓	✓									
6	18EEO03	Energy Conservation and Management	✓	✓	✓		✓									
6	18EIO02	Digital Image Processing and Its Applications	✓	✓	✓	✓	✓									
6	18EIO03	Industrial Automation	✓	✓	✓	✓	✓									
6	18CSO04	Web Engineering	✓	✓	✓	✓										
6	18CSO05	Foundations of Data Analytics	✓	✓	✓											
6	18CSO06	Nature Inspired Optimization Techniques	✓	✓	✓	✓										
6	18CSO07	Introducing Data Science	✓	✓	✓											
6	18ITO03	Java Programming	✓	✓	✓	✓	✓	✓						✓		
6	18ITO04	Next Generation Databases	✓	✓	✓	✓										
6	18CHO03	Bio Energy Resources	✓	✓	✓	✓	✓									
6	18CHO04	Fundamentals of Nanoscience and Nanotechnology	✓	✓	✓	✓	✓									
6	18FTO03	Processing of Milk and Milk Products	✓	✓	✓		✓	✓		✓	✓	✓		✓		
6	18FTO04	Processing of Fruits and Vegetables	✓	✓	✓		✓	✓		✓	✓	✓		✓		
7	18MAO04	Advanced Linear Algebra	✓	✓	✓											
7	18MAO05	Optimization Techniques	✓	✓	✓											



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18PHO02	Structural and Optical Characterization of Materials	✓	✓	✓											
7	18CYO03	Waste and Hazardous Waste Management	✓	✓	✓	✓			✓							
7	18MEO03	Fundamentals of Ergonomics	✓	✓	✓	✓		✓	✓			✓		✓		
7	18MEO04	Principles of Management and Industrial Psychology			✓			✓	✓	✓	✓	✓				
7	18MTO04	3D Printing and Design	✓	✓	✓	✓	✓						✓	✓		
7	18MTO05	Drone System Technology	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		
7	18AUO03	Alternate Fuels for Automobile	✓	✓												
7	18ECO04	Electronic Hardware and Troubleshooting	✓	✓	✓	✓	✓	✓								
7	18ECO05	Principles of Communication Techniques	✓	✓	✓	✓	✓									
7	18EEO04	Micro Grid and Smart Grid	✓	✓	✓	✓	✓									
7	18EEO05	Electrical Safety	✓	✓	✓											
7	18EIO04	Biomedical Instrumentation and Applications	✓	✓	✓	✓	✓									
7	18EIO05	PLC Programming and Its Applications	✓	✓	✓	✓	✓									
7	18CSO08	Artificial intelligence and its applications	✓	✓	✓											
7	18ITO05	Business Continuity Planning	✓	✓	✓	✓										
7	18ITO06	Mobile Application Development	✓	✓	✓	✓										
7	18CHO05	Enzyme Engineering	✓	✓	✓	✓	✓									
7	18CHO06	Nuclear Engineering	✓	✓												
7	18FTO05	Principles of Food safety	✓	✓	✓		✓	✓	✓	✓				✓		
7	18FTO06	Food and Nutrition	✓	✓	✓	✓								✓		
8	18MEO05	Safety Measures for Engineers		✓		✓	✓	✓	✓	✓	✓			✓		
8	18MEO06	Energy Conservation in Thermal Equipments	✓	✓	✓			✓	✓			✓	✓	✓		
8	18MTO06	Robotics	✓	✓	✓	✓	✓							✓		
8	18MTO07	Virtual and Augment Reality in Industry 4.0	✓	✓	✓	✓	✓	✓						✓		
8	18AUO04	Automotive Electronics	✓	✓	✓											
8	18AUO05	Vehicle Maintenance	✓		✓			✓								
8	18ECO06	Bioinspired Computing Technologies	✓	✓	✓	✓										



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18EEO06	Electric Vehicle	✓	✓	✓	✓	✓									
8	18EIO06	Measurements and Instrumentation	✓	✓	✓	✓	✓									
8	18EIO07	Graphical Programming using Virtual Instrumentation	✓	✓	✓	✓	✓									
8	18CSO09	Applied Machine Learning	✓	✓	✓											
8	18CSO10	Fundamentals of Blockchain	✓	✓	✓	✓										
8	18CSO11	Fundamentals of Internet of Things	✓	✓	✓	✓	✓									
8	18ITO07	Essentials of Information Technology	✓	✓	✓	✓										
8	18ITO08	Virtual and Augmented Reality Frameworks	✓	✓	✓	✓										
8	18CHO07	Fertilizer Technology	✓	✓												
8	18FTO07	Food Ingredients	✓	✓	✓			✓						✓		
8	18FTO08	Fundamentals of Food Packaging and Storage	✓	✓	✓		✓	✓		✓				✓		
		General Open Elective														
5,6,7,8	18GEO01	German Language Level 1								✓	✓	✓		✓		
5,6,7,8	18GEO02	Japanese Language Level 1								✓	✓	✓		✓		
7	18GEO03	Design Thinking for Engineers	✓	✓	✓	✓										
8	18GEO04	Innovation and Business Model Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5,6,7,8	18GEO05	German Language Level 2								✓	✓	✓		✓		
5,6,7,8	18GEO06	German Language Level 3								✓	✓	✓		✓		
5,6,7,8	18GEO07	German Language Level 4								✓	✓	✓		✓		
5,6,7,8	18GEO08	Japanese Language Level 2								✓	✓	✓		✓		
5,6,7,8	18GEO09	Japanese Language Level 3								✓	✓	✓		✓		
5,6,7,8	18GEO10	Japanese Language Level 4								✓	✓	✓		✓		
5,6	18GEO11	NCC Studies (Army Wing) – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
5,6	18GEO12	NCC Studies (Air Wing) – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				

**B.E. CIVIL ENGINEERING CURRICULUM – R2018**

<b>SEMESTER – I</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18EGT11	English for Communication I	3	0	0	3	50	50	100	HS
18MAC11	Mathematics I	3	1*	2*	4	50	50	100	BS
18PHC11	Applied Physics	3	0	2*	3.5	50	50	100	BS
18CYC11	Applied Chemistry	3	0	2*	3.5	50	50	100	BS
18GET11	Introduction to Engineering	3	0	0	3	50	50	100	ES
18MEC11	Engineering Drawing	2	0	2	3	50	50	100	ES
<b>Practical / Employability Enhancement</b>									
18MEL11	Engineering Practices Laboratory	0	0	2	1	100	0	100	ES
<b>Total Credits to be earned</b>					<b>21</b>				

\*Alternate Weeks

<b>SEMESTER – II</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18EGT21	English for Communication II	3	0	0	3	50	50	100	HS
18MAC21	Mathematics II	3	1*	2*	4	50	50	100	BS
18PHC21	Materials Science in Civil Engineering	3	0	2*	3.5	50	50	100	BS
18CYC21	Chemistry of Building Materials	3	0	2*	3.5	50	50	100	BS
18CSC11	Problem Solving and Programming	2	0	2	3	50	50	100	ES
18CET21	Elements of Civil Engineering	3	0	0	3	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
18VEC11	Value Education	2	0	1	1	100	0	100	HS
<b>Total Credits to be earned</b>					<b>21</b>				

\*Alternate Weeks

**B.E. CIVIL ENGINEERING CURRICULUM – R2018**

<b>SEMESTER – III</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18MAC31	Mathematics III	3	1*	2*	4	50	50	100	BS
18CET31	Engineering Geology	3	0	0	3	50	50	100	ES
18CET32	Engineering Mechanics for Civil Engineers	3	1	0	4	50	50	100	ES
18CET33	Mechanics of Fluids	3	1	0	4	50	50	100	PC
18CET34	Concrete Technology	3	0	0	3	50	50	100	PC
18CET35	Surveying and Geomatics	3	0	0	3	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
18CEL31	Fluid Mechanics Laboratory	0	0	2	1	100	0	100	PC
18CEL32	Concrete Technology Laboratory	0	0	2	1	100	0	100	PC
18CEL33	Surveying Laboratory	0	0	2	1	100	0	100	PC
<b>Total Credits to be earned</b>					<b>24</b>				

\*Alternate Weeks

<b>SEMESTER – IV</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18MAC41	Statistics and Numerical Methods	3	1*	2*	4	50	50	100	BS
18CET41	Open Channel Flow	3	0	0	3	50	50	100	PC
18CET42	Mechanics of Materials	3	1	0	4	50	50	100	PC
18CET43	Soil Mechanics	3	0	0	3	50	50	100	PC
18CET44	Transportation Engineering	3	1	0	4	50	50	100	PC
18CEC41	Building Planning and Practices	2	0	2	3	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
18CEL41	Transportation Engineering Laboratory	0	0	2	1	100	0	100	PC
18CEL42	Soil Mechanics Laboratory	0	0	2	1	100	0	100	PC
18EGL31	English for Workplace Communication	0	0	2	1	100	0	100	HS
<b>Total Credits to be earned</b>					<b>24</b>				

\*Alternate Weeks



**B.E. CIVIL ENGINEERING CURRICULUM – R2018**

<b>SEMESTER – V</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18CET51	Foundation Engineering	3	0	0	3	50	50	100	PC
18CET52	Environmental Engineering	3	0	0	3	50	50	100	PC
18CET53	Design of RC Elements	3	1	0	4	50	50	100	PC
18CET54	Structural Analysis I	3	1	0	4	50	50	100	PC
	Open Elective I	3	1/0	0/2	4	50	50	100	OE
<b>Practical / Employability Enhancement</b>									
18CEL51	Strength of Materials Laboratory	0	0	2	1	100	0	100	PC
18CEL52	Environmental Engineering Laboratory	0	0	2	1	100	0	100	PC
18CEL53	Environmental Engineering Design and Drawing	0	0	2	1	100	0	100	PC
18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I*	--	--	--	2	100	0	100	EC
18GET51	Universal Human Values	2	0	0	2	100	0	100	HS
<b>Total Credits to be earned</b>					<b>25</b>				

**\*80 Hours of Training**

<b>SEMESTER – VI</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18CET61	Estimation and Quantity Surveying	3	0	0	3	50	50	100	PC
18CET62	Design of Steel Structures	3	0	0	3	50	50	100	PC
18CET63	Structural Analysis II	3	1	0	4	50	50	100	PC
	Professional Elective I	3	0	0	3	50	50	100	PE
	Open Elective II	3	1/0	0/2	4	50	50	100	OE
<b>Practical / Employability Enhancement</b>									
18CEL61	Computer Aided Building Information Modelling Laboratory	0	0	2	1	100	0	100	PC
18CEL62	Structural Engineering Laboratory	0	0	2	1	100	0	100	PC
18CEL63	Computer Aided Structural Design and Detailing Laboratory	0	0	2	1	100	0	100	PC
18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II*	---	---	---	2	100	0	100	EC
18CEP61	Project Work I Phase I	0	0	4	2	100	0	100	EC
<b>Total Credits to be earned</b>					<b>24</b>				

**\*80 Hours of Training**

**B.E. CIVIL ENGINEERING CURRICULUM – R2018**

<b>SEMESTER – VII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
18MBT71	Engineering Economics and Management	3	0	0	3	50	50	100	HS
	Professional Elective II	3	0	0	3	50	50	100	PE
	Professional Elective III	3	0	0	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	50	50	100	PE
	Open Elective III	3	0	0	3	50	50	100	OE
<b>Practical / Employability Enhancement</b>									
18GEP71	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
18CEP71	Project Work I Phase II	0	0	8	4	50	50	100	EC
<b>Total Credits to be earned</b>					<b>21</b>				

<b>SEMESTER – VIII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
	Professional Elective V	3	0	0	3	50	50	100	PE
	Open Elective IV	3	0	0	3	50	50	100	OE
<b>Practical / Employability Enhancement</b>									
18CEP81	Project Work II	---	---	12	6	50	50	100	EC
<b>Total Credits to be earned</b>					<b>12</b>				

**Total Credits: 172**



LIST OF PROFESSIONAL ELECTIVE COURSES (PE)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
Elective I							
1.	18CEE01	Advanced Reinforced Concrete Design	3	0	0	3	VI
2.	18CEE02	Construction Engineering and Management	3	0	0	3	VI
3.	18CEE03	Solid and Hazardous Waste Management	3	0	0	3	VI
4.	18CEE04	Railway, Airport and Harbour Engineering	3	0	0	3	VI
5.	18CEE05	Ground Improvement Techniques	3	0	0	3	VI
6.	18CEE06	Remote Sensing and Geographical Information System	3	0	0	3	VI
Elective II							
7.	18CEE07	Advanced Steel Design	3	0	0	3	VII
8.	18CEE08	Architecture and Town Planning	3	0	0	3	VII
9.	18CEE09	Environmental Impact Assessment	3	0	0	3	VII
10.	18CEE10	Public Transportation Systems	3	0	0	3	VII
11.	18CEE11	Environmental Geo-technology	3	0	0	3	VII
12.	18CEE12	Road Safety Management	3	0	0	3	VII
Elective III							
13.	18CEE13	Design of Prestressed Concrete Structures	3	0	0	3	VII
14.	18CEE14	Sustainable Construction Methods	3	0	0	3	VII
15.	18CEE15	Air and Noise Pollution Control Engineering	3	0	0	3	VII
16.	18CEE16	Urban Transportation Planning	3	0	0	3	VII
17.	18CEE17	Rock Mechanics	3	0	0	3	VII
18.	18CEE18	Finite Element Methods	3	0	0	3	VII
19.	18GEE01	Fundamentals of Research	3	0	0	3	VII
Elective IV							
20.	18CEE19	Earthquake Engineering and Design	3	0	0	3	VII
21.	18CEE20	Construction Equipment and Management	3	0	0	3	VII
22.	18CEE21	Industrial Waste Management	3	0	0	3	VII
23.	18CEE22	Traffic Engineering and Management	3	0	0	3	VII
24.	18CEE23	Site Investigation and Soil Exploration	3	0	0	3	VII
25.	18CEE24	Green Building	3	0	0	3	VII
26.	18CEE25	Total Quality Management	3	0	0	3	VII

(Contd.)



		Elective V					
26.	18CEE26	Design of Prefabricated Structures	3	0	0	3	VIII
27.	18CEE27	Design of Bridges	3	0	0	3	VIII
28.	18CEE28	Distress Monitoring and Rehabilitation of Structures	3	0	0	3	VIII
29.	18CEE29	Hydrology	3	0	0	3	VIII
30.	18CEE30	Water Resources and Irrigation Engineering	3	0	0	3	VIII
31.	18CEE31	Intelligent Transport System	3	0	0	3	VIII
32.	18CEE32	Reinforced Soil Structures	3	0	0	3	VIII
33.	18CEE33	Disaster Preparedness and Planning	3	0	0	3	VIII
34.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII



<b>OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)</b>							
<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Sem</b>
1.	18CEO01	Remote Sensing and its Applications	3	0	2	4	V
2.	18CEO02	Disaster Management	3	1	0	4	VI
3.	18CEO03	Introduction to Smart Cities	3	0	0	3	VII
4.	18CEO04	Environmental Health and Safety	3	0	0	3	VII
5.	18CEO05	Infrastructure Planning and Management	3	0	0	3	VIII
6.	18CEO06	Environmental Laws and Policy	3	0	0	3	VIII



**18EGT11 - ENGLISH FOR COMMUNICATION I**  
(Common to all Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>HS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course is designed to impart required levels of fluency in using the English Language at B1 level in the Common European Framework (CEFR).
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<b>Unit - I</b>	<b>Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – I:</b>	<b>9</b>
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Listening - People talking about their past experiences - listening to descriptions - Speaking - Exchanging personal information - Talking about cities and transportation - Reading - Life and achievements of a famous personality - Global transport systems - Writing - Childhood experiences - Process Description.

<b>Unit - II</b>	<b>Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – II:</b>	<b>9</b>
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Listening - Information about hotels and accommodation - Recipes and food items - Speaking - Life style changes and making comparisons - Talking about food - Reading - Habit formation and changing habits - International cuisine - Writing - Personal email - emails about food and recipes.

<b>Unit - III</b>	<b>Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – III:</b>	<b>9</b>
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Listening - Information about travel - descriptions / conversations about family life - Speaking - Vacations and Holidays - Requests, complaints and offering explanations - Reading - Tourist places and travel experiences - Group behaviour and politeness - Writing - Personal letter about travelling - Writing guidelines and checklists.

<b>Unit - IV</b>	<b>Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – IV:</b>	<b>9</b>
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Listening - Descriptions about festivals - Presentations on technology - Speaking - About technology - festivals, special events and traditions - Reading - Sports, hobbies and past time - About different cultures - Writing - Product Description - Writing web content.

<b>Unit - V</b>	<b>Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – V:</b>	<b>9</b>
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Listening - Talking about changes - Job preferences - Speaking - Comparing different periods or phases in life – changes that happen - skills and abilities, Personality Development - Employability Skills – Reading - Reading about life experiences - emotions and feelings – Job preferences – Jobs and Personality – Writing - Writing about one's past, present and future – Researching job options – choosing the right job.

**Total: 45**

**TEXT BOOK:**

1.	Jack C. Richards, "Interchange, Student's Book 2", 4 <sup>th</sup> Edition, Cambridge University Press, New York, 2017.
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**REFERENCES:**

1.	Jack C. Richards & Theodore Rodgers, "Approaches and Methods in Language Teaching", 3rd Edition, Cambridge University Press, New York, 2014.
2.	Penny Ur, "A Course in English Language Teaching", 2 <sup>nd</sup> Edition, Cambridge University Press, New York, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	use language effectively and accurately acquiring vocabulary from real-life context	Applying (K3)
CO2	listen/view and comprehend different spoken discourses / excerpts in different accents	Applying (K3)
CO3	read different genres of texts adopting various reading strategies	Analyzing (K4)
CO4	write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide range of vocabulary, organizing their ideas logically on a topic	Creating (K6)
CO5	speak clearly, confidently, comprehensibly and communicate with others using appropriate communicative strategies	Creating (K6)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2	3	2	2		
CO2									2	3		1		
CO3						1				3	1	1		
CO4										3		1		
CO5									2	3		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		3	47	17		33	100
CAT2			37	23		40	100
CAT3		3	47	33		17	100
ESE		2	42	27		29	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MAC11 - MATHEMATICS I**  
(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>1</b>	<b>BS</b>	<b>3</b>	<b>1*</b>	<b>2</b>	<b>4</b>

**Preamble** To provide the skills to the students for solving different real time problems by applying matrices, multivariable functions and differential equations.

**Unit – I** **Matrices:** **9**

Introduction to Matrices in Engineering – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation – Applications of Eigen values and Eigen vectors: Electric circuit – Mass string problems.

**Unit – II** **Multivariable Calculus:** **9**

Functions of two variables – Partial derivatives – Total differential – Taylor's series for functions of two variables – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method.

**Unit – III** **First Order Ordinary Differential Equations:** **9**

Solutions of differential equations in variables separable form – Exact differential equations – Linear first order differential equations – Bernoulli's equation – Clairaut's equation.

**Unit – IV** **Ordinary Differential Equations of Higher Order:** **9**

Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types:  $e^{ax} - \cos ax$ ,  $\sin ax - x^n - e^{ax} x^n$ ,  $e^{ax} \sin bx$  and  $e^{ax} \cos bx - x^n \sin ax$  and  $x^n \cos ax$  – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.

**Unit – V** **Applications of Ordinary Differential Equations:** **9**

Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given).

**List of Exercises / Experiments:**

1.	Introduction to MATLAB
2.	Matrix operations : Addition, Multiplication, Transpose and Inverse
3.	Computation of eigen values and eigen vectors
4.	Finding ordinary and partial derivatives
5.	Computing extremes of a single variable function
6.	Plotting and visualizing single variable functions
7.	Solving first and second order ordinary differential equations
8.	Solution of Simultaneous first order ODEs

**\*Alternate Weeks**

**Lecture:45, Tutorial and Practical:15, Total:60**

**TEXT BOOK:**

1.	Grewal B. S., "Higher Engineering Mathematics", 42 <sup>nd</sup> Edition, Khanna Publications, New Delhi, 2011.
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**REFERENCES:**

1.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2 <sup>nd</sup> Edition, Pearson India Education, New Delhi, 2018.
2.	Won Y. Yang, Young K. Choi, Jaekwon Kim, Man Cheol Kim, Jin Kim H. and Taeho Im, "Engineering Mathematics with MATLAB", 1 <sup>st</sup> Edition, CRC Press, London, 2018.





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	solve engineering problems which needs matrix computations	Applying (K3)
CO2	compute extremal values which arise in function of several	Understanding (K2)
CO3	identify the appropriate method for solving first order ordinary differential equations	Applying (K3)
CO4	solve higher order linear differential equations with constant and variable coefficients	Applying (K3)
CO5	apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems	Applying (K3)
CO6	determine eigen values and eigen vectors of a given matrix using MATLAB	Applying (K3), Manipulation (S2)
CO7	compute maxima and minima of a single variable function, plot and visualize single variable function using MATLAB	Applying (K3), Manipulation (S2)
CO8	solve first and second order ordinary differential equations and simultaneous first order ordinary differential equations using MATLAB	Applying (K3), Manipulation (S2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1										
CO2	3	2												
CO3	3	3	1	1										
CO4	3	3	1	1										
CO5	3	3	1											
CO6					3									
CO7					3									
CO8					3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	10	70				100
CAT2	20	10	70				100
CAT3	20	10	70				100
ESE	20	10	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18PHC11 - APPLIED PHYSICS**  
(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>BS</b>	<b>3</b>	<b>0</b>	<b>2*</b>	<b>3.5</b>

<b>Preamble</b>	This course aims to impart the essential concepts of properties of matter, acoustics, ultrasonics, quantum physics, laser and fibre optics, crystal structure and crystal defects. It also describes the physical phenomena related to the aforementioned concepts and their applications in engineering and provides motivation towards innovations.
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<b>Unit - I</b>	<b>Properties of Matter:</b>	<b>9</b>
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Elasticity: Stress – Strain – Hooke's law – Stress-strain diagram – Poisson's ratio - Modulus of elasticity - Beams – Bending of beams – Expression for bending moment - Cantilever – Depression of the loaded end of a cantilever - Young's modulus by uniform and non-uniform bending methods - I-shaped girders. Viscosity: Viscous force – Viscosity – Co-efficient of viscosity – Importance of viscosity of liquids (qualitative).

<b>Unit - II</b>	<b>Acoustics and Ultrasonics:</b>	<b>9</b>
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Acoustics: Sound - Reverberation and reverberation time – Growth and decay of sound and Sabine's formula (qualitative) - Absorption coefficient - Factors affecting acoustics of buildings and their remedies. Ultrasonics: Properties of ultrasonic waves - Production of ultrasonic waves - Magnetostrictive generator - Piezoelectric generator - Applications of ultrasonic waves in non destructive testing.

<b>Unit - III</b>	<b>Thermal and Quantum Physics:</b>	<b>9</b>
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Thermal Physics: Modes of heat transfer - Thermal conductivity - Radial and cylindrical heat flow - Conduction through compound media (series and parallel). Quantum Physics: Matter waves - Schrodinger's time independent and time dependent wave equations – Physical significance of wave function - Particle in a one dimensional box.

<b>Unit - IV</b>	<b>Laser, Fibre Optics and Applications:</b>	<b>9</b>
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Laser and Applications: Spontaneous emission and stimulated emission - Population inversion - Pumping methods - Einstein's coefficients - Nd:YAG laser - Holography. Fiber Optics and Applications: Principle of propagation of light through optical fibers - Numerical aperture and acceptance angle - Classification of optical fibers based on refractive index, modes and materials - Fiber optical communication links (block diagram).

<b>Unit - V</b>	<b>Crystal Physics:</b>	<b>9</b>
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Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures - Crystal imperfections: line and surface imperfections.

**List of Exercises / Experiments:**

1.	Determination of the Young's modulus of the material of a given beam using uniform bending method.
2.	Determination of the viscosity of a given liquid using Poiseuille's method.
3.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using ultrasonic interferometer.
4.	Determination of the wavelength and the angle of divergence of a semiconductor laser.
5.	Determination of the acceptance angle and the numerical aperture of a given optical fiber.

**\*Alternate Weeks****Lecture:45, Practical:15, Total:60****TEXT BOOK:**

1.	Tamilarasan K. and Prabu K., "Engineering Physics - I", 3 <sup>rd</sup> Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2014.
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**REFERENCES:**

1.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8 <sup>th</sup> Edition, Dhanpat Rai and Sons, New Delhi, 2009.
2.	Mehta and Neeraj, "Applied Physics for Engineers", 1 <sup>st</sup> Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2011.
3.	Tamilarasan K. and Prabu K., "Physics Laboratory Manual", 3 <sup>rd</sup> Edition, SCM Publishers, Erode, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	make use of the concepts of elasticity and bending moment of a beam to a simple structure under simple loading to compute the Young's modulus of a material, and to explain the concepts of viscosity of liquids.	Applying (K3)
CO2	apply the concepts of growth and decay of sound energy in a hall to recognize the requirements of acoustically good buildings, and to describe the production of ultrasonic waves and non-destructive testing using ultrasonic waves.	Applying (K3)
CO3	use the concepts of heat flow to explain heat conduction through materials, and to describe the behavior of electrons in a metal by means of quantum physics.	Applying (K3)
CO4	apply the concepts of laser to explain the working and the applications of laser in engineering and technology, and to apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture to comprehend the fiber optic communication link.	Applying (K3)
CO5	explain seven crystal systems, atomic packing factor of the select crystal systems and the types of crystal defects.	Understanding (K2)
CO6	determine the Young's modulus of a material using the concepts of elasticity and bending moment of a beam, and to determine the viscosity of a liquid using the concepts of viscosity.	Applying (K3), Precision (S3)
CO7	compute the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using the concepts of propagation of sound through a medium.	Applying (K3), Precision (S3)
CO8	determine the wavelength and the angle of divergence of a semiconductor laser beam using the concepts of propagation of light through a medium, and to compute the acceptance angle and the numerical aperture of an optical fiber using the concept of total internal reflection.	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2												
CO6				3										
CO7				3										
CO8				3										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	45	35				100
CAT3	20	50	30				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CYC11 - APPLIED CHEMISTRY**  
(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	BS	3	0	2*	3.5

Preamble	Applied Chemistry course imparts the basic principles and concepts of chemistry in the field of Engineering and Technology. It also imparts knowledge on Water Technology, Electrochemistry, Corrosion and its control, Fuels & Combustion and Polymers.
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<b>Unit - I</b>	<b>Water Technology:</b>	<b>9</b>
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Introduction - Sources of water - Impurities in water - Types of water – Water Quality Standards - Hardness of water - Expression of hardness - Units of hardness - Estimation of hardness of water by EDTA method - Determination of alkalinity - Disadvantages of using hard water - Boiler troubles - Scale and sludge - Softening of water - External treatment method - Demineralization process - Internal treatment process - Carbonate and Calgon conditioning - Desalination by reverse osmosis method.

<b>Unit - II</b>	<b>Electrochemistry:</b>	<b>9</b>
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Introduction - Cells - Representation of a galvanic cell - Reversible and irreversible cells - Electrode potential - Nernst equation - Reference electrode - Standard hydrogen electrode - Glass electrode - Electrochemical series and its applications - Conductometric titrations - Mixture of weak and strong acid vs strong base.

<b>Unit - III</b>	<b>Corrosion and its Control:</b>	<b>9</b>
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Introduction - Chemical corrosion - Electrochemical corrosion - Galvanic corrosion - Concentration cell corrosion - Galvanic series - Factors influencing rate of corrosion - Corrosion control methods - Sacrificial anodic method - Protective coatings - Pretreatment of metal surface - Metallic coating - Electroplating - Nonmetallic coating - Phosphate coating - Organic coating - Paints - Constituents and their functions - Special paints - water repellent and luminescent paints.

<b>Unit - IV</b>	<b>Fuels and Combustion:</b>	<b>9</b>
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Introduction - Classification of fuels - Requirements of a good fuel - Combustion - Principle of combustion - Calorific value - Gross and net calorific values - Explosive range - Spontaneous ignition temperature - Calorific intensity - Solid fuels - Coal and its varieties - Proximate analysis - Significance - Metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - Refining of petroleum - Manufacture of synthetic petrol - Hydrogenation of coal - Bergius method - Knocking - Octane number - Cetane number - Gaseous fuel - LPG.

<b>Unit - V</b>	<b>Polymers:</b>	<b>9</b>
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Introduction - Classification of polymers - Functionality - Polymerization - Plastics - Types - Thermo and thermosetting plastics - Individual polymers - Polypropylene, PVC, PET and epoxy resin - Preparation, properties and uses - Compounding of plastics - Fabrication of plastics - Compression, injection, extrusion and blow moulding methods - Foamed plastics.

**List of Exercises / Experiments:**

1.	Estimation of total, temporary and permanent hardness of water by EDTA method.
2.	Estimation of Ca <sup>2+</sup> and Mg <sup>2+</sup> hardness separately by EDTA method.
3.	Estimation of alkalinity of the given water sample.
4.	Conductometric titration - Mixture of acids.
5.	Estimation of hydrochloric acid using pH meter.

**\*Alternate Weeks****Lecture:45, Practical:15, Total:60****TEXT BOOK:**

1.	Palanisamy P.N., Manikandan P., Geetha A. & Manjula Rani K., "Applied Chemistry", 5 <sup>th</sup> Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
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**REFERENCES:**

1.	Jain & Jain, "Engineering Chemistry", 16 <sup>th</sup> Edition, Dhanpat Rai Publishing Company, New Delhi, 2016.
2.	Sharma B.K., "Industrial Chemistry", Krishna Prakasan Media Pvt. Ltd, Meerut, 2014.
3.	Palanisamy P.N., Manikandan P., Geetha A & Manjula Rani K., "Chemistry Laboratory Manual", Rajaganapathy Publishers, Erode, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the suitable water softening methods to avoid boiler troubles	Applying (K3)
CO2	apply the principle of electrochemistry to construct cells and measure the electrode potential	Applying (K3)
CO3	adopt the suitable corrosion control methods for the given practical problems	Applying (K3)
CO4	illustrate the quality of fuels from its characteristics	Understanding (K2)
CO5	explain the types of polymers, plastics and fabrication methods	Understanding (K2)
CO6	estimate the amount of hardness for the given water sample by EDTA method	Applying (K3), Precision (S3)
CO7	estimate the amount of alkalinity for the given water sample	Applying (K3), Precision (S3)
CO8	demonstrate the conductivity meter and pH meter to estimate the amount of the given solution	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2												
CO5	3	2												
CO6	3	2	1	3										
CO7	3	2	1	3										
CO8	3	2	1	3										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18GET11 - INTRODUCTION TO ENGINEERING**  
(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	3	0	0	3

Preamble	The objective of this course is to realize the importance of engineering, measurements and the fundamental concepts of common engineering disciplines like Civil, Mechanical, Electrical and Electronics Engineering.
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<b>Unit - I</b>	<b>Engineering and Measurements:</b>	<b>9</b>
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Engineering and Measurements: Engineering - Engineer and Engineering Graduate - Graduate attributes - Role of engineer - Professional bodies and their role. Physical Quantities - Dimensions - SI Units, Symbols and Conversions - Mechanical Measuring Instruments - Electrical Measuring Instruments - Accuracy and Precision - Data Acquisition System.

<b>Unit - II</b>	<b>Mechanical Engineering:</b>	<b>9</b>
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Mechanical Engineering: IC Engines - Power Plants - Boilers and Furnaces - Pumps - Refrigeration and Air Conditioner - CAD/CAM - Additive Manufacturing. Hybrid Electric Vehicles, Industry 4.0.

<b>Unit - III</b>	<b>Civil Engineering:</b>	<b>9</b>
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Civil Engineering: Selection of the site for Building - Building approval process - Contract and tenders - Building Materials - Components of Building - Sequence of works for building construction - Prefabricated Structures - Water Management - Rainwater harvesting - Infrastructure - Bridges, Dams and Roads.

<b>Unit - IV</b>	<b>Electrical Engineering:</b>	<b>9</b>
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Electrical Engineering: Terminologies - Current, voltage, potential difference, power, energy - Supply: DC, AC - single phase and three phase - Energy conversion - Utility structure - Single line diagram of power system - Apparatus - Tariff - House wiring. Alternator - Induction motor - Solar and wind energy.

<b>Unit - V</b>	<b>Electronics Engineering:</b>	<b>9</b>
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Electronics Engineering: Resistor, Inductor, capacitor - Diode - LEDs - Rectifier - Power Supply - Transistor - Transistor as an amplifier - MOSFET - Logic Gates - Microprocessor - Micro controller - Radio communication - Internet of Things.

**Total:45**

**TEXT BOOK:**

1.	Faculty of Mechanical Engineering, "Introduction to Engineering", McGraw Hill Education India Pvt. Ltd., Chennai.
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**REFERENCES:**

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|----|---|
| 1. | Arvid R. Eide, Roland D. Jenison, Steven K. Mickelson and Larry L. Northup. , "Engineering Fundamentals and Problem Solving", 7 <sup>th</sup> Edition, McGraw Hill Education, New York, 2018. |
| 2. | Navaneethakrishnan P., Selvakumar P., Rajeshkumar G. and Sangeetha R.K., "Basic Civil and Mechanical Engineering", McGraw Hill Education, New Delhi, 2016.                                    |
| 3. | Senthilnathan N., Logeswaran T. and Suresh M., "Basic Electrical and Electronics Engineering", McGraw Hill, New Delhi, 2016.  |



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	recognize the roles of engineer, measurement quantities and systems in Engineering	Understanding (K2)
CO2	infer the components and principles of mechanical engineering applications	Applying (K3)
CO3	summarize the process involved in building construction, infrastructure and water conservation	Applying(K3)
CO4	recognize the fundamental terms involved in electrical engineering	Understanding (K2)
CO5	explain the working of basic electronic components and its applications	Applying ( K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1										3		
CO2	3	2	1	1		2	1					3		
CO3	3	2	1	1		2	1					3		
CO4	2	1										3		
CO5	3	2	1	1								3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	50	50					100
CAT3	50	50					100
ESE	50	50					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MEC11 - ENGINEERING DRAWING**  
(Common to all Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>ES</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on orthographic, isometric projections, sectional views and development of surfaces by solving different application-oriented problems.						
<b>Unit - I</b>	<b>General Principles of Orthographic Projection</b>						<b>9</b>
General Principles of Orthographic Projection: Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning - Projections of Points, Lines and Planes - General principles of orthographic projection - First angle projection - Layout of views - Projection of points located in all quadrant and straight lines located in the first quadrant - Determination of true lengths and true inclinations and location of traces - Projection of polygonal surface and circular lamina inclined to both reference planes.							
<b>Unit - II</b>	<b>Projections of Solid</b>						<b>9</b>
Projections of Solid: Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.							
<b>Unit - III</b>	<b>Sectioning of Solids</b>						<b>9</b>
Sectioning of Solids: Sectioning of solids - prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section.							
<b>Unit - IV</b>	<b>Development of Surfaces</b>						<b>9</b>
Development of Surfaces: Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.							
<b>Unit - V</b>	<b>Isometric Projection and Introduction to AutoCAD</b>						<b>9</b>
Isometric Projection and Introduction to AutoCAD: Principles of isometric projection - Isometric scale - Isometric projections of simple and truncated solids like prisms, pyramids, cylinders and cones - Conversion of isometric projection into orthographic projection - Introduction to AutoCAD.							

**Total:45**

**TEXT BOOK:**

1. Venugopal K. and Prabhu Raja V. "Engineering Graphics", 15 <sup>th</sup> Edition, New Age International Pvt. Ltd., New Delhi, 2018.
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**REFERENCES:**

1. Basant Agrawal, Agrawal C.M. "Engineering Drawing", 2 <sup>nd</sup> Edition, McGraw Hill Education, 2019.
2. Gopalakrishnana K.R. "Engineering Drawing", Volume. I & II, Subhas Publications, Bengaluru, 2014.
3. Parthasarathy N.S., Vela Murali. "Engineering Drawing", 1 <sup>st</sup> Edition, Oxford University Press, 2015.





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret international standards of drawings and sketch the projections of points, lines and planes.	Understanding(K2)
CO2	draw the projections of 3D primitive objects like prisms, pyramids, cylinders and cones.	Applying (K3)
CO3	construct the various sectional views of solids like prisms, pyramids, cylinders and cones.	Applying (K3)
CO4	develop the lateral surfaces of simple and truncated solids.	Applying (K3)
CO5	sketch the isometric projections of simple and truncated solids and convert isometric drawing in to orthographic projection.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2								3	2	2	2	3
CO2	3	2	1	1						3	2	3	2	3
CO3	3	2	1	1						3	2	3	2	3
CO4	3	2	1	1						3	2	3	2	3
CO5	3	2	1	1						3	2	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MEL11 - ENGINEERING PRACTICES LABORATORY**  
(Common to all Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>I</b>	<b>ES</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This course is designed to provide a hands-on experience in the field of mechanical engineering and electrical engineering such as fitting, plumbing, wood working, sheet metal work, welding, safety aspects, assembly and testing of electrical and electronic circuits.						

**List of Exercises / Experiments:**

<b>PART A – MECHANICAL ENGINEERING</b>	
1.	To prepare square or rectangular shaped MS plates using power tools for cutting, polishing and shaping to the required dimensions.
2.	To carryout drilling, tapping and assembly on the given MS plates.
3.	To carryout thread forming on a GI/PVC pipes and prepare water leak proof water line from overhead tank.
4.	To prepare a wood or plywood box/tray/any innovative models using modern power tools like cutting machine, router, jigsaw, power screw driver etc.
5.	To prepare a leak proof sheet metal tray/box/funnel using modern power tools.
6.	Welding practice using welding simulator.
7.	Project: Preparing innovative articles using wood/sheet metal.
<b>PART B – ELECTRICAL AND ELECTRONICS ENGINEERING</b>	
8.	Safety Aspects of Electrical Engineering, Electrical Symbols, Components Identification, Fuse selection and installation, Circuit Breakers selection
9.	Wiring circuit for fluorescent lamp and stair case wiring
10.	Measurement of earth resistance
11.	Soldering of simple circuits and trouble shooting
12.	Implementation of half wave and full wave rectifier using diodes

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Engineering Practices Laboratory Manual.
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<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	plan the sequence of operations for effective completion of the planned models/innovative articles	Creating (K6), Precision (S3)
CO2	identify and use appropriate modern power tools and complete the exercises/models accurately	Applying (K3), Precision (S3)
CO3	select fuses and Circuit breakers	Understanding (K2), Manipulation (S2)
CO4	perform house wiring and realize the importance of earthing	Applying (K3), Manipulation (S2)
CO5	trouble shoot the electrical and electronic circuits	Applying (K3), Manipulation (S2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3				3	3	2	3		
CO2	3	2	1	1					3	2	2	3		
CO3	2	1							3	2	2	3		
CO4	3	2	1	1					3	3	2	3		
CO5	3	2	1	1					3	2	2	3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18EGT21 - ENGLISH FOR COMMUNICATION II**  
(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>All BE/BTech branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>HS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

Preamble	This course is designed to impart required levels of fluency in using the English Language at B1 level in the CEFR.						
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<b>Unit - I</b>	<b>Listening, Speaking, Reading, Writing and Grammar &amp; Vocabulary. Activity Based Learning – Phase – VI:</b>	<b>9</b>
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Listening – Job and career related descriptions and conversations – requests of different kinds and the responses – Speaking - Career choices and professional skills – making requests and responding to requests – Reading – Using texts about jobs and careers – about different societies and cultural differences – Writing – Resumes, CVs and job oriented advertisements – business and career related emails – Grammar & Vocabulary – Gerunds and elements of comparison – requests and indirect requests.

<b>Unit - II</b>	<b>Listening, Speaking, Reading, Writing and Grammar &amp; Vocabulary. Activity Based Learning – Phase – VII:</b>	<b>9</b>
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Listening – Expository and narrative descriptions – information about different cultures, nations and societies - Speaking – Narrating and describing – talking about other countries and other cultures – Reading – Using texts about media and information technology – living abroad and experiencing different cultures – Writing – Blog writing – brochures and tourist pamphlets – Grammar & Vocabulary – The past tense forms - noun phrases and relative clauses.

<b>Unit - III</b>	<b>Listening, Speaking, Reading, Writing and Grammar &amp; Vocabulary. Activity Based Learning – Phase – VIII:</b>	<b>9</b>
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Listening – Consumerism – product description – complaints and redressal – environmental issues – ecology – saving the planet – Speaking – Talking about problems, issues, complaints – solutions and redressal – talking about environmental issues – Reading – Using texts on segregating wastes – recycling and reusing – texts on environmental issues – Writing – Online reviews, articles and writing web content – Grammar & Vocabulary – Phrases and sentences used for describing problems – passives – prepositions and infinitives.

<b>Unit - IV</b>	<b>Listening, Speaking, Reading, Writing and Grammar &amp; Vocabulary. Activity Based Learning – Phase – IX:</b>	<b>9</b>
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Listening – Education, learning and the choice of courses – various services needed in daily life – self-improvement for success in life – Speaking - Discussions about educational and career oriented issues – talking about everyday services – giving advice and self improvement – Reading – Reading about learning strategies and learning styles – using texts about personality development – Writing – Writing about hobbies – pastime and individual skills – writing short articles on everyday life and personality development – Grammar & Vocabulary – Using of “would” and certain gerund forms – use of modals, verbs, gerunds, negative questions and infinitives.

<b>Unit - V</b>	<b>Listening, Speaking, Reading, Writing and Grammar &amp; Vocabulary. Activity Based Learning – Phase – X:</b>	<b>9</b>
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Listening – Historical narratives – biographies and learning about the future – important life events, milestones and happenings of the past – Speaking – Talking about the past, present and the future – talking about important events in life – Reading – Texts about new technologies and future science – using texts about social organization, culture and social practices – Writing – Biographical sketches – historical events – famous personalities, stages of life and getting along with people – Grammar & Vocabulary – Future tense forms – time clauses and certain “if clauses”.

**Total:45****TEXT BOOK:**

1. Jack C. Richards, "Interchange, Student's Book 3", 4 <sup>th</sup> Edition, Cambridge University Press, New York, 2017.
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**REFERENCES:**

1. Jane Willis, "A Framework for Task Based Learning", Longman, Harlow, 1996.
2. Rod Ellis, "Task Based Language Learning and Teaching", Oxford University Press, London, 2003.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	use functional grammar for improving communication skills	Applying (K3)
CO2	listen and comprehend different spoken excerpts critically and infer unspoken and implied meanings.	Applying (K3)
CO3	read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation.	Analyzing (K4)
CO4	write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.	Creating (K6)
CO5	speak effectively, to express opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies.	Creating (K6)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			1	3	1	1		
CO2									2	3		1		
CO3						1				3	1	1		
CO4										3		2		
CO5									2	3		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	3	3	30	40		24	100
CAT2	3	3	33	43		18	100
CAT3	3	3	33	43		18	100
ESE	3	3	31	45		18	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MAC21 - MATHEMATICS II**  
(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>2</b>	<b>BS</b>	<b>3</b>	<b>1*</b>	<b>2*</b>	<b>4</b>

<b>Preamble</b>	To impart the knowledge of evaluation of real and complex integrals, vector calculus and analytic functions to the students for solving the problems related to various engineering disciplines						
<b>Unit - I</b>	<b>Multiple Integrals:</b>						<b>9</b>
Double integration in cartesian coordinates – Change of order of integration – Application: Area between two curves – Triple integration in cartesian coordinates – Volume as triple integrals.							
<b>Unit - II</b>	<b>Vector Calculus:</b>						<b>9</b>
Directional derivative – Gradient of a scalar point function – Divergence of a vector point function – Curl of a vector – Solenoidal and Irrotational vectors – Green's and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.							
<b>Unit - III</b>	<b>Beta and Gamma Functions:</b>						<b>9</b>
Definition of beta and gamma Functions – Properties – Relation between beta and gamma functions – Transformations of gamma function – Applications of beta and gamma functions: Evaluation of definite integrals in terms of beta and gamma functions.							
<b>Unit - IV</b>	<b>Analytic Functions:</b>						<b>9</b>
Functions of a complex variable – Analytic functions – Necessary and sufficient conditions (excluding proof) – Cauchy–Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic function – Construction of analytic function – Conformal mapping: $w = z + a$ , $az$ , $1/z$ – Bilinear transformation.							
<b>Unit - V</b>	<b>Complex Integration:</b>						<b>9</b>
Introduction – Cauchy's theorem (without proof) – Cauchy's integral formula – Singularities – Classification – Cauchy's residue theorem (without proof) – Applications: Evaluation of definite integrals involving sine and cosine functions over the circular contour.							

**List of Exercises / Experiments :**

1.	Evaluating indefinite and definite integrals
2.	Evaluating double and triple integrals
3.	Finding the area between two curves
4.	Computing gradient, divergence and curl
5.	Computation of beta and gamma functions
6.	Applying Milne-Thomson method for constructing analytic function
7.	Determination of Mobius transformation for the given set of points
8.	Finding poles and residues of an analytic function

**\*Alternate Weeks****Lecture: 45, Tutorial and Practical:15, Total:60****TEXT BOOK:**

1.	Grewal B.S., "Higher Engineering Mathematics", 43 <sup>rd</sup> Edition, Khanna Publications, New Delhi, 2014.
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**REFERENCES:**

1.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - II", 2 <sup>nd</sup> Edition, Pearson India Education, New Delhi, 2018.
2.	Won Y. Yang, Young K. Choi, Jaekwon Kim, Man Cheol Kim, Jin Kim H. and Taeho Im, "Engineering Mathematics with MATLAB", 1 <sup>st</sup> Edition, CRC Press, London, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	Solve problems involving double and triple integrals	Understanding (K2)
CO2	Apply the concept of vectors in engineering problems	Applying (K3)
CO3	Use Beta and Gamma functions to improper evaluate integrals	Applying (K3)
CO4	Identify, construct and apply analytic functions in electrostatics and fluid flow problems	Applying (K3)
CO5	Evaluate complex integrals which is extensively applied in engineering	Applying (K3)
CO6	Evaluate line, double and triple integrals and determine area between two curves using MATLAB	Applying (K3), Manipulation (S2)
CO7	Compute gradient, curl and divergence of a vector function using MATLAB	Applying (K3), Manipulation (S2)
CO8	Construct analytic function, find bilinear transformation and compute poles and residues using MATLAB	Applying (K3), Manipulation (S2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	2												
CO3	3	2	1											
CO4	3	1												
CO5	3	2	2											
CO6					3									
CO7					2									
CO8					2									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	10	70				100
CAT2	20	10	70				100
CAT3	20	10	70				100
ESE	20	10	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18PHC21 - MATERIALS SCIENCE IN CIVIL ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Applied Physics</b>	<b>2</b>	<b>BS</b>	<b>3</b>	<b>0</b>	<b>2*</b>	<b>3.5</b>

<b>Preamble</b>	This course aims to impart the knowledge on the physics of conductors, semiconductors, magnetic materials, superconductors, dielectrics, ceramics, composites, smart and nano materials. It also describes the select characterization techniques and the applications of aforementioned materials in civil engineering and provides motivation towards innovations.						
<b>Unit - I</b>	<b>Conducting and Semiconducting Materials:</b>						<b>9</b>
Conducting Materials: Conductors - Classical free electron theory - Electrical and thermal conductivities of metal - Wiedemann–Franz law - Drawbacks of classical theory - Quantum free electron theory - Fermi distribution function - Semiconducting Materials: Types of semiconductor - carrier concentration in intrinsic and extrinsic semiconductors (qualitative) - Hall Effect and Hall coefficient - Applications - Solar cell.							
<b>Unit - II</b>	<b>Magnetic, Superconducting and Dielectric Materials:</b>						<b>9</b>
Magnetic Materials: Introduction - Domain theory of ferromagnetism - Hysteresis - Soft and hard magnetic materials - Applications: Transformer core. Superconductors: Properties - Type I and Type II superconductors - Applications: magnetic levitation. Dielectric materials and its applications.							
<b>Unit - III</b>	<b>Ceramics and Composites:</b>						<b>9</b>
Ceramics: Introduction – Classification of ceramics: Glasses – Clay products – Refractories – Abrasives – Cements – General properties and applications of ceramics. Composites: Introduction – Fibre phase - Matrix phase - Classification of composites based on matrix materials – Polymer-matrix composites - metal-matrix composites - ceramic-matrix composites.							
<b>Unit - IV</b>	<b>Smart and Nano Materials:</b>						<b>9</b>
Smart Materials: Metallic glasses: Preparation by melt spinning, properties and applications – Shape memory alloys (SMA): Characteristics and applications. Nanomaterials: Low dimensional structures - quantum dot, quantum wire and quantum well – properties of nanomaterials – Synthesis: Top down and bottom up approaches – Ball milling – Physical vapor deposition method – Carbon nanotubes: Structures –Fabrication by laser ablation – Applications of nano materials.							
<b>Unit - V</b>	<b>Materials Characterization:</b>						<b>9</b>
Importance of materials characterization - Raman spectroscopy – X-ray diffraction - Scanning electron microscopes: principle, construction and working - Transmission electron microscope: principle, construction and working. Thermal analysis: Thermo gravimetric analysis (TGA).							

**List of Exercises / Experiments:**

1.	Determination of the specific resistance of a conductor using Carey Foster's bridge.
2.	Determination of the band gap of a semiconductor using post office box.
3.	Determination of the thermal conductivity of a composite/ceramic material using Lee's disc arrangement.
4.	Determination of the thickness of a nano-crystalline thin film using air-wedge arrangement.
5.	Determination of wavelength of Hg spectrum using spectrometer grating.

**\*Alternate Weeks****Lecture:45, Practical:15, Total:60****TEXT BOOK:**

1.	Tamilarasan K. and Prabu K., "Engineering Physics-II", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.
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**REFERENCES:**

1.	Raghavan V., "Physical Metallurgy: Principles and Practice", PHI Learning Pvt. Ltd., New Delhi, 2015.
2.	Balasubramaniam R., "Callister's Materials Science and Engineering", 2nd Edition, Wiley India Pvt. Ltd., 2014.
3.	Tamilarasan K. and Prabu K., "Physics Laboratory Manual", 3rd Edition, SCM Publishers, Erode, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the concepts of classical and quantum free electron theory of metals to compute the electrical conductivity and thermal conductivity of metals, and to apply concept of density of states to describe the carrier concentration of intrinsic and extrinsic semiconductors, and to explain Hall Effect and their applications	Applying (K3)
CO2	explain the select types, properties and applications of magnetic, superconducting and dielectric materials	Understanding (K2)
CO3	describe the composition, properties and applications of the select ceramics and composites	Understanding (K2)
CO4	explain the preparation, properties and applications of select smart materials (metallic glasses, SMA), nanomaterials and carbon nanotubes	Understanding (K2)
CO5	apply the concepts of Raman effect, X-ray diffraction, matter waves and thermograph to describe the principle and working of the select materials characterization techniques (Raman spectroscopy, XRD, SEM, TEM and TGA)	Applying (K3)
CO6	determine the specific resistance of conducting materials and the band gap of semiconducting materials using the concept of electrical conductivity	Applying (K3), Precision (S3)
CO7	determine the thermal conductivity of composites / ceramics using the concept of heat flow through materials	Applying (K3), Precision (S3)
CO8	determine the thickness of nano-crystalline thin films using the concept of interference of light, and to determine the wavelength of Hg spectrum using the concept of diffraction of light	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	2	1												
CO3	2	1												
CO4	2	1												
CO5	3	2	1											
CO6				3										
CO7				3										
CO8				3										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				100
CAT2	25	40	35				100
CAT3	25	45	30				100
ESE	25	40	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CYC21 - CHEMISTRY OF BUILDING MATERIALS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Applied Chemistry</b>	<b>2</b>	<b>BS</b>	<b>3</b>	<b>0</b>	<b>2*</b>	<b>3.5</b>

<b>Preamble</b>	This course aims to impart a sound chemistry knowledge on the ingredients and properties of concrete, building and polymeric materials towards applications in civil engineering and to realize the holistic nature of the environment.						
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<b>Unit - I</b>	<b>Chemistry of Cement:</b>	<b>9</b>
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Introduction - classification - functions of the ingredients of cement – portland cement – chemical composition -manufacturing – dry and wet process- differences between dry and wet process- properties of cement- setting and hardening of cement – heat of hydration of cement- applications in civil engineering.

<b>Unit - II</b>	<b>Chemistry of Building Materials:</b>	<b>9</b>
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Lime – classification – manufacture - properties and uses - properties and uses of gypsum and plaster of paris - refractory bricks - classification - properties - general method of manufacturing of refractories - green building materials - applications in civil engineering.

<b>Unit - III</b>	<b>Chemistry of Polymeric Materials:</b>	<b>9</b>
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Introduction - effect of heat on polymers - mechanical properties of polymers – plastics - types and examples – unique properties - disadvantages of plastics over metals - uses of plastics - rubbers (elastomers) - vulcanization of rubber - synthetic rubbers- preparation, properties and uses of styrene rubber, nitrile rubber and neoprene - polymer blends and alloys - applications in civil engineering.

<b>Unit - IV</b>	<b>Corrosion of Steel in Concrete:</b>	<b>9</b>
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Introduction- decay of concrete - corrosion mechanism in concrete - causes of corrosion – carbonation, chloride attack and sulphate attack- Delayed Ettringite formation - assessment method - half cell potential measurement - preventive measures for corrosion of steel in concrete - corrosion control by inhibitors.

<b>Unit - V</b>	<b>Chemistry and the Environment:</b>	<b>9</b>
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Environment - planet earth - components of environment- atmosphere-hydrosphere-lithosphere-biosphere-interrelationship between components and sub components - environmental pollution – environmental pollutants - toxic effects of pollutants - fluoride, arsenic, chromium, cadmium and lead - recovery and recycling of materials- role of an individual in prevention of pollution- case studies.

**List of Exercises / Experiments :**

1.	Determination of calcium in cement by complexometric titration.
2.	Estimation of molecular weight of the polymer using viscometer.
3.	Estimation of iron in steel using permanganometry.
4.	Estimation of chromium (Cr <sup>6+</sup> ) in wastewater sample.
5.	Determination of dissolved oxygen in the given wastewater sample.

**\*Alternate Weeks****Lecture:45, Practical:15, Total:60****TEXT BOOK:**

1.	Palanisamy P.N., Manikandan P, Geetha A, Manjula Rani K & Kowshalya V.N., "Chemistry for Civil Engineering", Revised Edition, Pearson Education, New Delhi, 2019.
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**REFERENCES:**

1.	Jain & Jain, "Engineering Chemistry", 16 <sup>th</sup> Edition, Dhanpat Rai Publishing, New Delhi, 2016.
2.	Mohamed A. El-Reddy, "Steel-Reinforced Concrete Structures – Assessment and Repair of Corrosion", CRC Press, Florida, 2008.
3.	Palanisamy P.N., Manikandan P., Geetha A & Manjula Rani K., "Chemistry Laboratory Manual", Rajaganapathy Publishers, Erode, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the knowledge of chemistry of cement in construction	Applying (K3)
CO2	summarize the properties and applications of various building materials in construction	Understanding (K2)
CO3	utilise the various polymeric materials in civil engineering	Applying (K3)
CO4	utilize the concepts of corrosion of steel in concrete and its control methods	Applying (K3)
CO5	apply the knowledge on components of environment to study the impacts of pollutants on it	Applying (K3)
CO6	demonstrate the viscometer to estimate the molecular weight of the polymer	Applying (K3), Precision (S3)
CO7	determine the amount of calcium in cement and iron in steel	Applying (K3), Precision (S3)
CO8	estimate the amount of chromium and DO in the given wastewater	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2												
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1			3							
CO6	3	2	1	3										
CO7	3	2	1	3										
CO8	3	2	1	3										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CSC11 - PROBLEM SOLVING AND PROGRAMMING**

(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E.&amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>2</b>	<b>ES</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

<b>Preamble</b>	This course mainly focuses on the basic concepts of computing, the methodology of problem solving and developing skills in programming using C language.
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<b>Unit - I</b>	<b>Introduction to Computer and Problem Solving:</b>	<b>6</b>
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Overview of computers - Applications of computers - Characteristics of computer - Basic computer Organization - Number System - Problem solving: Planning the computer program – Algorithms - Flowcharts – Pseudocodes - Structuring the logic.

<b>Unit - II</b>	<b>Case Study on Problem Solving:</b>	<b>6</b>
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Algorithm, Flowchart and Pseudo code for the problems: Exchanging the values of two variables - Finding the biggest number - Counting - Summation of numbers - Factorial computation - Generation of Fibonacci Sequence - Summation of series - Base Conversion - Reversing the digits of an Integer.

<b>Unit - III</b>	<b>Introduction to C and Control Statements:</b>	<b>6</b>
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Overview of C - Basic structure of a C Program - Executing a C Program - C Character set - Tokens - Keywords and Identifiers - Constants - Variables - Data types - Storage classes - Managing Input and Output operations - Operators and Expressions - Decision making and Branching - Looping - Break and continue statements.

<b>Unit - IV</b>	<b>Arrays, Strings and Structures:</b>	<b>6</b>
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Arrays - One dimensional and Two dimensional arrays - Handling of character strings: Declaring and initializing string variables - Performing simple string operations - Introduction to structures: Structure definition - Structure declaration - Accessing a structure member - Structure initialization - Unions.

<b>Unit - V</b>	<b>Functions:</b>	<b>6</b>
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User defined functions: Elements of user defined functions - String handling functions - Library functions (strings and characters manipulation) - Passing arguments to functions – Recursion. Introduction to Pointers: Understanding pointers - Accessing address of a variable - Declaring pointer variables - Initialization of pointer variables - Accessing a variable through its pointer - Parameter passing mechanisms.

**List of Exercises / Experiments :**

1.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving sequential, selective and repetitive structures
2.	Programs for demonstration of working of different types of operators like arithmetic, logical, relational and ternary operators involving sequential structures
3.	Demonstration of programs using decision making statements namely 'if', 'else if', 'switch', conditional and unconditional 'goto' (selective structures)
4.	Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (iterative structures)
5.	Demonstration of programs for declaration, initialization and performing operations on one-dimensional and two-dimensional numeric arrays
6.	Demonstration of programs for implementing various string operations like 'copy', 'finding length', 'compare', 'concatenate' with and without built-in library functions.
7.	Demonstration of programs for making use of user-defined data types namely structures and unions
8.	Demonstration of modular programming concepts using functions – developing programs using built-in and user-defined functions and parameter passing mechanisms

**Lecture:30, Practical:30, Total:60****TEXT BOOK:**

1.	"Problem Solving and Programming", compiled by Department of CSE, Kongu Engineering College, Internal circulation, 2017.
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**REFERENCES:**

1.	Dromey R.G., "How to Solve it by Computer", Pearson Education, 2009.
2.	Balagurusamy E., "Fundamentals of Computing and Programming", Tata McGrawHill Education Pvt. Ltd., 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the characteristics, organisation, working principles and applications of computers	Understanding (K2)
CO2	express the solution for the given real world problems in terms of algorithm, flowchart and pseudocode	Applying (K3)
CO3	identify the appropriate looping and control statements in C for providing the solution to the given problems	Understanding (K2)
CO4	demonstrate the usage of arrays, strings and structures to solve the given problems	Understanding (K2)
CO5	apply fundamental modular programming knowledge to solve the given problems and recall the basic concepts of pointers	Understanding (K2)
CO6	demonstrate the execution of flowchart for the given problem using Raptor	Applying (K3), Precision (S3)
CO7	demonstrate the application of control statements using simple C programs	Applying (K3), Precision (S3)
CO8	implement solutions to the given problem using user defined functions and data types	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	2	2	2		2									
CO3		2	1											
CO4		2	1											
CO5		2	1											
CO6	3	2	1	1	1					1				
CO7	3	2	1	1	1					1				
CO8	3	2	1	1	1					1				

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET21 - ELEMENTS OF CIVIL ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To give an understanding to the students about the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering						
<b>Unit - I</b>	<b>Overview of Civil Engineering:</b>						<b>9</b>
History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering.							
<b>Unit - II</b>	<b>Fundamentals of Building Materials:</b>						<b>9</b>
Bricks – stones – sand – cement – fly ash - silica fume - mortar- concrete – steel – glass - wood –plastics – ceramics.							
<b>Unit - III</b>	<b>Components of Building:</b>						<b>9</b>
Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing- weathering course.							
<b>Unit - IV</b>	<b>Infrastructure:</b>						<b>9</b>
Infrastructure - smart cities, transportation - roads, railways, metro rail, airports, docks and harbors. Bridges - tall structures - water retaining structures.							
<b>Unit - V</b>	<b>Digitalization in Civil Engineering:</b>						<b>9</b>
Remote sensing - applications of GIS and GPS- total station - LIDAR survey- automated integrated system and its application in transportation - construction automation and robotics - introduction to 3D printing - building information modeling - typical software used in Civil Engineering.							

**Total:45****TEXT BOOK:**

1.	Palanichamy M.S., "Basic Civil Engineering", 1 <sup>st</sup> Edition, Tata McGraw-Hill, New Delhi, 2006.
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**REFERENCES:**

1.	Anurag Kandya, "Elements of Civil Engineering", 3 <sup>rd</sup> Edition, Charotar Publishing House Pvt. Ltd, Gujarat, 2017.
2.	Poonam Sharma & Swati Rajput, "Sustainable Smart Cities in India - Challenges and Future Perspectives", 1 <sup>st</sup> Edition, Springer, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	recall the various aspects of Civil Engineering	Remembering (K1)
CO2	summarize the properties and applications of building materials	Understanding (K2)
CO3	explain the elements of a building	Understanding (K2)
CO4	summarize different infrastructures	Understanding (K2)
CO5	identify the various digital techniques in Civil Engineering	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					1							2	1
CO2	2	1				2							3	2
CO3	2	1				2							3	2
CO4	2	1				2							3	2
CO5	3	2	1			3							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	60	40					100
CAT2	30	70					100
CAT3	10	70	20				100
ESE	20	70	10				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18VEC11 - VALUE EDUCATION**  
(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	HS	2	0	1	1

Preamble	The aim of the course is to make the students to understand the purpose and value of life and to exhibit positive human values.						
<b>Unit - I</b>	<b>Philosophy of Life Science:</b>						
	Life - Purpose of life (four stages of life) - Philosophy of life (who am I) – Law of nature (cause of the life and body) - Content of the Life (five sheaths) - Goal of life. Five duties in life. Methodology: Life and messages of spiritual and national leaders - The forgotten hero, etc. Project report: Complementing with happiness - Every soul is potentially divine.						
<b>Unit - II</b>	<b>Human Values - Moral Foundation:</b>						
	Truth, forgiveness, compassion, endurance, humility, non violence, moderate diet, non stealing, self purification, self discipline, self study, content, cleanliness, honesty, and totality in faith - Good habits - Attitude forming for Individual peace. Practical Methods: Personal experience with above characters, Puranic Stories - Self resolve diary maintenance.						
<b>Unit - III</b>	<b>Social Values:</b>						
	Family - Family System - Greatness of women - World brotherhood (vasudeiva kudumbagam) - Glorious Bharath - Bharathian systems - Past-Present-Future - Team spirit - Goal setting - Economics - Education - Politics - Responsibilities of people - Preserving natural resources. Methodology: Preparing an album on glorious Bharath Past, Present and Future Plans. Goal setting - Management Games. Team Spirit - Yogic Games.						
<b>Unit - IV</b>	<b>Development of Mental Prosperity:</b>						
	Prosperity of mind - Functions of mind - Obstacles of mind - Practical method to perfect mind is yoga - Types - Uses - Precaution - Contradiction - Kriyas - Asanas - Pranayamas - Meditative techniques. Methodology: Asana - Pranayama - Cyclic meditation - Nada anu sandhana - Meditation - Yogic games for memory. Album on asanas, pranayama and mantra.						
<b>Unit - V</b>	<b>Maintenance of Physical Health:</b>						
	Human body - Structure - Ten Systems of the body as per modern science. Five elements - Harmonious relationship - Life force - Conserving vitality and health through natural life - Pranic food and its importance - Uses of herbs - Right way of cooking to preserve nutrients - Cause of the disease - Acute and chronic - Disease - Life and death. Methodology: Natural food making, traditional millet dishes. Asanas, pranayamas, cleansing procedures, Quiz on healthy living, Uses of herbs or kitchen garden.						

**List of Exercises / Experiments:**

1.	List of Loosening Exercises: Neck Movements, Shoulder Joint Movements, Elbow Joint Movement, Wrist Joint Movements, Finger Joint Movements, Rip Joint Movement, Hip Joint Movements, Spinal Cord Movement, Knee Joint Movements, Ankle Joint Movements, Toe Joint Movements.
2.	List of Asanas: Surya Namaskara, Shavasana, Makarasanas, Uttanpadasana, Pawanamuktasana, Sedubandasana, Naukasana, Vipareetakarani, Bhujangasana, Sarpasana, Shalabasana, Dhanurasana, Padmasana, Parvatasana, Vakrasana, Janu Sirashasana, Ustrasana, Yoga Mudra, Meru Tandasana, Tadasana, Katichakrasana, Paadahastana, Parivarta Trikonasana, Ardha Chakrasana, Viruksasana.
3.	List of Pranayamas: Naadi Sodhana Pranayama, Bhastrika Pranayama, Bhramari Pranayama, Sheetal Pranayama.

**Lecture:20, Practical:10, Total:30**

**TEXT BOOK:**

1.	Value Education, "Compiled by Vethathiri Maharishi Institute for Spiritual and Intuitional Education", Aliyar, Pollachi, 2018.
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**REFERENCES:**

1.	Value Education - Yoga Practical Guide, "Compiled by Padmasoorya Naturopathy and Yoga Foundation", Coimbatore, 2018.
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<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the purpose and value of life.	Understanding (K2)
CO2	exhibit positive human values.	Understanding (K2)
CO3	understand social values.	Understanding (K2)
CO4	take steps to develop mental and physical health	Applying (K3), Imitation (S1)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3				3		
CO2						3		3				3		
CO3						3		3				3		
CO4						3		3				3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1							0
CAT2							0
CAT3							0
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MAC31 - MATHEMATICS III**

(Common to Civil Engineering, Mechanical Engineering, Mechatronics Engineering, Automobile Engineering, Electronics And Communication Engineering, Electrical And Electronics Engineering, Electronics And Instrumentation Engineering, Chemical Engineering & Food Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>BS</b>	<b>3</b>	<b>1*</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	To provide the skills for solving the real time engineering problems involving partial differential equations and impart knowledge in Fourier transform and Z-Transform.						
<b>Unit - I</b>	<b>Fourier Series:</b>						<b>9</b>
Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.							
<b>Unit - II</b>	<b>Partial Differential Equations:</b>						<b>9</b>
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients.							
<b>Unit - III</b>	<b>Applications of Partial Differential Equations:</b>						<b>9</b>
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).							
<b>Unit - IV</b>	<b>Fourier Transform:</b>						<b>9</b>
Fourier Integral theorem (without proof) – Fourier transform pair – Properties (without proof) – Transforms of simple functions – Fourier Sine and Cosine transforms – Properties (without proof) – Convolution theorem and Parseval's identity (Statement and applications only).							
<b>Unit - V</b>	<b>Z –Transform:</b>						<b>9</b>
Definition – Z-transform of some basic functions – Elementary properties – Inverse Z- transform: Partial fraction method – Residue method – Convolution theorem – Applications of Z-transforms: Solution of difference equations.							

**List of Exercises / Experiments :**

1.	Expressing given function in terms of Fourier series.
2.	Harmonic Analysis of given data.
3.	Solving second order partial differential equations.
4.	Solution of One dimensional wave equation.
5.	Solution of Two dimensional heat equation.
6.	Determining Fourier and inverse Fourier transform of a given function.
7.	Computing Z- transform of a discrete sequence.
8.	Apply Z- transforms to obtain the solution of difference equations.

**\*Alternate Weeks****Lecture:45, Tutorial and Practical:15, Total:60****TEXT BOOK:**

1.	Veerarajan T., "Transforms and Partial Differential Equations", 3 <sup>rd</sup> Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
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**REFERENCES:**

1.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10 <sup>th</sup> Edition, John Wiley & Sons Ltd., USA, 2019.
2.	Duraisamy C., Vengataasalam S., Arun Prakash K. & Suresh M., "Engineering Mathematics – III", 2 <sup>nd</sup> Edition, Pearson India Education, New Delhi, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	express given function or data in terms of Fourier series	Applying (K3)
CO2	solve the given standard partial differential equations	Applying (K3)
CO3	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations	Applying (K3)
CO4	use the mathematical principles of Fourier transforms which will provide the ability to formulate and solve some of the physical problems of engineering	Applying (K3)
CO5	apply Z transform techniques for analyzing linear time invariant systems	Applying (K3)
CO6	express the given data in Fourier series using MATLAB	Applying (K3), Manipulation (S2)
CO7	solve partial differential equations using PDE Modeler	Applying (K3), Manipulation (S2)
CO8	find Fourier and Z-Transforms using MATLAB built in functions	Applying (K3), Manipulation (S2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1										
CO2	3	3	1	1										
CO3	3	3	1	1										
CO4	3	3	1	2										
CO5	3	3	1	2										
CO6					3									
CO7					3									
CO8					3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	10	70				100
CAT2	20	10	70				100
CAT3	20	10	70				100
ESE	20	10	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET31 - ENGINEERING GEOLOGY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>ES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand about the geological process, classification, morphology of rocks, and the importance of the study of geology for civil engineers with regard to the selection of appropriate site for their projects like dams, bridges, buildings, etc..						
<b>Unit - I</b>	<b>General Geology:</b>						<b>9</b>
Importance of geology in civil engineering – Earth structures and its composition - Earth processes: Weathering, work of rivers, wind and their engineering importance - Plate tectonics - Groundwater: Origin, mode of occurrence, vertical distributions and types of aquifers – Earthquake: Causes – Engineering importance - Seismic zones of India.							
<b>Unit - II</b>	<b>Mineralogy:</b>						<b>9</b>
Elementary knowledge on symmetry elements of crystallographic systems (normal class) – Index system of Miller - Physical properties of minerals – Study of the rock forming minerals: Quartz family – Feldspar family – Mica minerals: Muscovite and Biotite – Augite - Fundamentals of ore mineral formation.							
<b>Unit - III</b>	<b>Petrology:</b>						<b>9</b>
Rock cycle – Classification and distinction of rocks - Igneous rocks: granite, syenite, basalt and dolerite - Sedimentary rocks: Conglomerate, breccia, sandstone, shale and limestone - Metamorphic rocks: Gneiss, schist, quartzite, slate and marble.							
<b>Unit - IV</b>	<b>Structural Geology and Geophysical Investigations:</b>						<b>9</b>
Attitude of beds: Dip, strike and outcrops – Folds - Faults and Joints - causes and types – bearing on engineering construction – Electrical resistivity survey for civil engineering investigations.							
<b>Unit - V</b>	<b>Geological Investigations in Civil Engineering:</b>						<b>9</b>
Basic principles of remote sensing techniques - Types of remote sensing data - platforms – atmospheric windows – Electromagnetic spectrum - Applications of remote sensing – Geological considerations for construction of dam, reservoir and tunnels – landslides – causes and preventions.							

**Total:45****TEXT BOOK:**

1.	Duggal S.K., Pandey H.K. & Rawal N., “Engineering Geology”, 5 <sup>th</sup> Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2017.
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**REFERENCES:**

1.	Subinoy Gangopadhyay, “Engineering Geology”, 1 <sup>st</sup> Edition, Oxford University Press India, 2012.
2.	Marland P. Billings, “Structural Geology”, 3 <sup>rd</sup> Edition, Pearson Education India, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	retrieve different earth surface process	Remembering (K1)
CO2	describe the minerals with reference to their properties	Understanding (K2)
CO3	classify the different characteristics and types of rocks	Analyzing (K4)
CO4	employ the geological structures in the field	Applying (K3)
CO5	execute the suitable site for constructions of civil engineering projects	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					2							2	1
CO2	2	1				2							3	2
CO3	3	3	2			3	1					1	3	3
CO4	3	2	1			3	1					1	3	3
CO5	3	3	2			3	1					1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	60	40					100
CAT2	10	30	30	30			100
CAT3	20	40	40				100
ESE	10	20	40	30			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET32 - ENGINEERING MECHANICS FOR CIVIL ENGINEERS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>ES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Preamble** This course provides an introduction to the basic concepts of forces, inertias, centroids and moments of area and techniques of finding their effects on motion. It introduces the phenomenon of friction and its effects.

**Unit - I** **General Principles:** **9+3**

Engineering Mechanics - Units of measurements - SI units - Law of mechanics - General procedure of analysis and resolution - System of forces - Scalars and vectors - Vector operations - Vector addition of forces - Cartesian vectors - Addition of Cartesian vectors - Position vectors - Dot product - Equilibrium of particles - Condition for the equilibrium of a particle - Free body diagram - Internal forces in structures - Coplanar force system.

**Unit - II** **Statics of Rigid Bodies:** **9+3**

Types of supports and reactions - Moment of a force - Moment of a couple - Equilibrium of rigid bodies in two dimensions - Conditions for rigid body equilibrium - Free body diagram - Varignon's theorem - Equilibrium equations. Simple trusses - Method of joints - Method of sections.

**Unit - III** **Dry friction and Moments of Inertia:** **9+3**

Friction - Characteristics of dry friction - Laws of friction - Applications - Problems involving wedges, screws and flat belts. Centre of gravity and centroid - Centre of mass and centroid of a body - Theorems of Pappus and Guldinus. Mass moment of Inertia - Parallel axis theorem - Radius of gyration - Product of Inertia - Moments of inertia of area.

**Unit - IV** **Kinematics and Kinetics of Particles:** **9+3**

Rectilinear kinematics - Continuous motion - Curvilinear motion - Normal, tangential and cylindrical components D' Alembert's principle - Types of energy. Kinetics of particle - Force and acceleration - Newton's law - Energy methods - Principle of virtual work and Euler's equations of motion.

**Unit - V** **Impulse and Momentum:** **9+3**

Principles of linear impulse and momentum - Impact of elastic bodies - angular momentum - relation between moment of a force and angular momentum - Principle of angular impulse and momentum.

**Lecture:45, Tutorial:15, Total:60**

**TEXT BOOK:**

- Hibbeler R.C., "Engineering Mechanics Statics and Dynamics", 14<sup>th</sup> Edition, Pearson Education India, New Delhi, 2017.

**REFERENCES:**

- Dubey N.H., "Engineering Mechanics Statics and Dynamics", 1<sup>st</sup> Edition, Tata McGraw-Hill, New Delhi, 2013.
- Sinha S.K., "Engineering Mechanics Statics and Dynamics", 1<sup>st</sup> Edition, Pearson Education India, New Delhi, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	evaluate the principles in mechanics, forces and their equilibrium conditions	Analyzing (K4)
CO2	analyze the moment acting on a body due to force and couples	Analyzing (K4)
CO3	determine the frictional forces between the bodies and Moment of Inertia of various sections	Analyzing (K4)
CO4	calculate the forces acting on a particle/body at a kinematic and kinetics conditions	Analyzing (K4)
CO5	apply the relations between moment of force, angular impulse and angular momentum	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	3	2			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	30	50			100
CAT2	10	10	30	50			100
CAT3	10	10	30	50			100
ESE	10	10	30	50			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET33 - MECHANICS OF FLUIDS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Mathematics I &amp; Applied Physics</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To provide a basic knowledge of fluid properties and behaviour of fluids under different conditions, and imparts knowledge on pumps and turbines.						
<b>Unit - I</b>	<b>Fluid Properties and Statics:</b>						<b>9+3</b>
Fluid Properties: Definition, distinction between solid and fluid – Units and dimensions – Properties of fluids – density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension. Fluid Statics: Concept of fluid static pressure, absolute and gauge pressures – pressure measurements by manometers-forces on planes – centre of pressure – forces on immersed bodies - buoyancy and Metacentre.							
<b>Unit - II</b>	<b>Fluid Kinematics:</b>						<b>9+3</b>
Fluid Kinematics – Classification and types of flow – Velocity field and Acceleration – Continuity equation (one, two, and three-dimensional differential forms) - stream line-streak line-path line- stream function – velocity potential function – Flow net.							
<b>Unit - III</b>	<b>Fluid Dynamics:</b>						<b>9+3</b>
Euler and Bernoulli's equations – Application of Bernoulli's equation – Discharge measurement – Laminar flows through pipes and between plates – Hagen Poiseuille equation – Darcy-Weisbach formula - Major and minor losses of flow in pipes - Moody Diagram - Momentum Principle - Applications.							
<b>Unit - IV</b>	<b>Pumps:</b>						<b>9+3</b>
Basics of hydraulic Machines – Impact of Jets – Pumps – Classification – Specific Speed of pumps- Centrifugal pump – Single stage – Multistage Pumps – Working Principle and Work done - Reciprocating pump – Single acting and double acting – Slip – Negative slip – Air vessels – Effect of Acceleration with respect to suction and delivery pipes – Basic principles of Indicator diagram.							
<b>Unit - V</b>	<b>Turbines:</b>						<b>9+3</b>
Turbines – Classification – Efficiency and Specific speed of turbines - construction of velocity triangles - Radial flow turbines – Inward and outward turbines - Axial flow turbines – Working Principle of Impulse and reaction turbines – Draft tube - types - Cavitation and its effect – Performance curves of turbines.							

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1.	Victor L. Streeter, Benjamin E. Wylie & Bedford K.W., "Fluid Mechanics", 9 <sup>th</sup> Edition, McGraw Hill, India, 2010.
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**REFERENCES:**

1.	Douglas J.F., Gasirock J.M.& Swaffield J.A., "Fluid Mechanics", 14 <sup>th</sup> Edition, Pearson Education Publishers, India, 2002.
2.	Modi P.N.& Seth S.M., "Hydraulics and Fluid Mechanics Including Hydraulic Machines", 14 <sup>th</sup> Edition, Standard Book House, New Delhi, 2002.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	calculate hydro static forces on plane and curved surfaces.	Applying (K3)
CO2	determine velocity using analytical and empirical formulae.	Applying (K3)
CO3	compute discharge, major and minor losses in pipe flow.	Applying (K3)
CO4	measure the performance characteristics of pumps.	Applying (K3)
CO5	analyze the performance of turbines.	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60				100
CAT2	20	20	60				100
CAT3	15	20	55	10			100
ESE	10	20	60	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





**18CET34 - CONCRETE TECHNOLOGY**  
(IS 456- 2000 & IS 10262 - 2019 are permitted)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Introduction to Engineering, Elements of Civil Engineering	3	PC	3	0	0	3

Preamble	This course gives a knowledge about the various ingredients and properties of materials for concrete by suitable tests, mix design for concrete and special concretes.						
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<b>Unit - I</b>	<b>Constituents of Concrete:</b>	<b>9</b>
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Cement - ASTM classification of Cement - Manufacturing - Types of cement - Chemical composition and physical properties - Hydration - Testing - IS Specifications Aggregates - Classification- Types of aggregates – Physical and Mechanical properties - Tests - Importance of grading - Interfacial transition zone - M-Sand - Water- Quality of water for use in concrete - Use of sea water and its effects in concrete.

<b>Unit - II</b>	<b>Admixtures in Concrete:</b>	<b>9</b>
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Functions, Classification, Types, Effects of admixture on concrete properties - Mineral Admixtures - Chemical Admixtures – Compatibility of concrete chemicals - IS Specifications.

<b>Unit - III</b>	<b>Properties of Concrete and Quality Assessment:</b>	<b>9</b>
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Workability - tests for workability of concrete - Segregation and bleeding - Creep, shrinkage and temperature effects of concrete - Determination of strength Properties of hardened concrete - Gain of strength with age - Stress and strain characteristics of concrete-Rebound hammer - Ultrasonic pulse velocity test.

<b>Unit - IV</b>	<b>Special Concretes:</b>	<b>9</b>
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Light weight concrete – High density concrete – High performance concrete - Foam concrete – Self compacting concrete – Vacuum concrete – High strength concrete – Bacterial concrete – Fiber reinforced concrete – Ferrocement – Ready mix concrete – SIFCON – Shotcrete – Polymer concrete – Geopolymer concrete – Pumped concrete – Roller compacted concrete.

<b>Unit - V</b>	<b>Mix Proportioning and Durability:</b>	<b>9</b>
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Principles of mix proportioning - Factors influencing mix design - Different methods of mix design - IS method and ACI method. Durability of concrete – Chemical attack - Corrosion of steel in concrete – Causes-effects - remedial measures.

**Total:45**

**TEXT BOOK:**

1. Neville A.M., "Concrete Technology", 27 <sup>th</sup> Edition, Pearson India Education, New Delhi, 2019.
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**REFERENCES:**

1. Santhakumar A.R., "Concrete Technology", 2 <sup>nd</sup> Edition, Oxford University Press, India, 2018.
2. Gambhir M.L., "Concrete Technology", 5 <sup>th</sup> Edition, McGraw Hill Education, Bengaluru, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	determine the properties of various constituents present in concrete	Applying (K3)
CO2	utilize various admixtures and the effect of admixtures on properties of concrete	Applying (K3)
CO3	summarize the properties of fresh and hardened concrete	Understanding (K2)
CO4	apply the special concretes and their applications	Applying (K3)
CO5	compute the design mix for various grades of concrete as per IS and ACI standards with durability requirements	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2							3	3
CO2	3	2	1			2							3	3
CO3	2	1				2							3	2
CO4	3	2	1			2							3	3
CO5	3	2	1			3	1					2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	60	30				100
CAT3	15	55	30				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 18CET35 - SURVEYING AND GEOMATICS

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	3	0	0	3

Preamble	This course is designed to impart knowledge about to prepare the topographical map, area and volume calculation and to locate the points.						
<b>Unit - I</b>	<b>Chain and Compass Surveying:</b>						<b>9</b>
Definition - Principles - Classification – Plans and maps - Scales - Ranging and chaining - well conditioned triangle -Corrections - Prismatic compass – Surveyors compass - Bearing - Systems and conversions -True and magnetic bearings -Dip and declination - Local attraction - Adjustment of errors.							
<b>Unit - II</b>	<b>Leveling and Contouring:</b>						<b>9</b>
Level line - Horizontal line - Spirit level- Mean sea level - Sensitiveness - Bench marks – Leveling instruments - Types of leveling - Booking and reduction - Curvature and refraction - Calculation of areas and volumes - Contouring - Characteristics and uses of contours -Calculation of earth work volume - Capacity of reservoirs.							
<b>Unit - III</b>	<b>Theodolite Surveying and Curve Setting:</b>						<b>9</b>
Theodolite - Description and uses - Horizontal angles - Vertical angles - Traversing - Closing error and distribution - Omitted measurements - Curves –types - components and elements of simple curve -Setting out a simple curve by Rankine's method and two theodolite method - Transition curves - Functions and requirements.							
<b>Unit - IV</b>	<b>Tacheometric and Triangulation Surveying:</b>						<b>9</b>
Tacheometric systems – Tangential and stadia methods - Stadia systems - Horizontal and inclined sights - Vertical staffing - Fixed hairs - Determination of stadia constants - Anallactic lens - Triangulation - Corrections - Satellite station - Reduction to centre - Trigonometric leveling - Single and reciprocal observations.							
<b>Unit - V</b>	<b>Photogrammetric Surveying, Total Station and Remote Surveying:</b>						<b>9</b>
Introduction, basic concepts, aerial photogrammetry, terrestrial photogrammetry, stereoscopy, types of EDM instruments. Total station - Fundamental measurements - Horizontal and vertical angle - Slope distance - Advantages and applications, Principles of remote sensing and applications in surveying.							

**Total:45****TEXT BOOK:**

1. Duggal S.K., "Surveying", 4 <sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2013.
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**REFERENCES:**

1. Subramanian R., "Surveying and Levelling", 2 <sup>nd</sup> Edition, Oxford University Press, Noida, 2013.
2. Roy S.K., "Fundamentals of Surveying", 2 <sup>nd</sup> Edition, PHI Learning Pvt. Ltd, New Delhi, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	carry out the chain and compass surveying	Applying (K3)
CO2	compute the volume of earth works	Applying (K3)
CO3	carry out the adjusting of closed traverse for errors and setting out the simple curves	Applying (K3)
CO4	execute the Tacheometric and Triangulation Survey	Applying (K3)
CO5	apply the principles, concepts and applications of Photogrammetric Surveying, EDM equipments, Total station and Remote sensing	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						2	3	3
CO2	3	2	1			3						2	3	3
CO3	3	2	1			3						2	3	3
CO4	3	2	1			3						2	3	3
CO5	3	2	1			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	30	30	40				100
ESE	20	20	60				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEL31 - FLUID MECHANICS LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; CIVIL ENGINEERING</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Applied Physics, Mathematics</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This course is designed to provide hands on experience and acquiring practical knowledge of fluid flow and machinery related problems.						

**List of Exercises / Experiments:**

1.	Discharge measurement: Determination of co-efficient of discharge through orifice and mouthpiece
2.	Notches: Determination of co-efficient of discharge of notches
3.	Venturimeter: Determination of co-efficient of discharge of venturimeter through Bernoulli's equation
4.	Orificemeter: Determination of co-efficient of discharge of orificemeter through Bernoulli's equation
5.	Vanes: Determination of efficiency by impact of jet on vanes
6.	Losses in Pipes: Analyze the friction losses happening in pipes
7.	Analyze the various types of minor losses occurring in pipes
8.	Sketch the performance characteristics of Pelton wheel
9.	Sketch the performance characteristics of Francis turbine
10.	Assess the performance characteristics of centrifugal pump by varying pressure
11.	Assess the performance characteristics of reciprocating pump by varying pressure
12.	Assess the performance characteristics of submersible pump

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	calculate the rate of flow of fluids	Applying (K3), Manipulation (S2)
CO2	analyze the major and minor losses in pipelines	Analyzing (K4), Manipulation (S2)
CO3	sketch the performance characteristic curve of turbines and pumps	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**18CEL32 - CONCRETE TECHNOLOGY LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This lab would enhance the knowledge on various tests on concrete ingredients.						

**List of Exercises / Experiments:**

1.	Determination of specific gravity for cement, fine aggregate and coarse aggregate
2.	Determination of fineness modulus for fine aggregate and coarse aggregate by Sieve Analysis
3.	Determination of fineness and soundness test on cement
4.	Determination of consistency and initial setting time of cement
5.	Computation of optimum dosage of super plasticizer using Marsh Cone apparatus
6.	Determination of compressive strength on cement mortar
7.	Examine the fresh concrete properties using Slump cone, Compaction Factor apparatus and Vee-bee Consistometer
8.	Evaluate the hardened properties of concrete under compressive strength, flexural strength and split tensile strength
9.	Compute the strength of hollow blocks, solid blocks and paver blocks
10.	Assess the quality of concrete structures using Rebound Hammer and Ultrasonic Pulse Velocity
11.	Determine the chloride content in concrete using Rapid Chloride Permeability apparatus
12.	Study on accelerated corrosion test as per codal recommendations

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	determine the properties of various ingredients of concrete	Applying (K3), Manipulation (S2)
CO2	prepare the different concrete mixes and check the properties of concrete	Applying (K3), Manipulation (S2)
CO3	examine the durability properties of hardened concrete	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	2		3	2	1	1			2	3	3
CO2	3	2	1	2		3	2	1	1			2	3	3
CO3	3	3	2	2		3	2	1	1			2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



## 18CEL33 - SURVEYING LABORATORY

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This course is designed to impart knowledge in the field of surveying						

**List of Exercises / Experiments:**

1.	Ranging, chain and compass traversing: Measurement of distance, bearings and setting the perpendiculars
2.	Leveling: Determination of elevation of given points
3.	Leveling: Determination of height difference between the points by conducting differential and reciprocal leveling
4.	Theodolite: Determination of distance and elevation by stadia method
5.	Theodolite: Determination of distance and elevation by tangential method
6.	Determination of distance and elevation of points by trigonometric leveling - same vertical plane method
7.	Determination of distance and elevation of points by trigonometric leveling - double vertical plane method
8.	Measurement of distance, elevation using advanced total station
9.	Measurement of area using advanced total station
10.	Setting out works using advanced total station - foundation, column marking
11.	Contouring using advanced total station
12.	Study on plotting the graph by using the output from advanced total station

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	apply chain, compass and tape in the field of surveying	Applying (K3), Manipulation (S2)
CO2	find the level differences and distances between the points	Applying (K3), Manipulation (S2)
CO3	analysis the various topography using total station	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**18MAC41 - STATISTICS AND NUMERICAL METHODS**

(Common to Civil Engineering, Mechanical Engineering, Mechatronics Engineering, Automobile Engineering, Electrical And Electronics Engineering , Electronics And Instrumentation Engineering, Chemical Engineering &amp; Food Technology Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>BS</b>	<b>3</b>	<b>1*</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	To impart knowledge in testing of samples, ANOVA and interpolation. Also develop skills to apply numerical algorithms to identify roots of algebraic and transcendental equations and solve linear and ordinary differential equations.
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<b>Unit - I</b>	<b>Testing of Hypothesis:</b>	<b>9</b>
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Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for significance of means – F-test for comparison of variances – Chi-square test for goodness of fit and independence of attributes

<b>Unit - II</b>	<b>Design of Experiments:</b>	<b>9</b>
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Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.

<b>Unit - III</b>	<b>Solution to Algebraic and Transcendental Equations:</b>	<b>9</b>
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Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss - Jordan method – Iterative methods: Gauss Jacobi and Gauss-Seidel methods.

<b>Unit - IV</b>	<b>Interpolation, Numerical Differentiation and Integration:</b>	<b>9</b>
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Interpolation: Interpolation with equal intervals: Newton's forward and backward difference formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula. Numerical Differentiation and Integration: Differentiation using Newton's forward and backward interpolation formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule.

<b>Unit - V</b>	<b>Numerical Solution of First order Ordinary Differential Equations:</b>	<b>9</b>
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Single step methods: Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.

**List of Exercises / Experiments:**

1.	Testing significance of means by student's t – test
2.	Testing the independence of attributes by Chi-square test
3.	Analyze the difference in means is statistically significant by Completely Randomized Design
4.	Finding positive root by Regula – Falsi method
5.	Solving simultaneous linear equations by Gauss – Seidel Method
6.	Evaluating definite integrals by Trapezoidal and Simpson's rules
7.	Solution of ODE by Euler and Modified Euler methods
8.	Solution of ODE by Runge-Kutta method

**\*Alternate Weeks****Lecture:45, Tutorial and Practical:15, Total:60****TEXT BOOK:**

1.	Veerarajan T. & Ramachandran T. , "Statistics and Numerical Methods ", 1st Edition, Tata McGraw Hill Education, New Delhi, 2018.
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**REFERENCES:**

1.	Jay L. Devore. , "Probability and Statistics for Engineering and the Sciences " , 9th Edition, Cengage Learning , USA, 2016.
2.	Steven C. Chapra & Raymond P. Canale. , "Numerical Methods for Engineers " , 7th Edition, McGraw-Hill Education, New York, 2014.





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify large and small samples and apply suitable tests for solving engineering problems	Applying (K3)
CO2	handle experimental data with the knowledge of ANOVA	Applying (K3)
CO3	apply various numerical techniques to solve algebraic and transcendental equations	Applying (K3)
CO4	compute intermediate values of given data, numerical derivatives and integral values	Applying (K3)
CO5	obtain the solution of ordinary differential equations numerically	Applying (K3)
CO6	test whether the given data is significant by hypothesis testing and ANOVA using MATLAB	Applying (K3), Manipulation (S2)
CO7	use MATLAB for determining numerical solutions of algebraic equations and integral values	Applying (K3), Manipulation (S2)
CO8	obtain the numerical solution of ordinary differential equations using MATLAB	Applying (K3), Manipulation (S2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2										
CO2	3	1	2	2										
CO3	3	2	1	1										
CO4	3	1	1	1										
CO5	3	2	1	1										
CO6					3									
CO7					3									
CO8					3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET41 - OPEN CHANNEL FLOW**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Mechanics of Fluids</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge among students towards different types of fluids and its flow characteristics in open channels						
<b>Unit - I</b>	<b>Open Channel Flow:</b>						<b>9</b>
Types and regimes of flow – Channel hydraulics – Velocity distribution in open channel – Wide open channel – Specific energy – Minimum specific energy – Energy depth relationship – Applications – Critical flow and its computation							
<b>Unit - II</b>	<b>Uniform Flow:</b>						<b>9</b>
Flow measurements in channels – Velocity measurement by Manning 's and Chezy 's formula – Normal depth and velocity – Most economical sections (rectangular, trapezoidal and circular sections) – Non-erodible channels							
<b>Unit - III</b>	<b>Varied Flow:</b>						<b>9</b>
Equation of gradually varied flow – Characteristics and types of flow profiles – Draw down and back water curves – Surface Profile Calculation – Graphical integration and direct step method – Weirs and spillways							
<b>Unit - IV</b>	<b>Flow through Non-Prismatic Channels:</b>						<b>9</b>
Hydraulic Jumps – Surges – Types – Flow through culverts – Flow through bridges, piers, obstructions, channel junction – Boundary layer and thickness							
<b>Unit - V</b>	<b>Dimensional and Model Analysis:</b>						<b>9</b>
Dimensional Analysis – Dimensional parameters – Rayleigh 's method, Buckingham 's Pi theorem – Similitude and models – Scale effect and distorted models							

**Total:45****TEXT BOOK:**

1.	Glenn E. Moglen, "Fundamentals of Open Channel Flow", 1 <sup>st</sup> Edition, Taylor & Francis, NewDelhi, 2014.
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**REFERENCES:**

1.	Subramanya K., "Flow in Open Channels", 4 <sup>th</sup> Edition, Tata Mc Graw Hill, New Delhi, 2010.
2.	Hanif Chaudhry M., "Open Channel Flow", 2 <sup>nd</sup> Edition, Springer, New Delhi, 2007.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	classify different types of flow and compute the components related to critical flow	Applying (K3)
CO2	measure velocity and determine the section to be most economical	Applying (K3)
CO3	identify the flow profile for gradually varied flow	Applying (K3)
CO4	calculate the parameters of jumps and surges and determine the flow through non prismatic channels	Applying (K3)
CO5	analyze dimensional and model parameters to solve complex fluid problems	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60				100
CAT2	20	20	60				100
CAT3	15	20	55	10			100
ESE	10	20	60	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 18CET42 - MECHANICS OF MATERIALS

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Engineering Mechanics for Civil Engineers</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	This course would bring knowledge among students about the stresses and strains, shear force and bending moments due to various types of loading, deflection of beam due to various loading and behaviour of circular shafts due to torsion. It also enhances practical application of bending equation.						
<b>Unit - I</b>	<b>Stresses and Strain:</b>						<b>9+3</b>
Introduction - Stresses and strains - Axially loaded bars - Axial loading - St.Venant's principle - Shear stress - Bending stress - Stress analysis - Stress and strain diagram - Generalized Hooke's law - Poisson's ratio - Elastic constants - Thermal stresses - Deformation of simple and compound bars - Thin cylinder.							
<b>Unit - II</b>	<b>Shear Force and Bending Moments in Beams:</b>						<b>9+3</b>
Supports and loads - Types of beams - Bending moment and shear force - Sign conventions - Distributed loading - Concentrated loading and couples - Shear force and Moment diagrams.							
<b>Unit - III</b>	<b>Stresses in Beams:</b>						<b>9+3</b>
Bending stress - Assumptions - Compatibility equation (bending equation) - Equilibrium - Shear stress distribution in beam - Practical application of bending equation - Economic sections.							
<b>Unit - IV</b>	<b>Deflection of Beams:</b>						<b>9+3</b>
Double integration method - Slope and deflection method - Moment area method - Macaulay's Method - Conjugate beam method.							
<b>Unit - V</b>	<b>Torsion and Theory of Column:</b>						<b>9+3</b>
Torsion of circular shafts - Assumptions - Compatibility - Equilibrium - Torsion formulae - Power transmission. Critical load - Definition of critical load - Discussion of critical loads - Eccentric loads - Euler's and Rankine's formula - Long and short column - Effective length.							

Lecture:45, Tutorial:15, Total:60

**TEXT BOOK:**

1.	Purushothama Raj P. and Ramasamy V., "Strength of Materials", 1 <sup>st</sup> Edition, Pearson Education India, New Delhi, 2012.
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**REFERENCES:**

1.	Subramanian R., "Strength of Materials", 2 <sup>nd</sup> Edition, Oxford University Press, USA, 2007.
2.	Ferdinand Pierre Beer, Elwood Russell Johnston, John T. De Wolf & David Francis Mazurek, "Mechanics of Materials", 7 <sup>th</sup> Edition, McGraw-Hill Education, New Delhi, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	determine the various types of stresses and strain	Applying (K3)
CO2	calculate the critical position of loads which give the maximum moments/shear over beam member	Applying (K3)
CO3	select the economic section by analyzing the bending and shear stresses in beam	Applying (K3)
CO4	determine the deflection of beams by various methods	Applying (K3)
CO5	analyze the torsional behavior and column loads	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3						1	3	3
CO2	3	3	2			3						1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	30	50			100
CAT2	10	10	30	50			100
CAT3	10	10	30	50			100
ESE	10	10	30	50			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CET43 - SOIL MECHANICS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart basic knowledge on the index properties, engineering properties and classification of soil particles. Also to acquire knowledge on various concepts such as permeability, stress distribution, settlement, shear strength and slope stability.						
<b>Unit - I</b>	<b>Soil Classification and Compaction:</b>						<b>9</b>
Formation of soil - Soil description - Particle behavior -Soil structure - Phase relationship - Index properties - Significance - Soil classification - Compaction of soils - Theory and factors influencing compaction of soils - Field compaction methods.							
<b>Unit - II</b>	<b>Permeability and Effective Stress:</b>						<b>9</b>
Flow of water through soils - Capillary phenomena – Darcy's law -permeability - factors affecting permeability - Coefficient of permeability - Effective stress concepts in soils - quick sand conditions - Seepage - seepage velocity- discharge velocity- Introduction to flow nets - properties and uses.							
<b>Unit - III</b>	<b>Stress Distribution and Settlement:</b>						<b>9</b>
Stress distribution in homogeneous and isotropic medium -Boussinesq theory - Westergaard's theory - Use of New marks influence chart - Components of settlement - immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory - computation of rate of settlement - $\sqrt{t}$ and $\log t$ methods - $e$ - $\log p$ relationship.							
<b>Unit - IV</b>	<b>Shear Strength:</b>						<b>9</b>
Shear strength of cohesive and cohesion less soils - Mohr-Coulomb failure theory - Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests - Pore pressure parameters - Cyclic mobility - Liquefaction.							
<b>Unit - V</b>	<b>Slope Stability:</b>						<b>9</b>
Stability Analysis - Infinite slopes and finite slopes - Total stress analysis for saturated clay - Friction circle method - Use of stability number - Method of slices - Application of geosynthetics in slope protection - Geo-textile.							

**Total:45****TEXT BOOK:**

- |   |
|---|
| 1. Murthy V.N.S., "Soil Mechanics and Foundation Engineering", 1 <sup>st</sup> Edition, CBS Publishers Distribution, New Delhi, 2015. |
|---|

**REFERENCES:**

- |   |
|---|
| 1. Purusothamaraj P., "Soil Mechanics and Foundation Engineering", 2 <sup>nd</sup> Edition, Pearson Education, New Delhi, 2013. |
| 2. Das B.M., "Principles of Geotechnical Engineering", 8 <sup>th</sup> Edition, Cengage Learning, New Delhi, 2015.              |



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	classify the soil and solve three phase system problems	Understanding (K2)
CO2	solve the problems related to effective stress, permeability and seepage	Applying (K3)
CO3	determine vertical stress distribution and settlement in soil	Applying (K3)
CO4	examine the shear strength parameters for various soil conditions	Analyzing (K4)
CO5	analyze the stability of slopes	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	15	40	45				100
CAT3	10	40	35	15			100
ESE	10	35	40	15			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CET44 - TRANSPORTATION ENGINEERING**  
**IRC 37:2012, IRC 58:2002 are Permitted**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To impart knowledge about the history of highway development, planning, design, construction and maintenance of pavement & Traffic characteristics and controls.						
<b>Unit - I</b>	<b>Transportation Infrastructure:</b>						<b>9+3</b>
Highway development in India – Classification of roads – Road patterns – Highway Alignment and Engineering surveys – Highway materials – Soil, Aggregates & Bitumen – Desirable properties and control quality tests.							
<b>Unit - II</b>	<b>Geometric Design:</b>						<b>9+3</b>
Cross-sectional elements – Camber – Sight distances – Design of horizontal alignment – Horizontal curves, Super elevation, widening of curves, Transition curves, Set-back distance – Design of Vertical alignment – Gradients, Grade compensation, Vertical curves.							
<b>Unit - III</b>	<b>Highway Pavements:</b>						<b>9+3</b>
Design factors for flexible and rigid pavements – Design of flexible pavement using IRC: 37-2012 – Stresses, Design of joints, dowel bar, tie bar – Design of rigid pavements using IRC: 58-2002 –Construction Procedure and Distresses in flexible and rigid pavements – Drainage and Pavement Maintenance.							
<b>Unit - IV</b>	<b>Traffic Characteristics:</b>						<b>9+3</b>
Microscopic and Macroscopic parameters of traffic flow – Fundamental relationships– Traffic studies on Flow, Speed, Travel time, Delay and O-D study – PCU – Peak hour factor – Parking study – Accident study and analysis – Statistical Analysis of Traffic data.							
<b>Unit - V</b>	<b>Traffic Control:</b>						<b>9+3</b>
Conflicts at Intersection – Types of Intersections – At-grade Intersection – Grade separated intersections and channelization – Rotary intersection – Traffic signs – Road markings – Traffic control aids – Street furniture – Control devices – Signal design by Webster's method – Signal Coordination – Highway Capacity and level of service of rural highways and urban roads.							

**Lecture:45, Tutorial:15, Total:60**

**TEXT BOOK:**

1. Khanna S.K., Justo C.E.G.& Veeraraghavan A., "Highway Engineering", 10<sup>th</sup> Edition, Nem chand & Bros, Roorkee, 2015.

**REFERENCES:**

1. Kadiyali L.R., "Traffic Engineering and Transport Planning", 9<sup>th</sup> Edition, Khanna Publications, New Delhi, 2016.
2. Srinivasa Kumar R., "A Textbook on Highway Engineering", 1<sup>st</sup> Edition, Orient Blackswan Pvt Ltd, Hyderabad,2011.





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the knowledge of highway planning and testing of materials	Understanding (K2)
CO2	analyze the geometric design elements of highway	Applying (K3)
CO3	apply the design procedure of flexible and rigid pavement	Applying (K3)
CO4	analyze the characteristics of traffic and accident data	Applying (K3)
CO5	design traffic signals and elaborate intersections with traffic control	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEC41 - BUILDING PLANNING AND PRACTICES**

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Elements of Civil Engineering	4	PC	2	0	2	3

Preamble	To gain knowledge on software related to residential, commercial, institutional and industrial building planning by abiding the rules, regulations and the byelaws.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>6</b>
Basic terminologies – Tools and symbols – Doors and windows– fixtures and fasteners –Dimension and space requirement – staircase – foundation –steel truss.							
<b>Unit - II</b>	<b>Functional Requirements of Buildings:</b>						<b>6</b>
Land use classification – Development Control Regulations – Layout regulations – Town and Country Planning ACT – positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.							
<b>Unit - III</b>	<b>Building Planning:</b>						<b>6</b>
Types of buildings – planning standards – specifications – Development of plan, elevation, and section of residential, commercial, institutional and industrial buildings.							
<b>Unit - IV</b>	<b>Building Services:</b>						<b>6</b>
Lighting – ventilation – electrical and allied installations – acoustics – lifts and escalators – plumbing services.							
<b>Unit - V</b>	<b>Building Approvals:</b>						<b>6</b>
Building approval procedure – Review of town and country planning act of Tamilnadu – urban development act – public health act – slum improvement act, housing act – pollution act – heritage act – act's related to environment – legal aspects of ownership – lease and tenancy transfers development management – law relating to utilities and services – Implications of land ceiling act – betterment levy and development charges. Objectives and functioning of TNHB – TNSCB – CMDA – cooperatives and other department agencies.							

**List of Exercises / Experiments:**

1.	Preparation of site plan
2.	Building Components - Doors
3.	Building Components – Windows
4.	Building Components – Trusses
5.	Plan, Section and elevation of various buildings (Single storied building)
6.	Plan, Section and elevation of various buildings (Multi storied building)
7.	Plan, Section and elevation of industrial buildings
8.	Layout of plumbing drawings
9.	Layout of electrical drawings
10.	Preparation of drawings following building Bye Laws

**Lecture:30, Practical:30, Total:60****TEXT BOOK:**

1.	Loyal J.S., "Civil Engineering Drawing", 3 <sup>rd</sup> Edition, Satya Prakashan Publications, Delhi, 2014.
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**REFERENCES:**

1.	Verma B.P., "Civil Engineering Drawing & House Planning", 1 <sup>st</sup> Edition, Khanna Publishers, Delhi, 2008.
2.	Shah M.G.& Kale C.M., "Principles of Building Drawing", 1 <sup>st</sup> Edition, Macmillan Publishers India Ltd., Delhi, 2004.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the various functional requirements in a building	Understanding (K2)
CO2	indicate the rules and bylaws during planning	Understanding (K2)
CO3	prepare the plan of different buildings	Applying (K3)
CO4	sketch the allied services of buildings	Applying (K3)
CO5	summarize about the different ACTS to be followed in construction industry	Understanding (K2)
CO6	make the building components	Applying (K3), Precision (S3)
CO7	sketch the building plan for all types of buildings	Applying (K3), Precision (S3)
CO8	draw the functional services for the buildings	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1				3						1	3	2
CO6	3	3	3	3	1	3		1	1	3		2	3	3
CO7	3	3	3	3	1	3		1	1	3		2	3	3
CO8	3	3	3	3	1	3		1	1	3		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	40	40	20				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEL41 - TRANSPORTATION ENGINEERING LABORATORY**  
(IS 1201-1978 to 1220-1978 are Permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To impart knowledge about properties of highway materials						

**List of Exercises / Experiments:**

1.	Water absorption and Specific gravity test on aggregates and Bitumen
2.	Gradation of coarse aggregates
3.	Aggregate Impact value test and crushing value test
4.	Attrition and Abrasion test on aggregates
5.	Flakiness and Elongation test on aggregates
6.	Penetration and Specific Gravity test on Bitumen
7.	Viscosity on bitumen and Stripping test on bituminous mixes
8.	Softening point test on bitumen
9.	Ductility test on bitumen
10.	Marshall stability of bituminous mixes
11.	Skid resistance test
12.	CBR test on sub-grade soil

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	"IS 1201-1978 and IS 1220-1978, Methods of Test for Bitumen and Tar Materials", Bureau of Indian Standards, Reaffirmed 2004.
3.	Khanna S.K., Justo C.E.G & Veeraragavan A., "Materials and Pavement Testing", 5 <sup>th</sup> Edition, New Chand & Bros, Roorkee, 2014.

**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	determine physical properties of aggregates and bitumen	Applying (K3), Manipulation (S2)
CO2	design a mix ratio for required grade of bitumen	Analyzing (K4), Manipulation (S2)
CO3	determine the sub grade strength of the soil and to assess the surface condition of the pavement	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**18CEL42 - SOIL MECHANICS LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.						

**List of Exercises / Experiments:**

1.	Determination of Specific Gravity and water content of soil solids
2.	Determination of grain size distribution using sieve analysis
3.	Determination of Plasticity index of soil
4.	Determination of differential free swell index of cohesive soil
5.	Determination of field density by a. sand replacement method b. core cutter method
6.	Determination of relative density of cohesionless soil
7.	Determination of Coefficient of permeability by constant head and falling head method
8.	Determination of coefficient of consolidation by one dimensional consolidation test
9.	Determination of shear parameters by direct shear test in cohesionless soil
10.	Determination of shear parameters by unconfined compression test in cohesive soil
11.	Study on shear parameters of soil by Triaxial test

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	Braja M. Das, "Soil Mechanics Laboratory Manual", 9 <sup>th</sup> Edition, Oxford University Press, United Kingdom, 2015.

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	characterize the given soil based on the index properties	Analyzing (K4), Manipulation (S2)
CO2	determine the drainage characteristics and rate of consolidation	Applying (K3), Manipulation (S2)
CO3	evaluate the shear strength parameters of cohesive and cohesionless soil	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18EGL31 - ENGLISH FOR WORKPLACE COMMUNICATION**  
(Common to all Engineering & Technology Branches)

<b>Programme &amp; Branch</b>	<b>All BE/BTech branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>4</b>	<b>HS</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

<b>Preamble</b>	This course is designed to impart required levels of fluency in using the English Language at B2 level in the CEFR through activities, hands-on training and application.						
<b>Unit - I</b>	<b>Listening:</b>						<b>6</b>
Techniques for effective listening - Listening and note taking - Listening activities using listening texts - Listening to discourse samples of native English speakers – Focussed listening for improving pronunciation - understanding different accents.							
<b>Unit - II</b>	<b>Reading:</b>						<b>6</b>
Developing reading skills - Reading aloud - Group reading activities - Reading with correct word stress and intonation.							
<b>Unit - III</b>	<b>Soft Skills:</b>						<b>6</b>
Attitude - Goal setting - Time Management - Team Work - Telephonic conversation skills.							
<b>Unit - IV</b>	<b>Writing:</b>						<b>6</b>
Making preparatory notes, drafts and PPT's for laboratory activities - Word editing features - editing and proof reading..							
<b>Unit - V</b>	<b>Speaking:</b>						<b>6</b>
Verbal and non-verbal communication - Introducing oneself - Introducing others – Mock Interviews - Making presentations on chosen topics - Group Discussion.							

**Total:30**

**REFERENCES/ MANUALS:**

1.	Kumar, Sanjay and Pushp Lata, "Communication Skills", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2017.
2.	Laboratory Manual.

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	acquire effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2	acquire and demonstrate appropriate professional skills for the workplace	Applying (K3), Naturalization (S5)
CO3	speak fluently and write meaningfully in English in the given context	Applying (K3), Articulation (S4)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1									2	3		3		
CO2									2	2		2		
CO3									2	2		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18CET51 - FOUNDATION ENGINEERING**  
( IS 6403 – 1981 code book is permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Soil Mechanics</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the behaviour of foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems.
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<b>Unit - I</b>	<b>Soil Exploration and Foundation Systems:</b>	<b>9</b>
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Soil exploration – planning – test pits – boring – sampling – standard penetration test – static and dynamic cone penetration tests – geophysical methods (seismic, electrical resistivity and ground penetrating radar) – preparation of soil investigation report. Types of foundation – Choice of foundations based on soil profile.

<b>Unit - II</b>	<b>Bearing Capacity and Settlement Analysis:</b>	<b>9</b>
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Terms and definitions – types of bearing capacity failure – Terzaghi's method – IS code method – Teng's method. Causes of settlement – elastic settlement of cohesionless soil – primary settlement of cohesive soil – differential settlement – estimation of settlement from SPT – codal provisions – methods of minimizing settlement – plate load test for bearing capacity and settlement analysis.

<b>Unit - III</b>	<b>Design of Shallow Foundation:</b>	<b>9</b>
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Design of isolated and spread footing – Design principles of combined rectangular and trapezoidal footing – Design aspects of strap footings and mat foundation – Proportioning of footing for equal settlement – Contact pressure under footings.

<b>Unit - IV</b>	<b>Pile Foundation:</b>	<b>9</b>
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Classifications – Construction of piles – Load carrying capacity – Static and dynamic analysis – Pile load tests – negative skin friction. Group action of piles – Load carrying capacity of pile groups – Settlement of pile groups – Pile caps.

<b>Unit - V</b>	<b>Earth Pressure Analysis:</b>	<b>9</b>
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Introduction- Plastic equilibrium in soils – active and passive earth pressure – Rankine's theory – Coulomb's wedge theory – Graphical method (Rebhann and Culmann).

**Total: 45**

**TEXT BOOK:**

1. Punmia B.C., "Soil Mechanics and Foundations", 17 <sup>th</sup> Edition, Laxmi Publications, New Delhi, 2005.
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**REFERENCES:**

1. Varghese P.C., "Foundation Engineering", 2 <sup>nd</sup> Edition, PHI Learning, New Delhi, 2011.
2. Das B.M., "Principles of Foundation Engineering", 5 <sup>th</sup> Edition, Thomson Books, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	summarize soil exploration techniques and foundation systems	Understanding (K2)
CO2	determine bearing capacity and settlement of shallow foundations	Applying (K3)
CO3	design the shallow foundations	Applying (K3)
CO4	calculate the load carrying capacity, settlement of pile foundation	Applying (K3)
CO5	analyse the earth retaining structures	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				3				1		1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	30	60				100
CAT3	10	20	40	30			100
ESE	10	20	60	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CET52 - ENVIRONMENTAL ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on water and sewage occurrence, distribution, treatment and disposal techniques						
<b>Unit - I</b>	<b>Water Supply, Source and Conveyance:</b>						<b>9</b>
Objectives and Factors influencing Public water supply systems – Sources of water – Population Forecasts – Water quality parameters and standards – Intake Structures – Laying, Jointing and Testing of pipelines – Pipe Appurtenances.							
<b>Unit - II</b>	<b>Principles of Treatment:</b>						<b>9</b>
Basic principles of water treatment – Unit Processes and Operations – Screens – Grit chamber – Design of sedimentation tanks – Principles of flash mixers & Flocculators – Design of Filters – Disinfection methods – Water softening methods.							
<b>Unit - III</b>	<b>Collection and Conveyance of Sewage:</b>						<b>9</b>
Sources and characteristics of wastewater – Fluctuations in flow pattern – Quantity – Storm runoff estimation – Minimum and Maximum velocity – Laying, Jointing and Testing of sewers – Layout of Sewage Treatment Plant – Sewer appurtenances – Sewage pumping.							
<b>Unit - IV</b>	<b>Principles of Sewage Treatment:</b>						<b>9</b>
Basic principles of Biological treatment – Trickling filter – Principles and operation of standard and High rate filters – Activated sludge process and its Modifications – Aeration process and types – Oxidation ditch – Waste stabilization ponds – Principles and Design of Septic tanks.							
<b>Unit - V</b>	<b>Sewage Disposal and Rural Sanitation:</b>						<b>9</b>
Objectives of sludge treatment – Properties of sludge – Digesters and lagoons – Dilution – Oxygen sag curve – Eutrophication – Sewage farming practices – Sanitary fixtures – One pipe and Two pipe systems – Rural sanitation system – Environmental Protection Acts.							

**Total: 45****TEXT BOOK:**

1.	Birdie G. S. & Birdie J. S., "Water Supply & Sanitary Engineering", Dhanpat Rai Publishing Company, New Delhi, 2010.
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**REFERENCES:**

1.	Garg S.K., "Water Supply Engineering", 33 <sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2010.
2.	Garg S.K., "Sewage Disposal and Air Pollution Engineering", 39 <sup>th</sup> Edition, Khanna Publishers, New Delhi, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	estimate the population and analyse the water demand	Applying (K3)
CO2	classify the water purification methods	Applying (K3)
CO3	calculate the quantity of waste water generated from various sources	Applying (K3)
CO4	design the principal components of sewage treatment plant	Applying (K3)
CO5	suggest appropriate sludge treatment methods and sanitary fixtures	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	2	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	15	45	40				100
CAT3	10	40	50				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CET53 - DESIGN OF RC ELEMENTS**  
(IS 456:2000 & SP 16 code books are permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Concrete Technology, Mechanics of Materials</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To impart knowledge among the students to know about the design of various structural elements like slab, beam, column and footing.
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<b>Unit - I</b>	<b>Design Philosophies:</b>	<b>9+3</b>
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Stress – Strain curve for concrete in compression – Types of reinforcement – Stress – Strain curve for reinforcing steel. Concept of Working Stress Method (WSD), Ultimate Load Method (ULD) and Limit State Method (LSD) – Design codes and specifications – Permissible stress – Characteristic strength and characteristic load – Factor of safety and partial safety factors – Various limit states.

<b>Unit - II</b>	<b>Limit State Design of Slabs:</b>	<b>9+3</b>
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Types of slabs – Design of one-way slab – cantilever – simply supported – continuous. Design of two-way slab – restrained and non-restrained – continuous. Types of staircases – design of dog-legged staircase.

<b>Unit - III</b>	<b>Limit State Design of Beams:</b>	<b>9+3</b>
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Design of singly and doubly reinforced rectangular and flanged beams for flexure, shear – combined bending, shear and torsion – Design requirement for bond and anchorage as per IS code.

<b>Unit - IV</b>	<b>Limit State Design of Columns:</b>	<b>9+3</b>
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Column – Types – Design of short and slender columns subjected to axial, uni-axial and bi-axial bending.

<b>Unit - V</b>	<b>Limit State Design of Footings:</b>	<b>9+3</b>
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Design of axially and eccentrically loaded square and rectangular footings – design of combined rectangular footings for two columns only – Introduction to strap footing, raft/mat foundation.

**Lecture:45, Tutorial:15, Total:60**

**TEXT BOOK:**

1.	Subramanian N., "Design of Reinforced Concrete Structures", 1 <sup>st</sup> Edition, Oxford University Press, New Delhi, 2014.
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**REFERENCES:**

1.	Unnikrishna Pillai S. & Devdas Menon, "Reinforced Concrete Design", 3 <sup>rd</sup> Edition, Tata McGraw Hill Education (India) Pvt Ltd, New Delhi, 2009.
2.	Varghese P.C., "Limit State Design of Reinforced Concrete", 2 <sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2013.
3.	Krishna Raju N., "Design of Reinforced Concrete Structures", 4 <sup>th</sup> Edition, CBS Publishers & Distributors, New Delhi, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain the basic concept of design philosophies	Understanding (K2)
CO2	design the different types of slabs and dog-legged staircase	Applying (K3)
CO3	formulate the procedure to design the beams for flexure, shear & torsion	Applying (K3)
CO4	categorize the column and apply the appropriate design procedure	Applying (K3)
CO5	design the axially and eccentrically loaded isolated footing	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3				1		2	3	3
CO3	3	2	1			3				1		2	3	3
CO4	3	2	1			3				1		2	3	3
CO5	3	2	1			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	25	65				100
CAT3	10	25	65				100
ESE	5	20	75				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Mechanics for Civil Engineers & Mechanics of Materials	5	PC	3	1	0	4

**Preamble** To analyse indeterminate structures using various energy and force methods. It aims at determination of end moments and constructing shear force, bending moment diagrams for the beams and frames using slope deflection method and moment distribution method. It also gives an idea of analysing beams for moving loads.

**Unit - I** **Energy Methods:** **9+3**

Basic energy concepts – Strain energy – Linear system – Load potential energy – Energy principles based on displacement field – Castigliano's theorem (I & II) – Stiffness coefficients – Energy principles based on force field – Flexibility coefficients – Theorem of least work.

**Unit - II** **Force Methods:** **9+3**

Introduction – Choices of redundant – Method of consistent deformation – Applications – Statically indeterminate beams – Pin jointed plane frames – Statically indeterminate rigid jointed plane frames – System with elastic supports – Three moment equation.

**Unit - III** **Slope Deflection Method:** **9+3**

Introduction – Slope deflection equations – Continuous beams – Sinking of supports – Non sway frames – Structures with unknown sway.

**Unit - IV** **Moment Distribution Method:** **9+3**

Introduction – One cycle moment distribution – Action of support movement – Multiple cycle moment distribution – Continuous beams – Sinking of supports – Non sway frames – Structures with unknown sway.

**Unit - V** **Moving Loads and Influence Lines:** **9+3**

Influence lines for reactions in statically determinate structures – Influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections – Muller Breslau principle – Influence lines for continuous beams (2-degree redundant structures).

**Lecture:45, Tutorial:15, Total:60**

**TEXT BOOK:**

1. Devdas Menon, "Structural Analysis", 2<sup>nd</sup> Edition, Narosa Publishing House, New Delhi, 2018.

**REFERENCES:**

1. Hibbeler R.C., "Structural Analysis", 10<sup>th</sup> Edition, Pearson India, Bengaluru, 2018.

2. Bhavikatti S.S., "Matrix Methods of Structural Analysis", 1<sup>st</sup> Edition, I.K. International Publishing House, New Delhi, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	analyse the structural elements using energy methods	Analyzing (K4)
CO2	evaluate the behaviour of structural elements using force methods	Analyzing (K4)
CO3	analyse the continuous beams and rigid frames using slope deflection method	Analyzing (K4)
CO4	examine the concept of moment distribution for the analysis of continuous beams and rigid frames with and without sway	Analyzing (K4)
CO5	evaluate the shear force and bending moment of simply supported beams carrying moving loads	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	20	60			100
CAT2	10	10	20	60			100
CAT3	10	10	20	60			100
ESE	10	10	20	60			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEL51 - STRENGTH OF MATERIALS LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Mechanics of Materials</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To supplement the theoretical knowledge gained in mechanics of materials with practical testing for determining the strength of materials under externally applied loads.						

**List of Exercises / Experiments :**

1.	Tension test on metal specimens
2.	Compression test on wooden specimen
3.	Shear test on metal specimens
4.	Torsion test on metal specimen
5.	Impact tests on metal specimens
6.	Hardness tests on metal specimens
7.	Bending test-I: Verification of Maxwell's reciprocal theorem
8.	Bending test-II: Determination of Young's modulus and flexural rigidity
9.	Tests on open coil helical springs
10.	Tests on closed coil helical springs
11.	Study on mechanical and electrical strain gauges
12.	Study on fatigue test

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	solve the various material behaviour under tension, compression, shear and torsion	Applying (K3), Manipulation (S2)
CO2	analyse the impact strength and hardness of the material	Analyzing (K4), Manipulation (S2)
CO3	investigate strength of materials under stiffness and strain	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	2		3		1	1			2	2	3
CO2	3	2	1	2		3		1	1			2	2	3
CO3	3	2	1	2		3		1	1			2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



## 18CEL52 - ENVIRONMENTAL ENGINEERING LABORATORY

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Applied Chemistry</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This Course aims to enhance and ensure knowledge on water quality analysis and its standards for identification of treatment methods.						

**List of Exercises / Experiments:**

1.	Sampling and preservation methods of water and wastewater
2.	Determination of i) pH and Turbidity ii) Hardness
3.	Determination of Acidity & Alkalinity
4.	Determination of Chlorides
5.	Determination of Sulphates
6.	Calculate the Optimum Coagulant Dosage
7.	Determine the available Chlorine in Bleaching powder
8.	Determination of Dissolved oxygen
9.	Determination of Total Dissolved Solids and Suspended Solids
10.	Determination of B.O.D
11.	Determination of C.O.D
12.	Estimation of Iron and Fluoride in given water sample

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	analyse the physical and chemical parameters present in the water	Analyzing (K4), Manipulation (S2)
CO2	determine the amount of oxygen required for self-purification of a stream	Applying (K3), Manipulation (S2)
CO3	recommend the type of chlorination and coagulants required for public supplies	Understanding (K2), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18CEL53 - ENVIRONMENTAL ENGINEERING DESIGN AND DRAWING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Engineering Drawing</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To enable the students to design the treatment structures based on various requirements and make use of drafting principles to portray treatment facilities of water and waste water systems and to sketch the layouts and significant components of treatment plants						

**List of Exercises / Experiments:**

1.	Screen chamber
2.	Primary Clarifier
3.	Sand Filter
4.	Trickling Filter
5.	Septic Tank and Disposal Methods
6.	Intake Structures
7.	Sludge Digestion Tank
8.	Infiltration Galleries
9.	Layout of Water and Waste Water Treatment Plants
10.	Pipe and Sewer Appurtenances

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Metcalf & Eddy, "Waste water Engineering Treatment and Reuse", 4 <sup>th</sup> Edition, McGraw Hill, New Delhi, 2017.
2.	Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, "Environmental Engineering", 1 <sup>st</sup> Edition, McGraw Hill, New Delhi, 2017.

**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	design the treatment structures based on various requirements	Applying (K3), Manipulation (S2)
CO2	make use of drafting principles to portray treatment facilities of water and waste water systems	Applying (K3), Manipulation (S2)
CO3	sketch the layouts and significant components of treatment plants	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18GEL51 - PROFESSIONAL SKILLS TRAINING I**  
(Common to all BE/ BTech / MSc /MCA /BSc Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>80</b>	<b>2</b>

<b>Preamble</b>	This subject is to enhance the employability skills and to develop career competency						
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<b>Unit - I</b>	<b>Soft Skills – I:</b>	<b>20</b>					
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Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change- Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge upgradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.

<b>Unit - II</b>	<b>Quantitative Aptitude &amp; Logical Reasoning – I:</b>	<b>30</b>					
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Problem solving level I: Number System-LCM &HCF-Divisibility test-Surds and indices-Logarithms- Ratio-proportions and variation-Partnership-Time speed and distance-Data interpretation-data representation. Logical reasoning: Family tree-Deductions-Logical connectives-Binary logic Linear arrangements- Circular and complex arrangement

<b>Unit - III</b>	<b>Written Communication &amp; Verbal Aptitude:</b>	<b>30</b>					
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Writing Skills: Writing strategies and formats – Importance of Résumés – Writing a Cover letter – Writing a fresher's CV / Résumés – Responding to Job Advertisements – Professional e-mail Writing – Responding to e-mails and business letters – Technical Report writing – Interpretation of Technical Data (Transcoding) – Writing One-page Essays. Verbal Aptitude – Synonyms – Antonyms – Homonyms – One word substitution – Idioms and Phrases – Paired words – Analogies – Spelling test – Cloze test – using suitable verb forms – using appropriate articles and prepositions; Spotting Errors – Sentence Correction and Formation – Grammar Based questions (Transformation : Active-Passive & Direct-Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements.

**Total: 80****TEXT BOOK:**

1	Thorpe, Showick and Edgar Thorpe, "Objective English For Competitive Examination", 6 <sup>th</sup> Edition, Pearson India Education Services Pvt Ltd, 2017.
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**REFERENCES:**

1	Bailey Stephen, "Academic Writing: A practical guide for students", Routledge, New York, 2011.
2	Raman, Meenakshi and Sharma, Sangeeta, "Technical Communication - Principles and Practice", 3 <sup>rd</sup> Edition, Oxford University Press, New Delhi, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2				3	3		3	3	3	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18GET51 - UNIVERSAL HUMAN VALUES**  
(Common to All BE/BTech branches)

Programme & Branch	All BE/BTech Engineering & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	MC	2	0	0	2

Preamble	To make the student to know what they 'really want to be' in their life and profession, understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understanding of harmony at all the levels of human living, and live accordingly						
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<b>Unit - I</b>	<b>Introduction:</b>	<b>6</b>
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Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.

<b>Unit - II</b>	<b>Harmony in the Self and Body:</b>	<b>6</b>
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Human Begin and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I') – Understanding Myself – Harmony with Body.

<b>Unit - III</b>	<b>Harmony in the Family and Society:</b>	<b>6</b>
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Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.

<b>Unit - IV</b>	<b>Harmony in Nature and Existence:</b>	<b>6</b>
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Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.

<b>Unit - V</b>	<b>Implications of the above Holistic understanding of Harmony on Professional Ethics:</b>	<b>6</b>
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Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.

**Total: 30**

**TEXT BOOK:**

1.	Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1st Edition, Excell Books Pvt. Ltd., New Delhi, 2016.
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**REFERENCES:**

1.	Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.
2.	Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", Britain, 1973.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	restate the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	Understanding (K2)
CO2	distinguish between the Self and the Body, understand the meaning of Harmony in the Self, the Co-existence of Self and Body.	Understanding (K2)
CO3	infer the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society.	Understanding (K2)
CO4	transform themselves to co-exist with nature by realizing interconnectedness and four orders of nature.	Understanding (K2)
CO5	distinguish between ethical and unethical practices, and stand ethical and moral practices for a better living.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	3	2	2				
CO2						2	2	3	2	2				
CO3						2	2	3	2	2				
CO4						2	2	3	2	2				
CO5						2	2	3	2	2				

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	25	75					100
CAT3	NA						
ESE	NA						

\* ±3% may be varied (CAT 1, 2 – 100 marks)

**18CET61 - ESTIMATION AND QUANTITY SURVEYING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To estimate the quantities and rates for various structures.						
<b>Unit - I</b>	<b>Estimation of Buildings:</b>						<b>9</b>
Types of estimates - Units of measurements - Methods of estimates - Load bearing and framed structures - Calculation of quantities of various items for residential building with flat roof - Steel requirement and bar bending schedule - Various types of arches - Calculation of brick work in arches.							
<b>Unit - II</b>	<b>Estimation of other Structures and Specifications:</b>						<b>9</b>
Doors and windows (paneled and glazed) - Septic tank - Soak pit - Bituminous and cement concrete roads - Retaining walls - Culverts - Specifications - Sources - Detailed and general specifications - Measurement book.							
<b>Unit - III</b>	<b>Analysis of Rates:</b>						<b>9</b>
Rate for material and labour - Rate analysis for stone masonry, brick masonry, concreting, plastering and tiles laying - PWD Schedule of rates.							
<b>Unit - IV</b>	<b>Valuation:</b>						<b>9</b>
Basics of valuation - Capitalized value - Factors affecting the value of plot and building - Depreciation - Valuation of residential building - Escalation - Calculation of standard rent - Mortgage - Lease.							
<b>Unit - V</b>	<b>Tenders and Report Preparation:</b>						<b>9</b>
Tenders - e Tendering - Contracts - Types of contracts - Arbitration and legal requirements - Principles for report preparation - Report on estimate of residential building - Culvert - Roads - Water supply and sanitary installations.							

**Total: 45****TEXT BOOK:**

1.	Dutta B.N., "Estimating and Costing in Civil Engineering", 28 <sup>th</sup> Edition, UBS Publishers & Distributors Pvt. Ltd., Chennai, 2016.
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**REFERENCES:**

1.	Upadhyay A.K., "Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation", S.K. Kataria and Sons, New Delhi, 2013.
2.	Kohli D.D., & Kohli R.C., "A Textbook of Estimating and Costing (Civil)", 13 <sup>th</sup> Edition, S.Chand Publishing, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	compute quantities of various items for load bearing and framed structures	Applying (K3)
CO2	calculate the quantities of various items for other structures	Applying (K3)
CO3	analyse the rates for various items of works	Analyzing (K4)
CO4	carry out valuation of plots and buildings	Applying (K3)
CO5	prepare tenders, contract documents and reports as per norms	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	20	50	20			100
CAT3	10	40	50				100
ESE	10	20	50	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CET62 - DESIGN OF STEEL STRUCTURES**  
(IS 800:2007, IS 875 (Part-3) & SP 06 (Part-1) are permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Structural Analysis I</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To offers the course to follow the recommendation of IS: 800 – 2007. It aims at determination of safe as well as economical steel section for various industrial and framed structures.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Mechanical Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using welded and bolted connections – Design of bolted and welded joints subjected to axial loading– Efficiency of joints.							
<b>Unit - II</b>	<b>Tension Members:</b>						<b>9</b>
Types of Tension Members – Net area – Net effective sections for angle and Tee in tension – Design of connections in tension members – Design of tension splice – Concept of shear lag – Use of lug angles.							
<b>Unit - III</b>	<b>Compression Members:</b>						<b>9</b>
Types of compression members – Theory of columns – Codal provision for compression member design – Slenderness ratio – Design of simple and built-up compression members – Design of laced columns-Design procedure of battened column.							
<b>Unit - IV</b>	<b>Beams:</b>						<b>9</b>
Lateral stability of beams – Design of laterally supported and unsupported beams – Built-up beams – Design procedure of Beams subjected to uniaxial bending.							
<b>Unit - V</b>	<b>Roof Trusses:</b>						<b>9</b>
Roof and side coverings – components of trusses – Load combinations - Design procedure of Roof truss – Wind Pressure analysis- IS 875(part 3) - Design of Purlin.							

**Total: 45**

**TEXT BOOK:**

1.	Subramanian N., "Design of Steel Structures Limit States Method", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2018.
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**REFERENCES:**

1.	Bhavikatti S.S., "Design of Steel Structures", 5 <sup>th</sup> Edition, I.K. International Publishing House Pvt. Ltd, New Delhi, 2017.
2.	Duggal S., "Limit State Design of Steel Structures", 3 <sup>rd</sup> Edition, McGraw Hill Education (India) Private Limited, India, 2017.





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	discriminate the various connection methods	Analyzing (K4)
CO2	analyse and design the various profiles of tension members	Analyzing (K4)
CO3	analyse and design the forms of compression members	Analyzing (K4)
CO4	discriminate and design the flexural members	Analyzing (K4)
CO5	examine and design the roof truss	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3						1	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	30	40			100
CAT2		15	35	50			100
CAT3		15	40	45			100
ESE	10	20	30	40			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 18CET63 - STRUCTURAL ANALYSIS II

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Structural Analysis I</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To employ plastic and elastic methods for the analysis of determinate and indeterminate structures. It also aims at determination of member forces in arches and suspension cables in addition to the application of basic concepts of finite element analysis.						
<b>Unit - I</b>	<b>Plastic Analysis of Structures:</b>						<b>9+3</b>
Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.							
<b>Unit - II</b>	<b>Flexibility Matrix Method:</b>						<b>9+3</b>
Introduction – Static and kinematic indeterminacy – Equilibrium and compatibility conditions – Primary structure – Element and global flexibility matrix – Applications – Analysis of indeterminate beams, frames and trusses (redundancy restricted to two).							
<b>Unit - III</b>	<b>Stiffness Matrix Method:</b>						<b>9+3</b>
Introduction – Displacement and force transformation matrices – Element and global stiffness matrix – Applications – Analysis of indeterminate beams, frames and trusses (redundancy restricted to two).							
<b>Unit - IV</b>	<b>Arches:</b>						<b>9+3</b>
Arches as structural forms – Arch structures – Arch action – Types of arches – Parabolic and circular arches – Analysis of three hinged and two hinged arches – Settlement and temperature effects.							
<b>Unit - V</b>	<b>Space and Cable Structures:</b>						<b>9+3</b>
Analysis of space trusses using method of tension coefficients – Beams curved in plan – Suspension cables – Cables with two and three hinged stiffening girders – Analysis of portal frames by Substitute frame method. Introduction to Finite Element Method – Discretization of a structure – Displacement functions – Bar element, truss element and beam element – Plane stress and plane strain – Triangular elements.							

Lecture:45, Tutorial:15, Total:60

**TEXT BOOK:**

1. Hibbeler R.C., "Structural Analysis", 10 <sup>th</sup> Edition, Pearson India, Bengaluru, 2018.
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**REFERENCES:**

1. Devdas Menon, "Structural Analysis", 2 <sup>nd</sup> Edition, Narosa Publishing House, New Delhi, 2018.
2. Bhavikatti S.S., "Matrix Methods of Structural Analysis", 1 <sup>st</sup> Edition, I.K. International Publishing House, New Delhi, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	determine the plastic moment capacity of structures	Analyzing (K4)
CO2	derive bending moments of continuous beams, pin jointed trusses and rigid plane frames using flexibility matrix method	Analyzing (K4)
CO3	evaluate bending moments of continuous beams, pin jointed trusses and rigid plane frames using stiffness matrix method	Analyzing (K4)
CO4	analyse the various types of arches	Analyzing (K4)
CO5	calculate the member forces in space trusses, suspension cables and discretize the structures using finite element method	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3						1	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	2	1			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	40	40			100
CAT2	10	10	20	60			100
CAT3	10	10	40	40			100
ESE	10	10	30	50			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEL61 - COMPUTER AIDED BUILDING INFORMATION MODELLING LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Building Planning and Practices</b>	<b>6</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Exercises / Experiments:**

1.	Introduction to software tools available for 3-D modelling
2.	Building Components – Walls, Doors, Windows and Roofs
3.	Building Components – Floors, Staircase and Ramp
4.	3-D elevation for single storied building (output with Plan, Section and elevation rendering)
5.	3-D elevation for multi storied building (output with Plan, Section and elevation rendering)
6.	Interior design for rooms with lighting effect
7.	Building walk through model
8.	Single storied building documentation and quantity take off
9.	Multi storied building documentation and quantity take off
10.	Construction schedule for a multi storied building

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	Autodesk Revit
3.	Microsoft Project

**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	apply the building components effectively in 3D modelling for a building system	Applying (K3), Manipulation (S2)
CO2	prepare the 3-D elevation and interior design for a building system	Analyzing (K4), Manipulation (S2)
CO3	compute material quantity and construction duration for a building system	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**18CEL62 - STRUCTURAL ENGINEERING LABORATORY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Concrete Technology</b>	<b>6</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Exercises / Experiments:**

1.	Study on workability of Self Compacting Concrete
2.	Effect of water/cement ratio on workability and strength of concrete
3.	Effect of fine aggregate/coarse aggregate ratio on strength of concrete
4.	Stress - Strain relationship for concrete
5.	Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture
6.	Modulus of elasticity of steel by electrical strain gauge
7.	Study on rate of corrosion of steel in concrete
8.	Study on behaviour of beams under flexure
9.	Study on behaviour of beams under shear
10.	Study on behaviour of under reinforced and over reinforced beams

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	Gambhir M.L., "Concrete Testing Manual", 3 <sup>rd</sup> Edition, Dhanpat Rai & Sons, New Delhi, 2010.

**COURSE OUTCOMES:**

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

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
CO1	carry out the tests to determine the fresh and hardened properties of concrete	Applying (K3), Manipulation (S2)
CO2	relate the strength parameters of concrete	Applying (K3), Manipulation (S2)
CO3	analysis the performance of beams under flexure and shear	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18CEL63 - COMPUTER AIDED STRUCTURAL DESIGN AND DETAILING LABORATORY**  
(IS 456:2000, IS 3370:2009, SP 16, SP 34, IS 800:2007, SP 06, IS 875 and SP 38 are permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of RC Elements, Structural Analysis I</b>	<b>6</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Exercises / Experiments:**

1.	Introduction to software tools available to analysis the structural systems
2.	Prepare the Structural Plan with slab numbering, beam numbering and column centre line grid for R.C Building
3.	Analysis of building frames using STAAD Pro/ETABS
4.	Design and detailing of one-way slab and two-way slab (from analysed building frame)
5.	Design and detailing of beams (from analysed building frame)
6.	Design and detailing of columns (from analysed building frame)
7.	Design and detailing of foundation (from analysed building frame)
8.	Analysis and design of truss
9.	Analysis of steel building
10.	Design of Rafter and column in pre-engineered steel building (from analysed pre-engineered frame)

**Total:30****REFERENCES/MANUAL/SOFTWARE:**

1.	Subramanian N., "Design of Steel Structures", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2016.
2.	Subramanian N., "Design of Reinforced Concrete Structures", 1 <sup>st</sup> Edition, Oxford University Press, New Delhi, 2014.
3.	STAAD.pro, ETABS and AutoCAD

**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	analyse the reinforced concrete structures	Applying (K3), Manipulation (S2)
CO2	design and detailing of reinforced concrete elements	Applying (K3), Manipulation (S2)
CO3	analyse and design the steel structures	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	2	1	3			1	1		2	3	3
CO2	3	2	1	2	1	3			1	1		2	3	3
CO3	3	2	1	2	1	3			1	1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18GEL61 PROFESSIONAL SKILLS TRAINING – II**  
(For all BE/ BTech / MSc /MCA /BSc Branches)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>80</b>	<b>2</b>

<b>Preamble</b>	This subject is to enhance the employability skills and to develop career competency
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<b>Unit - I</b>	<b>Soft Skills – II:</b>	<b>30</b>
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Group discussions: Advantages of group discussions-Structured GD- Team work: Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. Facing an interview: Foundation in core subject- industry orientation / knowledge about the company- professional personality- Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.

<b>Unit - II</b>	<b>Quantitative Aptitude &amp; Logical Reasoning – II:</b>	<b>30</b>
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Problem solving level II: Money related problems-Mixtures-Symbol base problem-Clocks and calendars-Simple-linear-quadratic and polynomial equations-Special, equations-Inequalities-Sequence and series-Set theory-Permutations and combinations-Probability-Statistics-Data sufficiency- Geometry-Trigonometry-Heights and distances-Co-ordinate geometry-Mensuration. Logical reasoning: Conditionality and grouping-Sequencing and scheduling- Selections-Networks:-Codes; Cubes-Venn diagram in logical reasoning-Quant based reasoning-Flaw detection- Puzzles-Cryptarithms.

<b>Unit - III</b>	<b>Reading &amp; Speaking Skills:</b>	<b>20</b>
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Reading: Reading comprehension– Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer’s attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills.

**Total: 80**

**TEXT BOOK:**

1.	Thorpe, Showick and Edgar Thorpe, “Objective English For Competitive Examination”, 6 <sup>th</sup> Edition, Pearson India Education Services Pvt. Ltd., 2017.
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**REFERENCES:**

1.	ArunaKoneru, “Professional Speaking Skills,” Oxford University Press India, 2015.
2.	Thorpe, Showick and Edgar Thorpe, “Winning at Interviews,” 5 <sup>th</sup> Edition, Pearson Education, India, 2013.
3.	Rizvi, Ashraf M, “Effective Technical Communication,” 2 <sup>nd</sup> Edition, McGraw Hill Education India, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply reading and speaking skills effectively for various academic and professional purposes	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	0	0	3	3	0	3	0	3	2		
CO2	3	2	0	0	0	3	3	0	3	0	3	2		
CO3	0	2	0	0	0	3	3	0	3	3	3	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





## 18CEP61 - PROJECT WORK I PHASE I

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>6</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

Total: 60

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	2	1	3	2	3	3	3	3	3	3	3
CO2	2	2	2	2		3		1	1	3	2	3	3	2
CO3	2	2	2	2	1	3		3	3	3	3	3	3	3
CO4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3		1	1	2	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**18MBT71 – ENGINEERING ECONOMICS AND MANAGEMENT**

(Common to All BE/BTech Engineering And Technology Branches except Chemical Engineering)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	HS	3	0	0	3

Preamble	The aim of the course is to create fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management, accounting principles etc.						
<b>Unit - I</b>	<b>Micro Economics:</b>						<b>9</b>
Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic activities and Income.							
<b>Unit - II</b>	<b>Macro Economics, Business Ownership and Management concepts:</b>						<b>9</b>
National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Forms of business – Ownership types. Management concepts: Taylor and Fayol's Principles – Functions of Management - Managerial Skills - Levels of Management - Roles of manager.							
<b>Unit - III</b>	<b>Marketing Management</b>						<b>9</b>
Marketing - Core Concepts of Marketing - Four P's of Marketing - New product development – Intellectual Property rights (IPR), Product Life Cycle - Pricing Strategies and Decisions.							
<b>Unit - IV</b>	<b>Operations Management:</b>						<b>9</b>
Operations Management - Resources - Types of Production system - Site selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.							
<b>Unit - V</b>	<b>Financial Management:</b>						<b>9</b>
Accounting Principles – Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Significance –Traditional and discounted cash flow methods.							

**Total:45****TEXT BOOK:**

1.	Compiled by Department of Management Studies, Kongu Engineering College, "Economics and Management for Engineers", 1st Edition, McGraw Hill Education, Noida, 2013.
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**REFERENCES:**

1.	Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3rd Edition, McGraw-Hill, New Delhi, 2018.
2.	William J. Stevenson, "Operations Management", 14th Edition, McGraw-Hill Education, 2021.
3.	William G. Nickels, James M. McHugh, Susan M. McHugh, "Understanding Business", 12th Edition, McGraw-Hill Education, New York, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify market equilibrium and interpret national income calculations and inflation issues	Applying (K3)
CO2	choose a suitable business ownership for their enterprise and illustrate managerial functions	Applying (K3)
CO3	infer marketing management decisions	Understanding (K2)
CO4	apply appropriate operation management concept in business situations	Applying (K3)
CO5	interpret financial and accounting statements and evaluate new proposals	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2			3		2	2	2	3	2	1	2
CO2		1	2			2	2	2	2	2	3	2	1	2
CO3	1	2	1			2		2	2	2	3	2	2	2
CO4	1	2	1			2		2	2	2	3	2	1	2
CO5	2	2				2		2	2	2	3	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18GEP71 – COMPREHENSIVE TEST AND VIVA**  
(Common to all BE/BTech branches)

<b>Programme &amp; Branch</b>	<b>All BE/BTech branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	demonstrate knowledge in their respective programme domain.	Applying (K3)
CO2	defend any type of interviews, viva-voce, and aptitude tests conducted for career progression	Applying (K3)
CO3	exhibit professional etiquette and solve related engineering problems	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	3	2	2					1	2	2	3	3	2
CO2	3	3	2	2					1	2	2	3	3	2
CO3	3	3	2	2					1	2	2	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



## 18CEP71 - PROJECT WORK I PHASE II

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

Total: 120

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	2	1	3	2	3	3	3	3	3	3	3
CO2	2	2	2	2		3		1	1	3	2	3	3	2
CO3	2	2	2	2	1	3		3	3	3	3	3	3	3
CO4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3		1	1	2	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



## 18CEP81 - PROJECT WORK II

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>8</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>6</b>

Total: 180

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	2	2	2	2	2	2	2	3	3	3	3	2	3	3
CO2	2	2	2	2	2	2		3	3	3	2	2	3	3
CO3	2	2	2	2	3	2		3	3	3	2	2	3	3
CO4	2	2	2	3	3	2		3	3	3	3	2	3	3
CO5	2	2	2	2	2	2		2	2	2	3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



**18CEE01 - ADVANCED REINFORCED CONCRETE DESIGN**  
**(IS 456:2000, SP16, IS 3370:2009 (Part I, II & IV) and IS13920:2016 code books are permitted)**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of RC Elements</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge among the students about the analysis and design of retaining walls, flat slab, water tank, RC walls and corbels.						
<b>Unit - I</b>	<b>Design of Retaining Wall:</b>						<b>9</b>
Introduction – Earth pressure theories – Types of retaining wall – Design and detailing of cantilever and counter fort retaining wall.							
<b>Unit - II</b>	<b>Design of Flat Slabs and Yield Line Theory:</b>						<b>9</b>
Introduction – Design of flat slab (IS Code Method). Yield Line Theory – Equilibrium and virtual work method – Analysis and design of simply supported square, rectangular and circular slabs.							
<b>Unit - III</b>	<b>Design of Water Tank:</b>						<b>9</b>
Design of circular and rectangular water tank – Resting on ground for different end conditions.							
<b>Unit - IV</b>	<b>Design of RC and Shear Wall:</b>						<b>9</b>
Introduction – Design of Braced RC wall – Types and use of shear walls – Design of shear wall with boundary elements.							
<b>Unit - V</b>	<b>Design of Special RC Elements:</b>						<b>9</b>
Design and detailing of corbels (IS code method) – Design of pile caps –Design principles of bunkers and silos.							

**Total: 45****TEXT BOOK:**

1.	Subramanian N., "Design of Reinforced Concrete Structures", 1 <sup>st</sup> Edition, Oxford University Press, New Delhi, 2014.
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**REFERENCES:**

1.	Varghese P.C., "Advanced Reinforced Concrete Design", 2 <sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2013.
2.	Unnikrishna Pillai S. & Devdas Menon, "Reinforced Concrete Design", 3 <sup>rd</sup> Edition, Tata McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2009.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	design the retaining wall and perform the stability check	Applying (K3)
CO2	analysis and design the different types of slabs	Applying (K3)
CO3	design the water tank with appropriate design procedure	Applying (K3)
CO4	formulate the procedure to design the braced wall and shear wall for lateral forces	Applying (K3)
CO5	design the corbel and pile cap	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1			3				1		2	3	3
CO2	3	2	1			3				1		2	3	3
CO3	3	2	1			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			2				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
<b>Test / Bloom's Category*</b>	<b>Remembering (K1) %</b>	<b>Understanding (K2) %</b>	<b>Applying (K3) %</b>	<b>Analyzing (K4) %</b>	<b>Evaluating (K5) %</b>	<b>Creating (K6) %</b>	<b>Total %</b>
CAT1	10	25	65				100
CAT2	10	25	65				100
CAT3	10	25	65				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE02 - CONSTRUCTION ENGINEERING AND MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course imparts knowledge on Construction Engineering & Management principles necessary for execution of projects efficiently which deals with quality, cost control & safety aspects in construction industry.						
<b>Unit - I</b>	<b>Planning, Scheduling and Organizing:</b>						<b>9</b>
Planning for Construction projects – Objectives – Principles – Stages of planning, scheduling – Methods – Project management through networks – CPM & PERT. Project updating – Job layout – Work Breakdown Structure – Types of Construction organization.							
<b>Unit - II</b>	<b>Resource Management:</b>						<b>9</b>
Types of resources – Estimating resource requirements – Material management – Effective utilization of machineries and equipments – Depreciation of construction equipment – Manpower planning – Resource Levelling.							
<b>Unit - III</b>	<b>Quality Control:</b>						<b>9</b>
Quality control in construction – Importance – Elements – Quality control methods – ISO 9000 family of standards – Statistical methods – Sampling by attributes – Sampling by variables – Techniques and needs of QC.							
<b>Unit - IV</b>	<b>Schedule and Cost Control:</b>						<b>9</b>
Schedule Variance – Types of Variance – Cost schedule relationship – Budgeted cost – Cost control in construction – Objectives – Cost control systems – Direct and indirect cost control – Time-cost Trade off – Risk cost management.							
<b>Unit - V</b>	<b>Safety Management:</b>						<b>9</b>
Safety in construction projects – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Accidents – Causes – Classification – Safety measures – Approaches to improve safety in construction – Safety Codes and Standards.							

**Total:45****TEXT BOOK:**

1.	Seetharaman S., "Construction Engineering and Management", 4 <sup>th</sup> Edition, Umesh Publishing, Ghaziabad, 2008.
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**REFERENCES:**

1.	Gahlot P.S.&Dhir B.M., "Construction Planning and Management", 2 <sup>nd</sup> Edition, New Age International Ltd., New Delhi, 2002.
2.	Daniel W. Halpin, "Financial and Cost Concepts for Construction Management", 1 <sup>st</sup> Edition, John Wiley and Sons, New York, 1985.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the importance of planning and scheduling in construction projects	Applying (K3)
CO2	estimate the resource requirement for any construction projects	Applying (K3)
CO3	assess quality elements and its importance in construction materials	Applying (K3)
CO4	identify schedule and budgeted cost associated with construction activities	Applying (K3)
CO5	apply the safety codes and standards in order to improvise the safety culture at construction job site	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3				1	2	2	3	3
CO2	3	2	1			3					2	2	3	3
CO3	3	2	1			3					2	2	3	3
CO4	3	2	1			3					2	2	3	3
CO5	3	2	1			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	35	45				100
CAT2	25	40	35				100
CAT3	20	40	40				100
ESE	20	35	45				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE03 - SOLID AND HAZARDOUS WASTE MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Environmental Engineering</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the nature and characteristics of solid and hazardous wastes for providing appropriate treatment facilities						
<b>Unit - I</b>	<b>Solid Waste and its Perspectives:</b>						<b>9</b>
	Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of Sampling – Functional elements – Legislative measures – 3R concept – Participatory waste management.						
<b>Unit - II</b>	<b>Onsite and Offsite Processing:</b>						<b>9</b>
	Importance of onsite and offsite handling- storage methods – Effect of storage methods at site and offsite – materials used for containers – waste segregation and storage – Offsite processing techniques and Equipment – Types of composting – Incineration – Pyrolysis – Case studies.						
<b>Unit - III</b>	<b>Collection and Transfer:</b>						<b>9</b>
	Collection services – Classification of container systems – Analysis of collection system – Collection routes – Guidelines – Transfer station – Site selection – Types – Manpower requirement.						
<b>Unit - IV</b>	<b>Hazardous Wastes:</b>						<b>9</b>
	Sources and Impacts – Classification – Handling of wastes – Selection and design of storage facilities – Physical, Chemical and Biological treatment technologies – Federal and State Legislations – International treaties and their significance.						
<b>Unit - V</b>	<b>Disposal of Solid and Hazardous Wastes:</b>						<b>9</b>
	Design configurations and site selection of sanitary landfills – Merits and demerits – Classification – Leachate control methods – Principles and Design of Hazardous waste landfills – Bioremediation processes – Monitoring of disposal sites – Case studies.						

**Total:45****TEXT BOOK:**

1.	Rao M.N. & Razia Sultana, "Solid and Hazardous Waste Management", 2 <sup>nd</sup> Edition, B S Publications, Hyderabad, 2020.
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**REFERENCES:**

1.	George Tchobanoglous & Frank Kreith, "Handbook of Solid Waste Management", 2 <sup>nd</sup> Edition, McGraw Hill, New Delhi, 2002.
2.	George Tchobanoglous, Hilary Theisen & Samuel Vigil, "Integrated Solid Waste Management", 1 <sup>st</sup> Edition, McGraw Hill, New Delhi, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	illustrate the sources, types and characteristics of solid waste	Understanding (K2)
CO2	classify onsite and offsite processing methods	Understanding (K2)
CO3	explain the collection and conveyance approaches available in solid waste sector	Applying (K3)
CO4	discuss the causes and effects of hazardous wastes with treatment techniques	Applying (K3)
CO5	recommend appropriate disposal methods for solid and hazardous wastes	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	1			2							3	3
CO4	3	2	1			2							3	3
CO5	3	2	1			2							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	45	30				100
CAT2	20	40	40				100
CAT3	15	45	40				100
ESE	25	45	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE04 - RAILWAY, AIRPORT AND HARBOUR ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Transportation Engineering</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge about the planning & geometric design of Railway, Airport and Harbour engineering						
<b>Unit - I</b>	<b>Railway Planning:</b>						<b>9</b>
Role of Indian Railways in National development – Conventional and Modern methods – Obligatory points – Track Stress, Coning of wheels, Creep in rails, Defects in rails – Geometric design of railway tracks – Points and Crossings – Turnouts – Working principle – Signalling, Interlocking and Track circuiting.							
<b>Unit - II</b>	<b>Railway Infrastructure, Construction and Maintenance:</b>						<b>9</b>
Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of Materials required for track laying – Construction and maintenance of tracks –Modern methods of construction & maintenance – Railway stations and yards – Passenger amenities – Modern Transit Facilities – Railway Track – Transfer Station – Structures – Bridges – Tunnels – Planning and Design aspects.							
<b>Unit - III</b>	<b>Airport Planning:</b>						<b>9</b>
Air transport characteristics – Airport classification – ICAO - Airport planning – Site selection – Typical Airport Layouts, Case Studies – Parking and Circulation Area.							
<b>Unit - IV</b>	<b>Airport Design:</b>						<b>9</b>
Runway Design – Orientation, Wind Rose Diagram, Problems on basic and Actual Length – Geometric Design – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.							
<b>Unit - V</b>	<b>Harbour Engineering:</b>						<b>9</b>
Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours – Harbour Layout and Terminal Facilities – Coastal Structures – Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Coastal Regulation Zone.							

**Total: 45****TEXT BOOK:**

1.	Subramanian K.P., "Railways, Airports and Harbour Engineering", 1 <sup>st</sup> Edition, Scitech Publications (India) Pvt. Ltd., Chennai, 2018.
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**REFERENCES:**

1.	Saxena Subhash C.& Satyapal Arora, "A Course in Railway Engineering", 7 <sup>th</sup> Edition, Dhanpat Rai Publications Pvt. Ltd., New Delhi, 2013.
2.	Khanna S.K., Arora M.G.& Jain S.S., "Airport Planning and Design", 6 <sup>th</sup> Edition, Nem Chand & Bros, Roorkee, 2017.
3.	Bindra S.P., "A Course in Docks and Harbour Engineering", 3 <sup>rd</sup> Edition, Dhanpat Rai Publications Pvt. Ltd., New Delhi, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the concepts of railway planning and the components and functions	Understanding (K2)
CO2	infer the modern facilities of the railway infrastructure and explain the material requirement, construction and maintenance works	Understanding (K2)
CO3	report the suitable criteria in planning and site selection of Airport planning and design	Applying (K3)
CO4	analyze and design the elements for orientation of runway and passenger facility system	Applying (K3)
CO5	demonstrate the various features in harbor and port, their construction, coastal protection works and coastal regulations to be adopted	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	1			2							3	2
CO4	2	1				3						1	3	3
CO5	2	1				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE05 - GROUND IMPROVEMENT TECHNIQUES**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Foundation Engineering</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge about various problems associated with soil deposits and different techniques used to improve the characteristics of difficult soils.						
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<b>Unit - I</b>	<b>Problematic Soil and Improvement Techniques:</b>	<b>9</b>
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Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

<b>Unit - II</b>	<b>Dewatering:</b>	<b>9</b>
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Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

<b>Unit - III</b>	<b>Insitu Treatment of Cohesionless and Cohesive Soils:</b>	<b>9</b>
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Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques –Relative merits of above methods and their limitations.

<b>Unit - IV</b>	<b>Earth Reinforcement:</b>	<b>9</b>
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Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

<b>Unit - V</b>	<b>Grouting Techniques:</b>	<b>9</b>
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Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

**Total: 45****TEXT BOOK:**

1.	Purushothama Raj P., "Ground Improvement Techniques", 2 <sup>nd</sup> Edition, Laxmi Publications, New Delhi, 2016.
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**REFERENCES:**

1.	Koerner R.M., "Construction and Geotechnical Methods in Foundation Engineering", 2 <sup>nd</sup> Edition, Tata McGraw Hill, 1994.
2.	Das B.M., "Principles of Foundation Engineering", 7 <sup>th</sup> Edition, Cengage Learning, 2010.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	identify the geotechnical problems of various soil deposits	Applying (K3)
CO2	design / select suitable technique of dewatering	Analyzing (K4)
CO3	suggest suitable insitu treatments for cohesive and cohesionless soils	Analyzing (K4)
CO4	recommend different soil reinforcement materials based on their application	Applying (K3)
CO5	select different types of grouting methods and stabilization techniques	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2							3	3
CO2	3	3	2			3						1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	2	1			2							3	3
CO5	3	2	1			2							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	30	35	20			100
CAT2	15	30	35	20			100
CAT3	15	40	45				100
ESE	15	30	35	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE06 - REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course gives the knowledge on the remote sensing and its working principles. It also describes the image processing techniques using GIS for real time applications which motivates towards innovations in the relevant fields.						
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<b>Unit - I</b>	<b>Principles of Remote Sensing:</b>	<b>9</b>
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Definition – Components of Remote sensing – EMR Spectrum – EMR interactions with atmosphere – EMR interactions with Earth – Spectral signature curves of Earth surface features – Platforms and Sensors: Evolution of different types of satellites and their characteristics – Sensor types and properties – Resolution concepts.

<b>Unit - II</b>	<b>Geographical Information System:</b>	<b>9</b>
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Definition and Components of GIS – GIS Data Types – Non spatial data: Field and statistical data, Spatial data: Maps and Map projection methods, Aerial photographs and satellite data – Vector and Raster data types – Merits and demerits – Hardware: Data entry, Scanners and Digitizers, GIS Software: Open source.

<b>Unit - III</b>	<b>GIS Data Processing and Management:</b>	<b>9</b>
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Digital Image – Characteristics – Image pre-processing techniques – Image Enhancements techniques – Classification methods – Database concepts – Data structures: Run Length Encoding, Block encoding, Chain encoding and Quad tree, Topology – Data storage formats: BIL, BSQ and BIP, Topology – Data compression techniques – File formats.

<b>Unit - IV</b>	<b>GIS Data Analysis and Interpretation:</b>	<b>9</b>
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Data Retrieval: Querying – Raster data analysis: Spatial analysis – Reclassification – Vector data analysis: Overlay, Buffer and Network analysis – Modelling surfaces: TIN, DTM, DEM, Slope model: Slope, Aspect, Hill shades – Types of Data products – Image Interpretation: Visual Interpretation keys and techniques.

<b>Unit - V</b>	<b>Advancements and Applications of Remote sensing and GIS:</b>	<b>9</b>
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LiDAR and Microwave Remote sensing with its applications, Basics of Hyperspectral Remote sensing – Concepts of Online GIS and Mobile GIS – Fields of Applications and case studies: LIS and Cadastral mapping – Urban and Regional planning – Natural resources management – Climate studies and Disaster monitoring – Ocean studies.

**Total:45****TEXT BOOK:**

1.	Basudeb Bhatta, "Remote sensing and GIS", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2011.
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**REFERENCES:**

1.	Anji Reddy M., "Remote sensing and Geographical Information Systems", 4 <sup>th</sup> Edition, B S Publications, Hyderabad, Andhra Pradesh, 2008.
2.	Ialn H. Woodhouse, "Introduction to Microwave Remote Sensing ", 1 <sup>st</sup> Edition, Taylor and Francis group, Boca Raton, 2006.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	categories the earth features in an satellite imagery and the sensor properties for various applications of remote sensing	Applying (K3)
CO2	recommend suitable GIS elements for storing and analyzing different remote sensing datasets	Applying (K3)
CO3	select suitable GIS database for different remote sensing imageries using pre-processing techniques	Applying (K3)
CO4	elaborate raster and vector data analyses on different remote sensing images	Applying (K3)
CO5	explain the fields of applications of remote sensing and GIS with the recent advancement techniques	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3				1		1	3	3
CO2	3	2	1			3				1		1	3	3
CO3	3	2	1			3				1		1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE07 - ADVANCED STEEL DESIGN**  
( IS 800:2007, IS 875 (Part-3) and SP 06 (Part-1) are permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of Steel Structures</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To design steel structures as per limit state method and to determine safe as well as economical steel section for various industrial and framed structures.						
<b>Unit - I</b>	<b>Plate Girder:</b>						<b>9</b>
Introduction to Plate Girder – Difference Between Beam and Plate Girder – Types of Plated girders – Post buckling behaviour of the web plate – Proportioning of the web plate and flanges – Design of welded Plate Girder.							
<b>Unit - II</b>	<b>Gantry girder:</b>						<b>9</b>
Introduction – load considerations – max load effects – Determination of maximum bending moment and shear force due to vertical component of crane wheel load – horizontal component of crane wheel load – longitudinal effect of wheel load – Design of gantry girder.							
<b>Unit - III</b>	<b>Beam – Column:</b>						<b>9</b>
Introduction – In – plane behaviour of beam – column – Lateral – torsional behaviour of beam – columns – Second order moment in beam – column – Elastic torsional buckling of beam columns – Nominal strength in beam column in uni axial bending.							
<b>Unit - IV</b>	<b>Design of Truss:</b>						<b>9</b>
Introduction – Evaluation of design dead load, live load – wind load – Roof and side coverings – Components of trusses – Load combinations – Design wind speed and pressure – Design of Truss using Rolled steel sections.							
<b>Unit - V</b>	<b>Design of Connections:</b>						<b>9</b>
Introduction – Beams – Column connections – Bolted framed connections – Bolted seat connections – Welded framed connections – Bolted Moment Connections – Moment Resistant Connections.							

**Total:45**

**TEXT BOOK:**

1. Subramanian N., "Design of Steel Structures Limit State Method", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2016.
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**REFERENCES:**

1. Bhavikatti S.S., "Design of Steel Structures", 5 <sup>th</sup> Edition, I.K. International Publishing House Pvt.Ltd.,New Delhi, 2017.
2. Duggal S.K., "Design of Steel Structures", 3 <sup>rd</sup> Edition, McGraw Hill Education, 2017.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	design the welded plate girder	Analyzing (K4)
CO2	analyse and design the different gantry girders	Analyzing (K4)
CO3	analyse and design of beam – column joints	Analyzing (K4)
CO4	analyse and design of various components of truss	Analyzing (K4)
CO5	design the welded and bolted connections	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3						1	3	3
CO2	3	3	2			3						1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	15	35	40			100
CAT2		20	30	50			100
CAT3		20	35	45			100
ESE	10	20	30	40			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE08 - ARCHITECTURE AND TOWN PLANNING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To plan the buildings and architectural elements as per standards and zone regulations and carry out surveys related to site analysis						
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<b>Unit - I</b>	<b>Architectural Space Standards:</b>						<b>9</b>
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Introduction to Architectural design-Aesthetics, Concepts of Space, Form and Function-Factors and concepts related to building design - Climate, Site Characteristics, Land Form, Visual Elements, Behavioural Factors, Space Utilization.

<b>Unit - II</b>	<b>Site Analysis and Planning:</b>						<b>9</b>
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Site analysis- Site Planning - Development standards and design preparation - Factors affecting site selection -Considerations for site layout- Conceptual approach for site planning.

<b>Unit - III</b>	<b>Buildings Types and Standards:</b>						<b>9</b>
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Design of simple Residential, Commercial, Institutional Buildings-Anthropometrics, Human Activity and Space Use-Safety standards – Building rules and regulations – Integration of building services – Interior design.

<b>Unit - IV</b>	<b>Climate and Environmental Responsive Design:</b>						<b>9</b>
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Man and environment interaction with climatic factors– Characteristics of climate types – Design adopting different climatic conditions – Passive and active energy controls – Green building concept.

<b>Unit - V</b>	<b>Town Planning and Landscaping:</b>						<b>9</b>
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Type of planning surveys, Aerial photo and remote sensing techniques in planning - Urban planning standards and zoning regulations - Urban renewal – Conservation – Principles of Landscape design - Concepts of Smart cities.

**Total:45****TEXT BOOK:**

1.	Rangwala S., "Town Planning", 29 <sup>th</sup> Edition, Charotar Publishers, Gujarat , 2016.
2.	Muthushoba Mohan G., "Principles of Architecture", 1 <sup>st</sup> Edition, Oxford University Press, Noida,2006.

**REFERENCES:**

1.	Hiraskar G. K., "Fundamentals of Town Planning", 17 <sup>th</sup> Edition, Dhanpat Rai Publications, New Delhi, 2017.
2.	Francis D. K. Ching, "Architecture: Form, Space & Order", 4 <sup>th</sup> Edition, John Wiley & Sons, United States, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify and design architectural elements in buildings by considering space standards	Understanding (K2)
CO2	design and develop the standards required for site planning	Understanding (K2)
CO3	classify the building types along with its required standards	Understanding (K2)
CO4	incorporate green building concept in planning of buildings associated with climatic changes.	Applying (K3)
CO5	plan the buildings with interiors and landscaping as per standards and zoning regulations	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2						2	3	2
CO2	2	1				2						3	3	2
CO3	2	1				2						2	3	2
CO4	3	2	1			3	1					2	3	3
CO5	3	2	1			3	1					2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	15	35	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE09 - ENVIRONMENTAL IMPACT ASSESSMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Environmental Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To course helps to provide knowledge on EIA and to identify the impact of environmental attributes for the sustainable development.						
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<b>Unit – I</b>	<b>Introduction:</b>	<b>9</b>
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Definition & concept- Hierarchy in EIA-Initial environmental examination (IEE)- Environmental Impact Statement (EIS) – Environmental appraisal - Rapid and Comprehensive EIA, EIS, FONSI and NDS-Need for EIA studies-Advantages and limitation of EIA.

<b>Unit – II</b>	<b>Methodologies and Clearance Procedure:</b>	<b>9</b>
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Application Forms - Category of projects-Formation of EIA study team Methods of EIA -Criteria for selection of EIA methodology-Check lists – Matrices-Networks-overlay - Cost-benefit analysis –EIS format- Terms of Reference (ToR).

<b>Unit – III</b>	<b>Assessment and Prediction:</b>	<b>9</b>
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Baseline data-Assessment of Impact on land, water, air, noise, social, cultural, flora and fauna –Mathematical models-predictive measures-resettlement & rehabilitation-Public participation in EIA-EIA case studies for selected projects.

<b>Unit – IV</b>	<b>Environmental Management Plan:</b>	<b>9</b>
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Environmental audit- types of audit-definitions and concepts-stage of environmental audit- compliance schedule- Contents of EA reports-preparation of audit report- Introduction to ISO and ISO 14000- Environmental monitoring plan.

<b>Unit – V</b>	<b>Legislation:</b>	<b>9</b>
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Environmental audit- types of audit-definitions and concepts-stage of environmental audit- compliance schedule- Contents of EA reports-preparation of audit report- Introduction to ISO and ISO 14000- Environmental monitoring plan.

**Total:45****TEXT BOOK:**

1.	Larry W. Canter, "Environmental Impact Assessment", 2 <sup>nd</sup> Edition, McGraw-Hill, New Delhi, 1996.
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**REFERENCES:**

1.	Anjaneyulu Y.&ValliManikam, "Environmental Impact Assessment Methodologies", 2 <sup>nd</sup> Edition, B.S Publications, Hyderabad, 2011.
2.	Barthwal R.R., "Environmental Impact Assessment", 2 <sup>nd</sup> Edition, New Age International Publishers, New Delhi , 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explicate the concept of EIA framework	Understanding (K2)
CO2	identify the methodologies and prepare EIA reports.	Understanding (K2)
CO3	illustrate the necessity of public participation in EIA studies	Applying (K3)
CO4	prepare the compliance schedule for the developmental projects.	Applying (K3)
CO5	select the key steps involved in the EIA legislations	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1	3	2
CO2	2	1				3	2	1				1	3	3
CO3	3	2	1			3	2	1				1	3	3
CO4	3	2	1			3	2	1				1	3	3
CO5	2	1				3	2	1				1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	20	65	15				100
CAT3	20	60	20				100
ESE	15	65	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE10 - PUBLIC TRANSPORTATION SYSTEMS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Transportation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To Impart Knowledge on Public Transportation Systems and Planning.
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<b>Unit - I</b>	<b>Introduction:</b>	<b>9</b>
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Modes of public transport and comparison – Public transport travel characteristics – Prioritization of public transport – Technology of bus, Rail, Rapid transit systems.

<b>Unit - II</b>	<b>Rail Transit System:</b>	<b>9</b>
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Rail transport – Types of rail transit – Suburban commuter rail – Rapid rail transit – Light rail transit – Monorail system – Growth of rail based transit systems – Rail transit system development in Indian cities.

<b>Unit - III</b>	<b>Rail Transit Planning:</b>	<b>9</b>
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Transit system operations, Para-transit systems – Street transit systems, Rapid transit systems – Estimation of transit demand – Route development, properties of routing stop location and stopping Policy – Schedule.

<b>Unit - IV</b>	<b>Transit Management:</b>	<b>9</b>
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Bus transport – Transport Characteristics – Types of buses – Bus transit management – Estimation of the required fleet strength – Bus route planning – Expansion/Curtailment of services – Performance indicators – Fleet management – Methods of financing.

<b>Unit - V</b>	<b>Coordination of Public Transport:</b>	<b>9</b>
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Need for coordination – Selection of transit mode – Public transport financing – Transit fare structures – Transit marketing – Intermodal transfer.

**Total:45****TEXT BOOK:**

1.	Kadiyali L.R., "Traffic Engineering and Transport Planning", 9 <sup>th</sup> Edition, Khanna Publishers, Delhi, 2017.
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**REFERENCES:**

1.	Rao G.V., "Principles of Transportation and Highway Engineering", 5 <sup>th</sup> Edition, Tata McGraw-Hill Publishing, Uttar Pradesh, 2000.
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2.	Chakroborty P.& Das A., "Principles of Transportation Engineering ", 6 <sup>th</sup> Edition, Prentice Hall India, Delhi, 2003.
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<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	summarize different modes of public transport and its characteristics	Understanding (K2)
CO2	explain the types of rail transit system and its development in India	Understanding (K2)
CO3	interpret on rail transit planning system and understand routing and scheduling	Understanding (K2)
CO4	infer the transit management techniques and finance	Understanding (K2)
CO5	describe the coordination of public transport system and financing	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	2	1				3						1	3	2
CO3	2	1				3						1	3	2
CO4	2	1				3						1	3	2
CO5	2	1				3						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	80					100
ESE	20	80					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE11 - ENVIRONMENTAL GEO-TECHNOLOGY**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Foundation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To develop an understanding of the geotechnical aspects in the disposal of waste materials and the remediation of environmentally contaminated sites.						
<b>Unit - I</b>	<b>Fundamentals of Geo-environmental Engineering:</b>						<b>9</b>
Scope of geo-environmental engineering - Multiphase behaviour of soil – Role of soil in geo-environmental applications – Importance of soil physics, Soil chemistry, Hydrogeology, Biological process – Sources and type of ground contamination impact of ground contamination on geo-environment - Case histories on geo-environmental problems.							
<b>Unit - II</b>	<b>Soil-Water Interaction:</b>						<b>9</b>
Formation of soil minerals - Important clay minerals - Properties of clay minerals - Mineralogy characterization and its significance in determining soil behaviour – Soil-water interaction and concepts of double layer – Cation exchange capacity – Volumetric water content.							
<b>Unit - III</b>	<b>Waste Containment System:</b>						<b>9</b>
Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment – Different role of soil in waste containment – Different components of waste containment system and its stability issues – Property evaluation for checking soil suitability for waste containment – Design of waste containment facilities – Application of clay liners.							
<b>Unit - IV</b>	<b>Contaminant Site Remediation:</b>						<b>9</b>
Site characterization – Risk assessment of contaminated site - Remediation methods for soil and groundwater – Physico-chemical methods, Biological methods, Electro-kinetic methods, Thermal methods – Selection and planning of remediation methods – Case studies.							
<b>Unit - V</b>	<b>Advanced Soil Characterization:</b>						<b>9</b>
Contaminant analysis - Water content and permeability measurements – Electrical and thermal property evaluation- XRD and XRF analysis – Use of GPR for site evaluation - Introduction to geotechnical centrifuge modelling.							

**Total:45****TEXT BOOK:**

1.	Hsai-Yang Fang & Ronald C. Chaney, "Introduction to Environmental Geo-technology", 2 <sup>nd</sup> Edition, CRC Press, USA, 2016.
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**REFERENCES:**

1.	Sharma H.D. & Reddy K.R., "Geo-environmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies", 1 <sup>st</sup> Edition, John Wiley & Sons, USA, 2004.
2.	Reddi L.N. & Inyang H.I., "Geo-environmental Engineering, Principles and Applications", 3 <sup>rd</sup> Edition, Marcel Dekker, New York, 2004.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	discuss the importance, applications and case histories of GeoEnvironmental engineering	Understanding (K2)
CO2	describe clay minerals and phenomenon of soil water interaction	Understanding (K2)
CO3	design engineered land fill systems	Applying (K3)
CO4	recommend different remediation techniques based on type of pollutant	Applying (K3)
CO5	summarize advanced soil characterization techniques	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1	3	2
CO2	2	1				3	1					1	3	2
CO3	3	2	1			3	1					1	3	3
CO4	3	2	1			3	1					1	3	3
CO5	2	1				3	1					1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	50	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE12 - ROAD SAFETY MANAGEMENT**

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	To make the students understand the necessity of road safety management and its elements						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Road safety – Road safety demographics – 4E's of road safety – road users decisions – causes of accidents – human factors – Road and its condition – Environmental studies – safety management - roles and responsibilities.							
<b>Unit - II</b>	<b>Accident Data Collection:</b>						<b>9</b>
Accident data collection – accident investigation and reduction – crash factors and interaction – accident costs and prevention – types of statistics – crash reconstruction – computer record systems – RADMS – case studies.							
<b>Unit - III</b>	<b>Accident Analysis Techniques:</b>						<b>9</b>
Principles for effective road safety analysis – collision diagram – preparation, spatial analysis of accidents – methods and GIS in accident analysis – Black spot, Black route and area identification – area prediction models – development – Empirical Bayes approach – Before and after evaluation – case studies.							
<b>Unit - IV</b>	<b>Road Safety Audit:</b>						<b>9</b>
Need for road safety audit – concept and elements of safety audit – steps in road safety audit – safety audit for existing roads – Road safety legislation – legal requirements – provisions of Motor Vehicle Act and NGO's in prevention of accidents.							
<b>Unit - V</b>	<b>Accident Studies and Investigation:</b>						<b>9</b>
Accident data – Identification of accident prone location – prioritization – Investigation safety considerations on completed roads and in work zone – Mitigation measures.							

**Total:45****TEXT BOOK:**

1.	Ranade Prabha Shastri, "Road Safety Management: Issues and Perspectives", 1 <sup>st</sup> Edition, ICFAI University Press, Hyderabad, 2010
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**REFERENCES:**

1.	Elvik R.&Vaa T., "The Handbook of Road Safety Measures", 2 <sup>nd</sup> Edition, Emerald Group Publishing Limited, New Delhi, 2004.
2.	Rober F. & Baker, "The Highway Risk Problem – Policy Issues in Highway Safety", 2 <sup>nd</sup> Edition, John Wiley and Sons, Noida, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the road safety factors	Understanding (K2)
CO2	analyze accidents and accident data	Applying (K3)
CO3	sketch collision and condition diagrams	Applying (K3)
CO4	demonstrate the road safety audit	Understanding (K2)
CO5	assess accident prone areas	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	2	1				3						1	3	2
CO5	2	1				3						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	70	10				100
CAT3	20	80					100
ESE	10	80	10				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE13 - DESIGN OF PRESTRESSED CONCRETE STRUCTURES**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of RC Elements</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To give the knowledge on the prestressing principles and describes the methods of prestressing for real time applications which motivates towards innovations in the relevant fields
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<b>Unit - I</b>	<b>Introduction:</b>	<b>9</b>
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Basic Concepts of Prestressing-Need for High Strength Steel and Concrete-Terminology- Advantages of Prestressed Concrete-Applications of Prestressed Concrete-Materials for Prestressed Concrete – Prestressing Systems-Analysis of Prestress and Bending Stresses.

<b>Unit - II</b>	<b>Loss of Prestress and Deflection of Prestressed Concrete Beams:</b>	<b>9</b>
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Losses of Prestress – Deflections of Prestressed Concrete Members – Factors Influencing Deflections – Short-Term Deflections of Uncracked Members – Prediction of Long Time Deflections - Flexural Strength of Prestressed Concrete Sections – Types of Flexural Failure.

<b>Unit - III</b>	<b>Design of Prestressed Concrete Sections:</b>	<b>9</b>
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Design of Sections for Flexure-Design of Sections for Axial Tension- Design of sections for compression and bending- Design of Prestressed Sections for Shear and Torsion (design concepts only) - Design of Anchorage Zone by Guyon's method-Concept of Magnel's method (IS 1343 recommendations).

<b>Unit - IV</b>	<b>Composite Construction of Prestressed and in-situ Concrete:</b>	<b>9</b>
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Types of Composite Structures – Design Procedure-Calculation of stresses at important stages both for propped and unpropped construction-Design of shear connector-Shrinkage Stresses.

<b>Unit - V</b>	<b>Circular and Vertical Prestressing:</b>	<b>9</b>
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General Aspects- Analysis and design - IS Codal provisions –Circular Prestressing-Analysis and design of prestressed concrete tanks-types and design of prestressed concrete pipes-design of prestressed concrete Poles - design of prestressed concrete sleepers.

**Total:45****TEXT BOOK:**

1.	Krishna Raju N., "Prestressed Concrete", 6 <sup>th</sup> Edition, McGraw Hill Education, 2018.
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**REFERENCES:**

1.	Praveen Nagarajan, "Prestressed Concrete Design", 1 <sup>st</sup> Edition, Pearson Education India, 2013.
2.	Rajagopalan N., "Prestressed Concrete", 2 <sup>nd</sup> Edition, Narosa Book Distributors, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	evaluate the losses in prestress applying the design philosophy	Analyzing (K4)
CO2	calculate the deflections in prestressed concrete structural sections	Analyzing (K4)
CO3	design the prestressed concrete structural elements	Applying (K3)
CO4	design shear connectors	Applying (K3)
CO5	design the prestressed circular tanks and concrete poles	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE14 - SUSTAINABLE CONSTRUCTION METHODS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart the knowledge on Sustainable construction methods incorporating site and climatic zone-specific sustainability features.
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<b>Unit - I</b>	<b>Introduction to Sustainable Engineering:</b>	<b>9</b>
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Definitions of Sustainability - Need for Sustainability-Concept of Sustainable Development-Three Pillar Basic Model - Egg of Sustainability Model- Atkisson's Pyramid Model-Prism Model-Principles of Sustainable Development-Threats for Sustainability.

<b>Unit - II</b>	<b>Environmental Issues:</b>	<b>9</b>
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Zero Waste Concept -3R Concept-Waste to Energy Technology -Climate Change and Global Warming- Ozone Layer Depletion-Resource Degradation- Carbon Footprint.

<b>Unit - III</b>	<b>Tools for Sustainability:</b>	<b>9</b>
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Environmental Management System (EMS)- Concept of ISO 14000-Life Cycle Assessment (LCA)- Basic Concepts- EIA Process in India - Environmental Auditing- Case Studies.

<b>Unit - IV</b>	<b>Sustainable Habitat:</b>	<b>9</b>
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Introduction- Necessity - Concept of Green Building-Principles of Green Building-Green Building Certification and Rating-Sustainable Cities -Sustainable Transport-Sustainable Pavements-Case Studies.

<b>Unit - V</b>	<b>Sustainable Industrialization and Urbanization:</b>	<b>9</b>
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Need-Pollution Prevention-Industrial Ecology-Green Business-Green Technology-Green Construction-Green Energy-Green Transportation.

**Total:45****TEXT BOOK:**

1.	Rag R.L. &RemeshLekshmiDinachandran, "Introduction to sustainable engineering", 2 <sup>st</sup> Edition, PHI Learning Pvt. Ltd., New Delhi, 2016.
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**REFERENCES:**

1.	Bill Reed, "The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability", 1 <sup>st</sup> Edition, Wiley India Pvt. Ltd., New Delhi, 2009.
2.	Rogers Peter P., "An Introduction to Sustainable Development", 1 <sup>st</sup> Edition, Glen Educational Foundation Inc., USA, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	assimilate the concept of sustainability for future	Understanding (K2)
CO2	examine the local and global environmental issues to overcome the challenges in implementing sustainability	Applying (K3)
CO3	use sustainable tools for construction	Applying (K3)
CO4	implement green building practices in a building	Applying (K3)
CO5	carry out sustainable industrialization and urbanization process	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	1
CO2	3	2	1			3						1	2	2
CO3	3	2	1			3						1	2	2
CO4	3	2	1			3						1	2	2
CO5	3	2	1			3						1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE15 - AIR AND NOISE POLLUTION CONTROL ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Environmental Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To realize the importance of Air and Noise pollution measurement and its control strategies for maintaining environmental quality standards.						
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<b>Unit - I</b>	<b>Sources and Effects of Air Pollutants:</b>	<b>9</b>
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Classification of air pollutants - Sources of air pollution - Effects of air pollution on human beings, materials, vegetation, animals - Global warming -Ozone layer depletion - Basic Principles of Sampling - Source and ambient sampling - Analysis of pollutants.

<b>Unit - II</b>	<b>Dispersion of Pollutants:</b>	<b>9</b>
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Elements of atmosphere - Meteorological factors - Wind rose diagram - Lapse rate - Atmospheric stability and turbulence - Plume rise - Dispersion of pollutants - Dispersion models - Applications.

<b>Unit - III</b>	<b>Air Pollution Control:</b>	<b>9</b>
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Concepts of control - Principles and design of control measures - Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation - Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion - Pollution control for specific major industries.

<b>Unit - IV</b>	<b>Noise Pollution:</b>	<b>9</b>
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Sources, Measurements, Effects and Occupational hazards of noise pollution - Assessment-Control methods - Noise Exposure Index - Prevention - Noise Measurement strategies - Case Studies.

<b>Unit - V</b>	<b>Noise and Air Quality Management:</b>	<b>9</b>
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Noise and Air quality standards - Quality monitoring - Preventive measures - Pollution control efforts - Noise and Air quality Zoning - Town planning regulation of new industries - Legislation and enforcement - Environmental Impact Assessment on Air and Noise quality.

**Total:45****TEXT BOOK:**

1.	Rao M.N.& Rao H.V.N., "Air Pollution", 1 <sup>st</sup> Edition, McGraw Hill Education (India) Pvt. Limited, Chennai, 2017.
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**REFERENCES:**

1.	Howard Peavy, Donald Rowe & George Tchobanoglous, "Environmental Engineering", 1 <sup>st</sup> Edition, McGraw Hill, New Delhi, 2017.
2.	Heumann W.L., "Industrial Air Pollution Control Systems", 1 <sup>st</sup> Edition, McGraw Hill, New Delhi, 1997.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the sources and impacts of air pollutants.	Understanding (K2)
CO2	prepare the Wind rose diagram based on the plume behaviour.	Applying (K3)
CO3	adopt air pollution control methods for different pollutants.	Understanding (K2)
CO4	select the control methods for noise pollution.	Understanding (K2)
CO5	enumerate air and noise quality standards.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1	2	2
CO2	3	2	1			3	1					1	2	2
CO3	2	1				3	1					1	3	2
CO4	2	1				3	1					1	3	2
CO5	2	1				3	1					1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	20	60	20				100
CAT3	30	70					100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE16 - URBAN TRANSPORTATION PLANNING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Transportation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To make the students learn the Principles of Urban Transport Planning and its Components.						
<b>Unit - I</b>	<b>Urban Transportation Planning Process &amp; Concepts:</b>						<b>9</b>
Role of transportation – Transportation problems – Urban travel characteristics – Evolution of transportation planning process – Concept of travel demand – Demand function – Independent variables – Travel attributes – Assumptions in demand estimation – Sequential, recursive and simultaneous processes.							
<b>Unit - II</b>	<b>Transportation Survey and Analysis:</b>						<b>9</b>
Definition of study area – Zoning – Types and sources of data – Road side interviews – Home interview surveys – Expansion factors – Accuracy check – Trip generation models – Zonal models – Category analysis – Household models – Trip attractions of work centre – Trip distribution models – Growth factor models – Gravity models – Opportunity models.							
<b>Unit - III</b>	<b>Design and Mode Split Analysis:</b>						<b>9</b>
Standards and guidelines – Transport policies – Mode choice behaviour, Completing modes, Mode split curves, Probabilistic models – Route Split Analysis – Elements of transportation networks, coding – Minimum path trees, all-or-nothing assignment.							
<b>Unit - IV</b>	<b>Urban Goods Movement:</b>						<b>9</b>
Importance and Characteristics of urban goods movement – Problems of urban goods movement – Goods traffic management in urban area – Urban goods movement planning process – Goods movement forecasting- Comprehensive mobility plan – Master plan – Case studies.							
<b>Unit - V</b>	<b>Innovations in Urban Transportation:</b>						<b>9</b>
Need for innovative approaches – Classification of urban transportation innovations – Bus Rapid Transit (BRT) – Bus route rationalization – Geographic Information System (GIS) – Intelligent Transportation System (ITS) – Track guided bus – Duo bus.							

**Total:45****TEXT BOOK:**

1.	Jotin Khisty C.& Kent Lall B., "Transportation Engineering - An Introduction", 3 <sup>rd</sup> Edition, Pearson Education, 2017.
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**REFERENCES:**

1.	Papacostas C.S. & Prevedouros P.D., "Transportation Engineering and Planning", 3 <sup>rd</sup> Edition, Prentice Hall, Delhi, 2009.
2.	Hutchinson B.G., "Principles of Urban Transportation System Planning", 1 <sup>st</sup> Edition, Tata McGraw-Hill Publishing, Noida, 1974.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain urban transport planning and its basic concepts	Understanding (K2)
CO2	infer the transportation survey and summarize trip attraction, generation, distribution	Understanding (K2)
CO3	summarize the modal choice and the transportation network	Understanding (K2)
CO4	comprehend the characteristics, problems and management of urban goods movement and case studies for mobility plan	Applying (K3)
CO5	paraphrase the advancement in urban transportation	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	2	1				3						1	3	2
CO3	2	1				3						1	3	2
CO4	3	2	1			3						1	3	3
CO5	2	1				3						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE17 - ROCK MECHANICS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Foundation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings
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<b>Unit - I</b>	<b>Classification and Index Properties of Rocks:</b>	<b>9</b>
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Introduction – Scope of rock mechanics – Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock mass rating and Q System

<b>Unit - II</b>	<b>Rock Strength and Failure Criteria:</b>	<b>9</b>
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Modes of rock failures – Strength of rock – Laboratory measurement of shear, tensile and compressive strength – Stress-strain behaviour of rock under hydrostatic compression and deviatoric loading – Mohr-Coulomb failure criteria

<b>Unit - III</b>	<b>Initial Stresses and their Measurements:</b>	<b>9</b>
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Estimation of initial stresses in rocks – Influence of joints and their orientation in distribution of stresses – Measurement of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method

<b>Unit - IV</b>	<b>Application of Rock Mechanics in Engineering:</b>	<b>9</b>
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Simple engineering application – Underground openings – Rock slopes – Bolting – Anchoring – Foundations and mining subsidence

<b>Unit - V</b>	<b>Rock Stabilization:</b>	<b>9</b>
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Rock support and rock reinforcement – Methods of excavation of tunnels – Control and maintenance – Tunnel ventilation – Control of ground water and gas – Shotcreting

**Total:45****TEXT BOOK:**

1.	Deb Debasis & Verma Abhiram Kumar, "Fundamentals and Applications of Rock Mechanics" 1 <sup>st</sup> Edition, PHI Learning Pvt.Ltd., 2016.
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**REFERENCES:**

1.	Richard E. Goodman, "Introduction to Rock Mechanics", 2 <sup>nd</sup> Edition, John Wiley and Sons, United States, 1989.
2.	Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", 3 <sup>rd</sup> Edition, PHI Learning Pvt. Ltd., 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	classify the rocks and study the index properties of rock systems	Understanding (K2)
CO2	understand the modes of rock failure, stress-strain characteristics	Understanding (K2)
CO3	estimate the stresses in rocks	Analyzing (K4)
CO4	study the stability applications in rock mechanics	Applying (K3)
CO5	suggest suitable methods for rock stabilization	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	2	2
CO2	2	1				3						1	2	2
CO3	3	3	2			3						1	2	2
CO4	3	2	1			3						1	2	3
CO5	3	2	1			3						1	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	20	40	30	10			100
CAT3	20	30	50				100
ESE	10	30	40	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE18 - FINITE ELEMENT METHODS**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Structural Analysis II</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course gives an idea on the mathematical concepts on one, two and three-dimensional problems.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Mathematical models of physical systems–Analytical Solutions-Variational methods of approximation–Ritz method–Weighted residual method: Galerkin, Least squares and Collocation methods. Piecewise approximation–Finite element method –Basic features-steps of FEM–Numerical solution of finite element equations–Gauss elimination method.							
<b>Unit - II</b>	<b>One Dimensional Problems:</b>						<b>9</b>
One dimensional element–Interpolation and Shape Functions-Principle of minimum potential energy-Derivation of element equations–Connectivity of elements–Imposition of boundary conditions–Solution of equations-Application to Bars and Plane Trusses							
<b>Unit - III</b>	<b>Two and Three-Dimensional Problems:</b>						<b>9</b>
Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements - Numerical Evaluation of Element Stiffness - Computation of Stresses, Geometric Nonlinearity and Static Condensation – Axi symmetric Element - Finite Element Formulation of Axi symmetric Element - Finite Element Formulation for 3 Dimensional Elements							
<b>Unit - IV</b>	<b>Isoparametric Formulation:</b>						<b>9</b>
Natural co-ordinate systems – Iso parametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems							
<b>Unit - V</b>	<b>Applications of FEM:</b>						<b>9</b>
Stiffness of Truss Members - Analysis of Truss - Stiffness of Beam Members - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Analysis of Grids- Fluid flow analysis - vibration analysis - Eigen Values and Eigen Vectors used for fluid analysis in pipes - Elastic Stability analysis - Plate bending problem- Introduction to Analysis Software							

**Total:45****TEXT BOOK:**

1. Chandrupatla R.T. & Belegundu A.D., "Introduction to Finite Elements in Engineering", 4 <sup>th</sup> Edition, Pearson Education, 2012.
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**REFERENCES:**

1. Reddy J.N., "An Introduction to Finite Element Method", 3 <sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2005.
2. Seshu P., "Text Book of Finite Element Analysis", 4 <sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2007.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the basic concept of FEM	Applying (K3)
CO2	solve the one-dimensional problems	Analyzing (K4)
CO3	analyse one and two- and three-dimensional problems	Analyzing (K4)
CO4	solve dynamic problems	Analyzing (K4)
CO5	analyse beam and truss by using FEM	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	3	2			3						1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2		20	40	40			100
CAT3		15	45	40			100
ESE	15	25	30	30			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18GEE01 - FUNDAMENTALS OF RESEARCH**

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
<b>Prerequisites</b>	<b>NIL</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	This course familiarize the fundamental concepts/techniques adopted in research, problem formulation and also disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.						
<b>Unit - I</b>	<b>Introduction to Research</b>						<b>9</b>
Introduction to Research: Types and Process of Research - Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords.							
<b>Unit - II</b>	<b>Literature Review</b>						<b>9</b>
Literature Review: Literature Collection - Methods - Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.							
<b>Unit - III</b>	<b>Research Methodology</b>						<b>9</b>
Research Methodology: Appropriate Choice of Algorithms/Methodologies/Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations.							
<b>Unit - IV</b>	<b>Journals and Papers:</b>						<b>9</b>
Journals and Papers: Journals in Science/Engineering - Indexing and Impact factor of Journals. Plagiarism and Research Ethics. Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study.							
<b>Unit - V</b>	<b>Reports and Presentations</b>						<b>9</b>
<b>Reports and Presentations:</b> How to Write a Report - Language and Style - Format of Project Report - Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc - Different Reference Formats. Presentation using PPTs. Research Tools.							

**Total: 45****TEXT BOOK:**

1. Walliman, Nicholas. "Research Methods: The basics". Routledge, 2017.
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**REFERENCES:**

1. Melville S, Goddard W. "Research Methodology: An Introduction For Science and Engineering Students". Kenwyn: Juta & Co Ltd., 1996.
2. Kumar, Ranjit. "Research Methodology: A step-by-step guide for beginners". SAGE Publications Limited, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	list the various stages in research and categorize the quality of journals.	Analyzing (K4)
CO2	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper.	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	1	1		3	3	3	2	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	35	25			100
CAT2		30	40	30			100
CAT3				50	50		100
ESE		25	25	25	25		100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE19 - EARTHQUAKE ENGINEERING AND DESIGN**

(IS: 13920:1993, IS 4326:1993, IS: 1893: 2000, IS: 13828: 1993, IS: 13827: 1993 code books are permitted)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	Earthquake-resistant design of structures has grown into a true multi-disciplinary field of engineering wherein many exciting developments are possible in the near future.						
<b>Unit - I</b>	<b>Elements of Seismology:</b>						
Causes of Earthquake - Geological faults - Tectonic plate theory - Elastic rebound - Epicenter - Hypocenter - Primary, Shear and Rayleigh waves - Seismogram - Magnitude and Intensity scales - Information on some disastrous earthquakes.							
<b>Unit - II</b>	<b>Earthquake Causes and Basics of Vibration:</b>						
Earthquake causes and its effect on built structures - EQ resistant provisions in masonry building - Single degree freedom system - Free and forced vibration - Forced vibration using Duhamel integral and Laplace transform - Multi degree of freedom system.							
<b>Unit - III</b>	<b>Response Spectrum and Dynamic Analysis:</b>						
Response of structure subjected to Random vibrations - Seismic coefficient method and Dynamic analysis - Ductile detailing of reinforced concrete beams, Columns and shear wall - Design procedure on ductile detailing - Design concepts of non-structural members.							
<b>Unit - IV</b>	<b>Earthquake Hazard Assessment Procedure:</b>						
Seismic failure of RC and masonry failure - DSHA - Case studies on PSHA - completeness analysis - Rapid Visual Screening method, Push Over Analysis - Estimation procedure of Dynamic soil properties - Field Testing - MASW test - Seed and Idriss method.							
<b>Unit - V</b>	<b>Seismic Measuring Instruments:</b>						
Principle of seismic instruments - Transducers for velocity and acceleration measurements - LVDT - Cathode Ray Oscilloscope, frequency measuring instruments - XY Plotter - Strip Chart recorder							

**Total:45****TEXT BOOK:**

1.	Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", 2 <sup>nd</sup> Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.
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**REFERENCES:**

1.	Chopra A.K., "Dynamics of Structures: Theory and Applications to Earthquake Engineering", 3 <sup>rd</sup> Edition, Pearson Education India, New Delhi, 2007.
2.	Paz M., "Structural Dynamics –Theory & Computation", CSB Publishers & Distributors, New Delhi, 1985.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	acquire the knowledge of various elements seismology with some case studies	Applying (K3)
CO2	assess the causes of vibration under earthquakes	Applying (K3)
CO3	interpret response spectra presented in different formats, including the acceleration-displacement response spectrum (adrs) diagram	Applying (K3)
CO4	acquire the knowledge of various screening techniques for earthquake hazard assessment	Understanding (K2)
CO5	organize the seismic measuring instruments	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	2	1				3						1	3	2
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	35	45				100
CAT2	20	35	45				100
CAT3	25	35	40				100
ESE	20	35	45				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE20 - CONSTRUCTION EQUIPMENT AND MANAGEMENT**

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	To impart knowledge in selection strategies of various equipment based on the requirement of the project at optimum cost and time.						
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<b>Unit - I</b>	<b>Equipment Management:</b>	<b>9</b>
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Identification – Factors in Selection of Equipment - Planning Equipment Utilization–Renting Strategies – Capital cost – Investment Alternatives – Elements of Operating and Owning – Bidding Costs – Replacement Decisions – Rent and Lease Considerations.

<b>Unit - II</b>	<b>Earthwork Equipment:</b>	<b>9</b>
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Tractors - Motor Graders - Scrapers - Front end Loaders - Earth Movers -Equipment for Dredging and Trenching- Tunnelling methods and equipment- Compaction Equipment-Diaphragm wall equipment- Pile Driving Equipment - Drilling and Blasting- Safety measures.

<b>Unit - III</b>	<b>Equipment for Screening and Transporting:</b>	<b>9</b>
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Forklifts and related equipment - Portable Material Bins - Tower crane - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - General Crane - Gantry girder.

<b>Unit - IV</b>	<b>Concreting Equipment:</b>	<b>9</b>
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Batching and Mixing Equipment - Hauling equipment - RMC- Modern Form work Techniques- MIVAN Construction - Shuttering - Types of pumps used for Construction - Boom placer- Equipment for Grouting and De-watering - 3D Concrete Printing.

<b>Unit - V</b>	<b>Surveying Equipment:</b>	<b>9</b>
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Modern electronic surveying equipment - Digital levels - Digital theodolite - Advance Total station - Lasers and sensors in Surveying - Remote sensing - Geographical Information System.

**Total:45****TEXT BOOK:**

1.	Sharma S.C., "Construction Equipment and Management ", 1 <sup>st</sup> Edition, Khanna Publishers, New Delhi, 2019.
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**REFERENCES:**

1.	Peurifoy R.L., "Construction Planning, Equipment and Methods", 2 <sup>nd</sup> Edition, McGraw Hill, Singapore, 2013.
2.	Leonid Nadolinets, "Surveying Instruments and Technology", 1 <sup>st</sup> Edition, CRC Press, United States, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	select suitable equipment required for building construction	Understanding (K2)
CO2	identify the best earthwork equipment for different earth conditions	Understanding (K2)
CO3	infer equipment required for screening and transporting	Understanding (K2)
CO4	choose the best and effective equipment needed for concreting and its method	Understanding (K2)
CO5	select modern equipment need for surveying with its applications	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>															
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	1				2						1	3	2	
CO2	2	1				2						1	3	2	
CO3	2	1				2						1	3	2	
CO4	2	1				2						1	3	2	
CO5	2	1				2						1	3	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	30	70					100
CAT3	30	70					100
ESE	30	70					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE21 - INDUSTRIAL WASTE MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the significance of industrial wastewater and solid waste treatment techniques for ensuring environmental sustainability.
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<b>Unit - I</b>	<b>Introduction:</b>	<b>9</b>
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Industrial scenario in India – Uses of water by industry – Sources, characteristics and types of industrial wastewater – Industrial wastewater and environmental impacts – Industrial waste survey – Industrial wastewater generation rates – Population equivalent – Toxicity of Industrial effluents and bioassay tests.

<b>Unit - II</b>	<b>Industrial Pollution Prevention:</b>	<b>9</b>
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Importance of prevention techniques – Significance of control measures – Benefits and barriers – Source reduction techniques – Waste audit – Recycle, reuse and byproduct recovery – Applications.

<b>Unit - III</b>	<b>Pollution from Major Industries:</b>	<b>9</b>
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Sources, characteristics, waste treatment flow sheets for selected industries – Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, Fertilizer, Thermal power plants – Wastewater reclamation concepts.

<b>Unit - IV</b>	<b>Waste Treatment Methods:</b>	<b>9</b>
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Equalization – Neutralization – Oil separation – Flotation – Precipitation – Heavy metal removal – Adsorption – Sequential batch reactor (SBR) – Handling and treatment of solid waste management.

<b>Unit - V</b>	<b>Wastewater Reuse and Residual Management:</b>	<b>9</b>
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Zero effluent discharge systems – Residue management – Quality requirements for wastewater reuse and industrial reuse – Disposal on water and land – Quantification and characteristics of sludge – Location, needs and flow sheet of operational sequences in CETPs.

**Total:45****TEXT BOOK:**

1. Rao M.N. & Datta A.K., "Wastewater Treatment", 3 <sup>rd</sup> Edition, Oxford - IBH Publication, New Delhi, 2017.
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**REFERENCES:**

1. Eckenfelder W.W., "Industrial Water Pollution Control", 3 <sup>rd</sup> Edition, McGraw-Hill Book Company, New Delhi, 2000.
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2. Bishop P.L., "Pollution Prevention: Fundamental and Practice", 1 <sup>st</sup> Edition, McGraw-Hill, New Delhi, 2000.
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<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	elaborate the sources and effects of industrial contaminants	Understanding (K2)
CO2	recommend rigid preventive measures to overcome environmental pollution	Applying (K3)
CO3	delineate the causes and effects of pollution from various industries	Applying (K3)
CO4	categorize various industrial waste treatment techniques	Applying (K3)
CO5	discuss the significance of reuse system and appropriate waste management techniques	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1	3	2
CO2	3	2	1			3	2	1				2	3	3
CO3	3	2	1			3	2	1				2	3	3
CO4	3	2	1			3	2	1				2	3	3
CO5	3	2	1			3	2	1				2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	60	20				100
CAT3	20	80					100
ESE	10	70	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE22 - TRAFFIC ENGINEERING AND MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Transportation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To make students understand and apply the traffic engineering and management concepts						
<b>Unit - I</b>	<b>Fundamentals of Traffic Engineering:</b>						<b>9</b>
Scope of Traffic Engineering – Elements of Traffic Engineering – Road user, vehicle and road way. Road Characteristics – Road user characteristics – PIEV theory – Vehicle characteristics – IRC standards – Design speed, volume – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.							
<b>Unit - II</b>	<b>Traffic Surveys and Level of Service:</b>						<b>9</b>
Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Origin Destination Survey – Parking Survey – Accident analysis – Statistical applications in traffic studies and traffic forecasting – Level of service – Highway capacity – Capacity of urban and rural roads – PCU concept and its limitations – Traffic Flow theory.							
<b>Unit - III</b>	<b>Traffic Design and Visual Aids:</b>						<b>9</b>
Design of at-grade intersections – Principles of design – Channelization – Design of rotaries – Traffic signals - pre-timed and traffic actuated – Design of signal setting – phase diagrams – timing diagram – Signal co-ordination – Roundabouts – Grade separated intersections – Geometric elements for divided and access controlled highways and expressways.							
<b>Unit - IV</b>	<b>Traffic Safety and Environment:</b>						<b>9</b>
Road furniture – Street lighting – Traffic signs including Variable Message Sign and road markings – Networking pedestrian facilities & cycle tracks – Traffic regulation and control Traffic Safety – Principles and Practices – Road Safety Audit – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures.							
<b>Unit - V</b>	<b>Traffic Management:</b>						<b>9</b>
Area Traffic Management System – Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures -Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods – Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education – Car pooling.							

**Total:45****TEXT BOOK:**

1.	Kadiyali L.R., "Traffic Engineering and Transport Planning", 9 <sup>th</sup> Edition, Khanna Publishers, Delhi, 2017.
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**REFERENCES:**

1.	Fred L. Mannering, Scott S. Washburn & Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", 5 <sup>th</sup> Edition, Wiley India Pvt. Ltd., New Delhi, 2012.
2.	Garber & Hoel, "Principles of Traffic and Highway Engineering", 3 <sup>rd</sup> Edition, Cengage Learning, New Delhi, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the fundamental concepts of traffic engineering	Understanding (K2)
CO2	demonstrate the survey of traffic parameters and highway capacity LOS	Understanding (K2)
CO3	design channels, intersections, signals, roundabouts and parking arrangements	Applying (K3)
CO4	understand the traffic signs, markings and road safety and the environmental impacts	Understanding (K2)
CO5	summarize the traffic planning and management systems	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3							3	2
CO2	2	1				3							3	2
CO3	3	2	1			3						1	3	3
CO4	2	1				3							3	2
CO5	2	1				3							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	60	20				100
CAT3	20	80					100
ESE	10	70	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE23 - SITE INVESTIGATION AND SOIL EXPLORATION**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Foundation Engineering</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on the preparation of soil exploration report based on laboratory, field exploration and testing techniques.						
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<b>Unit - I</b>	<b>Scope and Objectives of Site Investigation and Subsurface Exploration:</b>	<b>9</b>
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Site investigation –scope and objectives – activities involved in site investigation – preliminary desk studies-subsurface exploration –general considerations – Planning an exploration programme – location, spacing and depth of borings –Soil Profile – Bore logs – Data Presentation – Soil investigation and exploration reports.

<b>Unit - II</b>	<b>Exploration Techniques:</b>	<b>9</b>
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Open pits and trenches - Different methods of boring and drilling – stabilization of bore holes – cleaning of bore hole – Geophysical exploration and interpretation – Non-displacement and displacement methods – Drilling in difficult subsoil conditions.

<b>Unit - III</b>	<b>Soil Sampling Techniques:</b>	<b>9</b>
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Different type of samples – sample disturbance – measurement of sample disturbance – area and recovery ratio – RQD – Types of samplers – Undisturbed sampling technique – Drive sampling – Design criteria for drive samplers – Methods for preventing loss of samples – Surface and control sampling in site testing – Advanced sampling techniques – Offshore sampling – Preservation and handling of samples.

<b>Unit - IV</b>	<b>Field Testing in Soil Exploration:</b>	<b>9</b>
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Field tests – Importance of field tests in soil exploration – Penetration testing – Standard Penetration Test – Static Cone Penetration Test – Dynamic cone penetration test – Plate load test – Field Vane shear test – Pressure meter and dilatometer testing – Data interpretation – Cyclic load test – Block vibration test – Field Permeability test.

<b>Unit - V</b>	<b>Geophysical Methods:</b>	<b>9</b>
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Geophysical methods- types- Seismic Methods – Electrical Resistivity Methods – Electrical Profiling Method –Electrical Sounding Method – Ground Penetrating Radar.

**Total:45****TEXT BOOK:**

1.	Clayton C.R., Matthews M.C. & Simons N.E., "Site Investigation", 2 <sup>nd</sup> Edition, Trans Tech Publications Ltd, 1995.
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**REFERENCES:**

1.	Hanna T.H., "Field Instrumentation in Geotechnical Engineering", 2 <sup>nd</sup> Edition, Trans Tech Publications Ltd, 1985.
2.	Brahma S.P., "Foundation Engineering", 5 <sup>th</sup> Edition, Tata McGraw-Hill Publishing Company, New Delhi, 1993.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	discuss the importance, features and stages of geotechnical investigation	Understanding (K2)
CO2	recommend different exploration techniques based on type of subsoil	Applying (K3)
CO3	design of soil and rock samplers	Applying (K3)
CO4	outline in-situ testing of soil and rock	Understanding (K2)
CO5	summarize non destructive geophysical methods	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2						1	3	3
CO2	3	2	1			2						1	3	3
CO3	3	2	1			2						1	3	3
CO4	2	1				2						1	3	3
CO5	2	1				2						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	50	40				100
CAT3	30	70					100
ESE	10	50	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE24 - GREEN BUILDING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on Eco friendly building concepts and building certification systems as per Indian and International Standards
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<b>Unit - I</b>	<b>Introduction to IGBC and Green Building Concept:</b>	<b>9</b>
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Green Building Concept- Introduction to IGBC- Green Building Rating Tools - Green Project Management and Certification - Documentation and Certification.

<b>Unit - II</b>	<b>Introduction to Green Rating Systems:</b>	<b>9</b>
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History of Green Rating systems - LEED, GRIHA, BREEAM, IGBC - Need and use of Green Rating systems - Structure of the rating systems - Selection of the appropriate rating system- ZEB-ZCB ratings.

<b>Unit - III</b>	<b>Alternative Construction Materials &amp; Construction Methods:</b>	<b>9</b>
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Building and Material Reuse - Salvaged Materials - Material Content - Manufactured Materials - Recycled Content – Eco Block - Volatile Organic Compounds (VOC's) Natural Non-Petroleum Based Materials - Alternative Construction Methods - Waste Management and Recycling - Design for Deconstruction.

<b>Unit - IV</b>	<b>Performance Testing:</b>	<b>9</b>
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Cost and Performance Comparisons and Benchmarking - Building Modelling & Energy Analysis - Cost Benefit Analysis - Energy, Shell and Systems Installation Testing - Blower Door - Duct Tightness - Thermal Imagery - - Moisture Testing - Commissioning, Metering, Monitoring -Weatherization - Air Sealing - Moisture Control - Energy Retrofits and Green Remodels.

<b>Unit - V</b>	<b>Future of Building Rating Systems:</b>	<b>9</b>
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Role of Green building consultant - Determining the various green points - Green Accreditation examinations - Energy modelling and energy auditing in green building ratings - Consultancy scope and services for green rating systems - Codes and Certification Programs - Green Rating Registration - Green Remodel Ratings - International Green Construction Codes and ratings –Service life span - Case Study.

**Total:45****TEXT BOOK:**

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|----|---|
| 1. | Abe Kruger, "Green Building: Principles and Practices in Residential Construction", 1 <sup>st</sup> Edition, Cengage learning India Pvt. Ltd., New Delhi, 2012. |
|----|---|

**REFERENCES:**

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| 1. | Dru Meadows, "Preparing a Building Service Life Plan for Green Buildings", 1 <sup>st</sup> Edition, McGraw-Hill Publications, United States, 2014. |
| 2. | Linda Reeder, "Guide to green building rating systems ", 3 <sup>rd</sup> Edition, John Wiley & Sons, New Jersey, 2010.                             |



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	summarize the concepts of green building	Understanding (K2)
CO2	interpret on existing green building rating systems	Understanding (K2)
CO3	identify alternate construction materials and methods	Understanding (K2)
CO4	rate the green building materials	Evaluating (K5)
CO5	re-frame the codes for certification of green construction	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1	3	2
CO2	2	1				3	1					1	3	2
CO3	2	1				3	1					1	3	2
CO4	3	2	1			3	1					1	3	3
CO5	2	1				3	1					1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	35	65					100
CAT3	20	50	30				100
ESE	30	50	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE25 - TOTAL QUALITY MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>7</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course deals with Quality concepts and TQM principles focusing on process quality to assure product quality to the customers. It also deals with the Basic and modern Quality management tools including ISO standards						
<b>Unit - I</b>	<b>Quality Concepts and Principles:</b>						<b>9</b>
Quality Concepts and Principles: Definition of Quality - Dimensions of Quality - Quality Planning - Quality costs - Basic concepts of Total Quality Management - Historical Review. Principles of TQM - Leadership –Concepts - Quality Council - Quality Statements - Strategic Planning - Deming Philosophy - Barriers to TQM Implementation.							
<b>Unit - II</b>	<b>Total Quality Management-Principles and Strategies:</b>						<b>9</b>
Total Quality Management-Principles and Strategies: Customer satisfaction –Customer Perception of Quality - Customer Complaints - Customer Retention - Employee Involvement –Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal - Benefits. Continuous Process Improvement –Juran Trilogy - PDCA Cycle - 5S - Kaizen - Supplier Partnership –Partnering - sourcing - Supplier Selection - Supplier Rating - Relationship Development - Performance Measures							
<b>Unit - III</b>	<b>Control Charts for Process Control:</b>						<b>9</b>
Control Charts for Process Control: The seven tools of quality - Statistical Fundamentals –Measures of central Tendency and Dispersion - Population and Sample - Normal Curve - Control Charts for variables and attributes - Process capability - Concept of six sigma.							
<b>Unit - IV</b>	<b>TQM-Modern Tools:</b>						<b>9</b>
TQM-Modern Tools: The new seven tools of quality - Benchmarking-Need - Types and process; Quality Function Deployment-HOQ construction - case studies; Taguchi's Robust design-Quality loss function - DOE; Total Productive Maintenance-uptime enhancement; Failure Mode and Effect Analysis-Risk Priority Number - Process - case studies.							
<b>Unit - V</b>	<b>Quality Systems:</b>						<b>9</b>
Quality Systems: Need for ISO 9000 and Other Quality Systems - ISO 9000 : 2015 Quality System –Elements - Implementation of Quality System - Documentation - Quality Auditing - Introduction to TS 16949 - QS 9000 - ISO 14000 - ISO 18000 - ISO 20000 - ISO 22000. Process of implementing ISO - Barriers in TQM implementation.							

**Total: 45****TEXT BOOK:**

1.	Dale H.Besterfield , "Total Quality Management", 3 <sup>rd</sup> Edition, Pearson Education, New Delhi, 2011.
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**REFERENCES:**

1.	Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2008.
2.	Feigenbaum A.V. , "Total Quality Management", 4 <sup>th</sup> Edition, Tata McGraw Hill , New Delhi, 2004.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	demonstrate the need, history and principles of quality and TQM	Applying (K3)
CO2	illustrate the principles and strategies of TQM	Applying (K3)
CO3	make use of various tools and techniques of quality management	Analyzing (K4)
CO4	apply various quality tools and techniques in both manufacturing and service industry	Applying (K3)
CO5	explain the concepts of quality management system and ISO.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1				2	2	3	2	2	1	1		3
CO2	1	1				3	2	3	3	3	1	1	2	3
CO3	3	2	2	2	2	2		1	2	2	1	1	1	3
CO4	2	2	2	2	2	2		1	2	2	1	1	2	3
CO5						3	3	2	3	2	1	1		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	45	30				100
CAT2	20	30	30	20			100
CAT3	25	45	30				100
ESE	20	30	35	15			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE26 - DESIGN OF PREFABRICATED STRUCTURES**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of RC Elements</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart the knowledge among the students to understand the principles, components and design of various prefabricated structural elements.
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<b>Unit - I</b>	<b>Design Principles:</b>	<b>9</b>
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General principles of fabrication – need for prefabrication – general principles of prefabrication – comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – materials – modular coordination – systems – production – transportation – erection.

<b>Unit - II</b>	<b>Prefabricated Components and Joints:</b>	<b>9</b>
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Planning for components of prefabricated structures, Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls, disuniting of structures. Joints – joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

<b>Unit - III</b>	<b>Production and Fabrication:</b>	<b>9</b>
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Production technology – Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology – equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

<b>Unit - IV</b>	<b>Design of Prefabricated Beams:</b>	<b>9</b>
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Prefabricated load carrying members – Types of beams – design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses – beams, columns, symmetric frames.

<b>Unit - V</b>	<b>Design of Prefabricated Elements:</b>	<b>9</b>
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Types of Slabs - construction of roof and floor slabs - Design of hollow core slab. Columns – construction and design principles of column.

**Total:45****TEXT BOOK:**

1.	Ramachandra Murthy D.S., "Design and Construction of Precast Concrete Structures", 1 <sup>st</sup> Edition, Dipti Press OPC Private Limited, Chennai; 2017.
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**REFERENCES:**

1.	Kim S. Elliott, "Precast Concrete Structures", 2 <sup>nd</sup> Edition, CRC Press, United States, 2016.
2.	"PCI Design Hand Book", 6 <sup>th</sup> Edition, Precast / Prestressed Concrete Institute, ACI, Chicago, 2004.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	enumerate the principles, manufacture and erection of prefabricated components	Understanding (K2)
CO2	illustrate the production, erection and loading process	Understanding (K2)
CO3	identify the behaviour of the components of prefabricated structures and different joints	Understanding (K2)
CO4	formulate the design procedure to the prefabricated slab and column	Applying (K3)
CO5	design the prefabricated beams	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2						1	3	2
CO2	2	1				3						1	3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3				1		2	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	30	70					100
CAT3	30	30	40				100
ESE	25	40	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE27 - DESIGN OF BRIDGES**

(IS 1893:2016, IRC 6;2000, IRC 5;1998, IRC 18: 2000, IRC 21:2000, IRC 22:1996, IRC 24:2001 and IRC 83: Part 1,2 &amp;3 are permitted)

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Design of RC Elements</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	The course deals with the analysis and design of long and short span bridges. It also deals with the bearings and balanced cantilever bridges.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Classification, Investigation and preliminary survey, structural arrangement for various bridge deck, choice of types, I.R.C Specifications for road bridges, standard live loads, other forces acting on bridges, permissible stress - depth of foundation							
<b>Unit - II</b>	<b>Short Span Bridges and Culvert:</b>						<b>9</b>
Load distribution theory - General design principles for bridge deck, slab culverts, T-beam and slab bridges.							
<b>Unit - III</b>	<b>Long Span Bridges:</b>						<b>9</b>
General design principles for deck slab, girder, wing wall, return wall – Detailing of slab and girder bridges - Detailing of skew slab and curved bridge							
<b>Unit - IV</b>	<b>Piers and Abutments:</b>						<b>9</b>
Reaction at support, types of bearings– Design procedure for pedestal and pier caps - Jacking effect on pier cap. Layout of bearings, expansion joints - Analysis of Piers and Analysis of abutments							
<b>Unit - V</b>	<b>Balanced cantilever Bridges:</b>						<b>9</b>
Types of Superstructure –proportioning of members - Design consideration –Design procedure. Rigid frame bridges: General-Method of analysis and design considerations –temperature effect- effect of shrinkage, wind and water current.							

**Total:45****TEXT BOOK:**

1.	Krishna Raju N., "Design of Bridges", 5 <sup>th</sup> Edition, Oxford and IBH Publishing Company, New Delhi, 2019.
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**REFERENCES:**

1.	Jagadeesh T.R., "Design of Bridge Structures", 2 <sup>nd</sup> Edition, Prentice Hall of India Pvt. Ltd., NewDelhi, 2009.
2.	Haifan X., "Conceptual Design of Bridges", 1 <sup>st</sup> Edition, S.K. Kataria& Sons, New Delhi, 2015.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	classify the forces acting on bridges as per IRC loading standards	Understanding (K2)
CO2	discuss the design principles of short span bridges	Understanding (K2)
CO3	discuss the design principles of long span bridges	Understanding (K2)
CO4	analysis and check the stability requirements of the piers and abutments	Applying (K3)
CO5	discuss the design principles of balanced cantilever and rigid frame bridges	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	2	1				3						1	3	2
CO3	2	1				3						1	3	2
CO4	3	3	2			3						1	3	3
CO5	2	1				3						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	45	55					100
CAT2	40	60					100
CAT3	30	45	25				100
ESE	30	50	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE28 - DISTRESS MONITORING AND REHABILITATION OF STRUCTURES**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Concrete Technology</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course aims to impart knowledge in maintenance and rehabilitation of concrete structures by the application of various repair materials and suitable strengthening techniques.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Maintenance, rehabilitation, repair, retrofit and strengthening - need for rehabilitation of structures - Cracks in R.C. buildings - causes and effects - importance of maintenance, routine and preventive maintenance.							
<b>Unit - II</b>	<b>Repair Materials:</b>						<b>9</b>
Criteria for material selection -Special mortars and concrete - Polymer Concrete and Mortar - Quick setting compounds - Grouting materials - Gas forming grouts - Bonding agents -Latex emulsions - Epoxy bonding agents - Protective coatings - FRP sheets.							
<b>Unit - III</b>	<b>Damage Diagnosis and Assessment:</b>						<b>9</b>
Visual inspection - Non-Destructive Testing - Rebound hammer, ultra-sonic pulse velocity - Semi destructive testing - Probe test - Pull out test - Chloride penetration test – Carbonation - Corrosion activity measurements.							
<b>Unit - IV</b>	<b>Crack Repair Techniques:</b>						<b>9</b>
Methods of crack repair –Grouting – Routing – sealing – Stitching - Dry packing - Repair of active cracks - dormant cracks - Corrosion of embedded steel in concrete – Mechanism - Stages of corrosion - Repair techniques of corroded structural elements.							
<b>Unit - V</b>	<b>Retrofitting of Structures:</b>						<b>9</b>
Jacketing - Column jacketing - Beam jacketing - Beam Column joint -Reinforced concrete jacketing - Steel jacketing - FRP jacketing – Strengthening - shear strengthening - Flexural strengthening.							

**Total:45****TEXT BOOK:**

1.	Dodge Woodson R., "Concrete Structures: Protection, Repair and Rehabilitation ", 1 <sup>st</sup> Edition, Elsevier India Pvt. Ltd., New Delhi, 2012.
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**REFERENCES:**

1.	"Handbook on repair and rehabilitation of RCC buildings", CPWD, Government of India, New Delhi, 2002.
2.	Chakrabarti A., "Handbook on seismic retrofit of buildings", Narosa Publishing House, New Delhi, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the causes and effects of distress in concrete structures	Understanding (K2)
CO2	summarize the importance of maintenance of structures, types and properties of repair materials	Understanding (K2)
CO3	assess the damage of corroded structures	Applying (K3)
CO4	apply various repair techniques for cracked and corroded elements	Applying (K3)
CO5	apply the various methods of strengthening the structural components	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	25	35	40				100
CAT3	25	25	50				100
ESE	25	25	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





## 18CEE29 - HYDROLOGY

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course imparts knowledge about various hydrological components and well hydraulics. Simple statistical analysis and application of probability distribution of rainfall run off and simple methods of flood routing and ground water hydrology shall also be understood.						
<b>Unit - I</b>	<b>Hydrometeorology:</b>						<b>9</b>
Concept of hydrology–Hydrologic cycle– Components of hydrologic cycle – Annual water resources balance of India – Triple cell air circulation – Recording and non–recording rain gauges – Density and Adequacy of rain gauges – Optimum number of rain gauges.							
<b>Unit - II</b>	<b>Precipitation:</b>						<b>9</b>
Forms and types of Precipitation – Measurement of precipitation – Mean aerial depth of precipitation – Competition of missing data, double mass analysis, computation of rainfall data network density, DAD curves –Evaporation – Evapo–transpiration – Horton’s equation – Infiltration indices – Measurement of infiltration problems.							
<b>Unit - III</b>	<b>Hydrograph Analysis:</b>						<b>9</b>
Hydrograph and its features – Base flow separation – Problems in unit hydrograph and its derivation, unit hydrographs from complex storms and for various durations – Problems in S–curve hydrograph and its uses – Synthetic unit hydrograph – Applications and advantages.							
<b>Unit - IV</b>	<b>Ground Water Hydrology:</b>						<b>9</b>
Watershed – Occurrence of ground water–Types of aquifer–Dupuit’s assumptions– Applications of Darcy’s law–Estimation of aquifer parameters– Yield of wells– Steady state well hydraulic flow to confined and unconfined aquifer – Artificial recharge methods.							
<b>Unit - V</b>	<b>Flood Analysis:</b>						<b>9</b>
Flood estimation – Flood frequency analysis–Gumbel’s and Log–Pearson’s type III distribution– Flood routing and reservoir routing – Modified Pul’s method, Goodrich method– Channel routing– Prism and wedge storage – Muskingum method.							

**Total:45****TEXT BOOK:**

1.	Subramanya K., "Engineering Hydrology", 4 <sup>th</sup> Edition, McGraw Hill Education, Chennai, 2017.
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**REFERENCES:**

1.	Jaya Rami Reddy P., "A text book of Hydrology", Laxmi Publications, New Delhi, 2009.
2.	VenTe Chow, David R. Maidment & Larry W. Mays, "Applied Hydrology", Tata McGraw–Hill Publishing Company, New Delhi, 2010.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	illustrate with the concept of hydrological cycle and types of rain gauges	Understanding (K2)
CO2	predict the amount of precipitation, infiltration and evaporation	Applying (K3)
CO3	estimate the flood discharge using Unit and S–Curve hydrograph	Analyzing (K4)
CO4	analyse the steady state well hydraulic flow into aquifers	Analyzing (K4)
CO5	estimate the flood discharge using Gumbel’s and Log Pearson method	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				3							3	2
CO2	3	2	1			3						1	2	3
CO3	3	3	2			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	40	25	15			100
CAT3	15	30	40	15			100
ESE	25	30	30	15			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE30 - WATER RESOURCES AND IRRIGATION ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course aims to expose the Civil Engineering students with the clear knowledge on water resources, irrigation engineering concepts and national water policy. Further they will be imparted required knowledge on reservoir management and irrigation management practices.
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<b>Unit - I</b>	<b>Water Resources:</b>	<b>9</b>
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Need for water resources – Water resources of Tamil Nadu and India– Planning of water resources – Assessment of water requirement for drinking and irrigation purposes – Reservoirs – Single and multipurpose reservoir – Multi objective –Storage capacity of reservoirs – Reservoir operation strategies – Design flood level – levees and flood walls.

<b>Unit - II</b>	<b>Water Resource Management:</b>	<b>9</b>
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Financial aspects of water resources planning – National water policy – Consumptive and non – consumptive water use – Water quality – Scope and aims of master plan – Idea of basin as a unit for development – Water budget – Conjunctive use of surface and ground water.

<b>Unit - III</b>	<b>Irrigation Engineering:</b>	<b>9</b>
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Need – Advantages and disadvantages – Connection between duty, delta and base period – Causes affecting duty– Problems – Irrigation efficiencies – problems – Seasonal crops of India – Crop water requirement – Evaluation of consumptive use of water.

<b>Unit - IV</b>	<b>Canal Irrigation:</b>	<b>9</b>
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Types of impounding structures : Gravity dam – Diversion head works – Canal drop – Cross drainage works – Canal regulations – Canal outlets – Canal classifications – Alignment of canals – River Training works – Kennedy’s and Lacey’s regime theory.

<b>Unit - V</b>	<b>Irrigation Methods and Management:</b>	<b>9</b>
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Types of Irrigation –Lift irrigation – Tank irrigation – Well irrigation – Irrigation methods: Surface and sub– surface and micro irrigation – Merits and demerits – Irrigation scheduling – Water distribution – Participatory irrigation management with a case study –On farm development works– Participatory irrigation management – Case study.

**Total:45****TEXT BOOK:**

1.	Asawa G.L., “Irrigation and Water Resources Engineering”, 1 <sup>st</sup> Edition, New Age International Publishers, New Delhi, 2005.
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**REFERENCES:**

1.	Garg S.K., “Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures”, 34 <sup>th</sup> Edition, Khanna Publishers, New Delhi, 1976.
2.	Suresh Ukarande, “Irrigation Engineering and Hydraulic Structures”, 3 <sup>rd</sup> Edition, Ane Books Pvt. Ltd., New Delhi, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the components of water storage structures with its functions	Applying (K3)
CO2	illustrate the significance of water budgeting along with management techniques	Understanding (K2)
CO3	compute the delta, duty relationship and irrigation efficiency	Applying (K3)
CO4	identify the types of canal irrigation and analyze the functions of diversion head works	Applying (K3)
CO5	apply participatory irrigation management and infer the types of irrigation methods	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	2	1				3							3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	15	55	30				100
CAT3	10	50	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE31 - INTELLIGENT TRANSPORT SYSTEM**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Transportation Engineering</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To make students understand the importance and elements of Intelligent Transport System						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS – ITS data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.							
<b>Unit - II</b>	<b>Telecommunications in ITS:</b>						<b>9</b>
Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC), Vehicle – Road side communication – Vehicle Positioning System.							
<b>Unit - III</b>	<b>ITS Functional Areas:</b>						<b>9</b>
Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).							
<b>Unit - IV</b>	<b>ITS User Needs and Services:</b>						<b>9</b>
Travel and Traffic management, Public Transportation Management, Electronic payment, Commercial Vehicle Operations, Emergency management, Advanced vehicle safety systems, Information management.							
<b>Unit - V</b>	<b>Automated Highway Systems:</b>						<b>9</b>
Vehicles in Platoons – Integration of Automated Highway Systems. ITS programs in the world – Overview of ITS implementations in developed countries, ITS in developing countries.							

**Total:45****TEXT BOOK:**

1.	Pradip Kumar & Amit Kumar Jain, "Intelligent Transport Systems", 1 <sup>st</sup> Edition, PHI Learning Pvt. Ltd., New Delhi, 2018.
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**REFERENCES:**

1.	Ignacio Julio & Enrique Onieva, "Intelligent Transport Systems", 1 <sup>st</sup> Edition, Wiley India Pvt. Ltd., Noida, 2015.
2.	Mashrur A. Chowdhury & Adel Sadek, "Fundamentals of Intelligent Transportation Systems Planning", 1 <sup>st</sup> Edition, Artech House Inc., London, 2003.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	report the common techniques and benefits of ITS,AVL and GIS	Applying (K3)
CO2	infer the concepts of telecommunication in ITS	Understanding (K2)
CO3	apply the various advanced ITS methodologies in transportation system	Applying (K3)
CO4	identifying various public services and understand the usage.	Understanding (K2)
CO5	interpret the implementation of ITS worldwide.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3						1	3	2
CO2	2	1				3						1	3	2
CO3	2	1				3						1	3	2
CO4	2	1				3						1	3	2
CO5	2	1				3						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEE32 - REINFORCED SOIL STRUCTURES**

<b>Programme &amp; Branch</b>	<b>B.E. &amp; Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Foundation Engineering</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge on geosynthetics, design principles and mechanism of reinforced soil, soil nailing and its applications in dams, embankments, pavements and foundation structures.
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<b>Unit - I</b>	<b>Principles and Mechanisms:</b>	<b>9</b>
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Historical background - Initial and recent developments - Principles - Concepts and mechanisms of reinforced soil - Factors affecting behaviour and performance of soil - Reinforcement interactions.

<b>Unit - II</b>	<b>Materials and Material Properties:</b>	<b>9</b>
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Materials used in reinforced soil structures - Fill materials, reinforcing materials, metal strips, geotextile, geogrids, geomembranes, geocomposites, geojutes, geofoam, natural fibres, coir geotextiles - Bamboo - Timber - Facing elements - Properties - Methods of testing - Advantages and disadvantages - Preservation methods.

<b>Unit - III</b>	<b>Design Principles and Applications:</b>	<b>9</b>
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Design aspects of reinforced soil - Soil reinforcement function - Separator, Filtration, Drainage, Barrier function - Design and applications of reinforced soil of various structures - Retaining walls –Foundations - Embankments and slopes - Seismic aspects.

<b>Unit - IV</b>	<b>Geosynthetics and Applications:</b>	<b>9</b>
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Introduction - Historical background - Applications - Design criteria - Geosynthetics in roads - Design - Giroud and Noiray approach - Geosynthetics in landfills - Geosynthetic clay liner - Design of landfills - Barrier walls.

<b>Unit - V</b>	<b>Durability of Reinforcement Materials:</b>	<b>9</b>
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Measurement of corrosion factors, resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion – Influence of environmental factors on the performance of Geosynthetic materials.

**Total:45****TEXT BOOK:**

1.	Sivakumar Babu G.L., "Introduction to Soil Reinforcement and Geosynthetics", 1 <sup>st</sup> Edition, University Press, Hyderabad, 2005.
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**REFERENCES:**

1.	Jones C.J.F.P, "Earth Reinforcement and Soil Structures", 1 <sup>st</sup> Edition, Earthworks, London, 1982.
2.	Koerner R.M., "Designing with Geosynthetics", 3 <sup>rd</sup> Edition, Prentice Hall, New Delhi, 1997.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the soil reinforcement interaction mechanism.	Understanding (K2)
CO2	summarize properties, testing methods of geosynthetics in earth reinforcement.	Understanding (K2)
CO3	select suitable reinforcing material to suit the functional requirement	Applying (K3)
CO4	the design criteria for use of geosynthetics in landfills, pavement, liners	Applying (K3)
CO5	evaluate the simple durability properties of reinforcement material	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	15	40	45				100
CAT3	10	40	50				100
ESE	10	40	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CEE33 - DISASTER PREPAREDNESS AND PLANNING**

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	PE	3	0	0	3

Preamble	To get idea about the various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.						
<b>Unit - I</b>	<b>Introduction to Disasters:</b>						<b>9</b>
Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters - Climate Change - Classification, Causes, Impacts – Do's and Don'ts during disaster - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change.							
<b>Unit - II</b>	<b>Earthquakes and Tsunami:</b>						<b>9</b>
Earthquakes – Causes of earthquakes – Effects – Plate tectonics – Seismic waves – Measures of size of Earthquakes – Earthquake resistant design concepts. Tsunami – Causes – Effects – Undersea earthquakes – Landslides – Volcanic eruptions – Impact of sea meteorite – Remedial measures – Precautions – Case studies.							
<b>Unit - III</b>	<b>Floods and Droughts:</b>						<b>9</b>
Climatic Hazards – Floods – Causes of flooding – Regional flood frequency analysis – Flood control measures – Flood routing – Flood forecasting – Warning systems. Droughts – Causes – Types of droughts – Effects of drought – Mitigation – Case studies.							
<b>Unit - IV</b>	<b>Landslides and Slope Stability:</b>						<b>9</b>
Landslides – Causes - Principles of stability analysis – Remedial and corrective measures for slope stabilization – Mitigation – Case studies.							
<b>Unit - V</b>	<b>Disaster Preparedness and Management:</b>						<b>9</b>
Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard – Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.							

**Total:45****TEXT BOOK:**

1.	Nishith R. & Singh A.K., "Disaster Management in India: Perspectives, Issues and Strategies", 1 <sup>st</sup> Edition, New Royal Book Company, India, 2007.
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**REFERENCES:**

1.	Gupta M.C., "Manual on natural disaster management in India", NIDM, New Delhi, 2000.
2.	Michael Duncan J. & Stephan G. Wright, "Soil Strength and Slope Stability", 2 <sup>nd</sup> Edition, John Wiley & Sons Inc, 2005.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	diagnose the different forms of disaster and their causes	Understanding (K2)
CO2	know the causes, effects and precautionary measures of earthquakes and tsunami	Applying (K3)
CO3	gain knowledge about the causes and control measures of flood and droughts	Applying (K3)
CO4	acquire knowledge about the causes and remedial measures of slope stabilization	Applying (K3)
CO5	construct a disaster management cycle with disaster risk reduction measures	Analyzing (K4)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	3	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	40	50				100
CAT3	10	30	30	30			100
ESE	10	20	40	30			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MBE49 - ENTREPRENEURSHIP DEVELOPMENT**  
(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Economics and Management	8	EC	3	0	0	3

Preamble	The purpose of this course to create entrepreneurial awareness among engineering students.						
<b>Unit - I</b>	<b>Entrepreneurship Concepts:</b>						<b>9</b>
Entrepreneurship & Entrepreneur- Role in Economic Development - Factors affecting Entrepreneurship- Creativity and Innovation - Entrepreneurship vs Intrapreneurship- Entrepreneurial Motivation factors – Types of Entrepreneurship & Entrepreneurs - Characteristics of Entrepreneurs -Entrepreneurship Development in India							
<b>Unit - II</b>	<b>Entrepreneurial Ventures and Opportunity Assessment:</b>						<b>9</b>
New venture creation – Bootstrapping, Minipreneurship, Start-ups, Acquiring, Franchising & Social venturing - Venture development stages - Models of market opportunity- Opportunity assessment: Critical Factors In Opportunity Assessment, Idea vs Opportunity, Evaluation process, Global opportunities for entrepreneurs.							
<b>Unit - III</b>	<b>Business Plan:</b>						<b>9</b>
Designing Business Model- Business Model Canvas- Objectives of a Business Plan - Business Planning Process – Structure of a Business Plan – Technical, Marketing, Financial Feasibility assessment - Competitive analysis - Common errors in Business Plan formulation - Presentation of the Business Plan: The 'Pitch'- case studies							
<b>Unit - IV</b>	<b>Financing and Accounting:</b>						<b>9</b>
Forms of entrepreneurial capital – Sources of Financial capital: debt financing- Commercial banks and other sources, equity financing: Initial Public offering (IPO), Private placement - Venture capitalists - Angel investors-New forms of financing: Impact investors, Micro-financing, Peer-to-Peer Lending, Crowd funding - Natural capital. Preparing Financial Budget, Break even analysis, Taxation-Direct and indirect taxes, Insolvency and Bankruptcy.							
<b>Unit - V</b>	<b>Small Business Management:</b>						<b>9</b>
Definition of Small Scale Industries: Strengths and Weaknesses, Sickness in Small Enterprises: Symptoms -Causes and remedies- Indian Startup Ecosystem – Institutions supporting small business enterprises, Business Incubators – Government Policy for Small Scale Enterprises - Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger, FDI and Sub-Contracting							

**Total:45**

**TEXT BOOK:**

1.	Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", 11 <sup>th</sup> Edition, Cengage Learning, Boston, 2020.
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**REFERENCES:**

1.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, Sabyasachi Sinha, "Entrepreneurship", 11 <sup>th</sup> Edition, McGraw Hill, Noida, 2020.
2.	Charantimath Poornima M., "Entrepreneurship Development and Small Business Enterprises", 3 <sup>rd</sup> Edition, Pearson Education, Noida, 2018.
3.	Gordon E. & Natarajan K., "Entrepreneurship Development", 6 <sup>th</sup> Edition, Himalaya Publishing House, Mumbai, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the importance of entrepreneurship and demonstrate the traits of an entrepreneur	Applying (K3)
CO2	identify suitable entrepreneurial ventures and business opportunity	Applying (K3)
CO3	assess the components of business plan	Analyzing (K4)
CO4	appraise the sources of finance and interpret accounting statements	Applying (K3)
CO5	interpret the causes of sickness of small scale enterprises and its remedies	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	1	1		3	2		1
CO2	1	2	2	2		2	2	1	1		3	2		2
CO3	2	2	2	2	2	2	2	2	2	2	3	2		1
CO4	1	1	2	1		2	1	1	1	2	3	2		1
CO5	1	1	2	1		2	1	1	1	2	3	2		1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	30	30	20			100
CAT3	30	30	40				100
ESE	20	30	40	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CE001 - REMOTE SENSING AND ITS APPLICATIONS**

(Offered by Department of Civil Engineering)

<b>Programme &amp; Branch</b>	<b>All BE/BTech Branches except Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>5</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	This course gives the knowledge on the remote sensing and its working principles. It also describes the Image processing techniques using GIS for real time applications which motivates towards innovations in the relevant fields.						
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<b>Unit - I</b>	<b>Principles of Remote Sensing:</b>	<b>9</b>
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Definition - Components of Remote sensing - EMR Spectrum - EMR interactions with atmosphere - EMR interactions with Earth - Spectral signature curves of Earth surface features – Concept of Photogrammetry- IFOV – Stereoscope and Its applications.

<b>Unit - II</b>	<b>Orbits and Platforms:</b>	<b>9</b>
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Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites .

<b>Unit - III</b>	<b>Sensing Techniques:</b>	<b>9</b>
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Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV –Orbital and sensor characteristics of live Indian earth observation satellites.

<b>Unit - IV</b>	<b>Data Products and Interpretation:</b>	<b>9</b>
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Photographic and digital products – Types, levels and open source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys – Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

<b>Unit - V</b>	<b>Remote Sensing for Urban Planning:</b>	<b>9</b>
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Urban Area Definition and Characterization–Base Map Preparation – Urban Land use Classification –Visual and Digital Techniques for Land use Mapping - Urban Structure and Patterns– Urban Land Cover Classification –Feature Extraction techniques –Change Detection – Sprawl Detection and Characterization - Mapping of Urban Morphology –Building Typology

**List of Exercises / Experiments :**

1.	Study of Toposheet, Aerial Photographs and Satellite Images.
2.	Data Input – Onscreen Digitisation – Creation of Point, Line and Polygon layers.
3.	Geo-referencing the base image.
4.	Preparation of Base Map from Survey of India Toposheets.
5.	Extracting area of Interest (AOI).
6.	Preparation of Land use map using Satellite Data.
7.	Preparation of Land cover map using Satellite Data.
8.	Testing stereovision with test card and Stereoscopic acuity.
9.	Mirror stereoscope- base lining and orientation of aerial photographs.
10.	Use of parallax bar to find the height of point.

**Lecture:45, Practical:30, Total:75****TEXT BOOK:**

1.	Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman Thomas Lillesand, Ralph W. Kiefer & Jonathan Chipman, "Remote Sensing and Image Interpretation", 7 <sup>th</sup> Edition, Willey Publications, United States, 2015.
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**REFERENCES:**

1.	George Joseph, Jeganathan C., "Fundamentals of Remote Sensing", 3 <sup>rd</sup> Edition, Universities Press (India) Pvt. Ltd., Hyderabad, 2018.
2.	Basudeb Bhatta, "Remote Sensing and GIS", 2 <sup>nd</sup> Edition, Oxford University Press, Oxford, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	make use the principles of EM spectrum to categories the earth features in an image and the sensor properties for various applications of remote sensing	Understanding (K2)
CO2	acquire knowledge about satellite orbits and different types of satellites	Understanding (K2)
CO3	understand the different types of remote sensors	Understanding (K2)
CO4	gain knowledge about the concepts of interpretation of satellite imagery	Applying (K3)
CO5	apply Remote Sensing for Mapping of Urban Elements and Processes	Applying (K3)
CO6	imparts the knowledge in preparation of base map and thematic maps	Applying (K3), Precision (S3)
CO7	input the data in the computer and prepare the Map Layout Design process	Applying (K3), Precision (S3)
CO8	apply the working of Stereoscope in aerial photographs	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											3	3
CO2	2	3	1										3	3
CO3		3	1										3	3
CO4	2	3	1										3	3
CO5	1	1	3										3	3
CO6	3	3	3	3	3								3	3
CO7	3	3	3	3	3								3	3
CO8	3	3	3	3	3								3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	40	30				100
CAT3	10	40	50				100
ESE	30	40	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CE002 - DISASTER MANAGEMENT**  
(Offered by Department of Civil Engineering)

<b>Programme&amp; Branch</b>	<b>All BE/BTech Branches except Civil Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>6</b>	<b>OE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To get idea about the various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.						
<b>Unit - I</b>	<b>Introduction to Disasters:</b>						<b>9+3</b>
Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters, Climate Change- Classification, Causes, Impacts – Do's and Don'ts during disaster - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change.							
<b>Unit - II</b>	<b>Pre and Post Disaster Risk Reduction Strategies:</b>						<b>9+3</b>
Disaster cycle - Phases of Disaster - Disaster Mapping - Predictability, forecasting and Warning - Disaster Preparedness Plan - Land- use Zoning for Disaster Management - Preparing Community through IEC - Disaster Mitigation - Disaster Relief: Search, Rescue and Evacuation - Shelter for Victims - Livestock and Relief Measures - Clearance of Debris and Disposal of the Dead - Control of Situation - Damage Assessment -Rehabilitation: Social and economic Aspects - Reconstruction and Rehabilitation as means of Development.							
<b>Unit - III</b>	<b>Inter-Relationship between Disasters and Development:</b>						<b>9+3</b>
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Landuse etc. - Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India.							
<b>Unit - IV</b>	<b>Disaster Management in India:</b>						<b>9+3</b>
Disaster Management Act 2005 - Hazard and Vulnerability profile of India, Roles and responsibilities of community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), NGO's States, Centre - Disasters of India and Lesson learnt from it.							
<b>Unit - V</b>	<b>Applications of Science and Technology for Disaster Management:</b>						<b>9+3</b>
Geo-informatics in Disaster Management (RS, GIS & GPS)- Early Warning and Its Dissemination-Land Use Planning and Development Regulations-Disaster Safe Designs and Constructions-Structural and Non Structural Mitigation of Disasters - Institutions for Disaster Management in India.							

**Lecture:45, Tutorial:15, Total:60**

**TEXT BOOK:**

1. Singhal J.P., "Disaster Management", 1 <sup>st</sup> Edition, Laxmi Publications, India, 2007.
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**REFERENCES:**

1. Gupta.M.C., "Manual on natural disaster management in India", NIDM, New Delhi, 2000.
2. "National Disaster Management Policy", Government of India, 2009.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	diagnose the different forms of disaster and their causes.	Understanding (K2)
CO2	construct a disaster management cycle with disaster risk reduction measures	Applying (K3)
CO3	interpret the various effects of development projects	Applying (K3)
CO4	identify the agencies involved to manage the disaster in India	Understanding (K2)
CO5	summarize the role of technology in disaster	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1		
CO2	3	2	1			3	1					1		
CO3	2	1				3	1					1		
CO4	2	1				3	1					1		
CO5	3	2	1			3	1					1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	10	30	60				100
CAT3	30	70					100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CE003 - INTRODUCTION TO SMART CITIES**

(Offered by Department of Civil Engineering)

Programme & Branch	All BE/BTech Branches except Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	OE	3	0	0	3

Preamble	To understand and explain national smart city mission of India, components, policies, challenges and future of smart city in India.						
<b>Unit - I</b>	<b>Introduction:</b>						<b>9</b>
Definitions – Evolution – Features and strategies – Challenges – India 100 smart cities policy and mission, smart city planning and development, financing smart cities development. Governance of smart cities – case studies in India.							
<b>Unit - II</b>	<b>Smart Urban Mobility and Smart Energy:</b>						<b>9</b>
Need for urban mobility – multiple perspectives – objectives – components – emerging concepts and strategies – ICT supported smart mobility systems – policy priorities. Introduction to smart energy – urban density and energy use – objectives – elements of smart energy management system – strategies – smart grid – challenges.							
<b>Unit - III</b>	<b>Water and Waste Management:</b>						<b>9</b>
Smart water management – definitions – water resource and cycle – functions and objectives – steps in implementation – benefits – policy challenges. Smart waste management – approaches and implementation – existing systems – strategies – challenges and policies.							
<b>Unit - IV</b>	<b>Smart Environment and Smart Buildings:</b>						<b>9</b>
Global background of environmental concerns – concept of environmental resources - basic environmental challenges – smart environment – stakeholders – ICT framework for environmental management. Intelligent buildings – objectives – components – systems of smart building – benefits, challenges.							
<b>Unit - V</b>	<b>E- Governance and ICT:</b>						<b>9</b>
Governance challenges in new era – history of smart governance – functions and objectives – ICT in governance – system infrastructure – benefits, challenges and future vision. Taxonomy of layers of ICT architecture – major technology areas – components – emerging technologies in ICT – challenges and concerns in ICT.							

**Total:45****TEXT BOOK:**

1.	Anilkumar P.P, "Introduction to Smart Cities", 1 <sup>st</sup> Edition, Pearson India Education Service Pvt. Ltd., Noida,Uttar Pradesh, India, 2019.
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**REFERENCES:**

1.	Germaine R. Haleboua, "Smart Cities", 1 <sup>st</sup> Edition, The MIT Press Essential Knowledge Series, London, England, 2020.
2.	Andy Pike, Andres Rodriguez-Pose & John Tomaney, "Handbook of Local and Regional Development", 3 <sup>rd</sup> Edition, Taylor & Francis, United Kingdom, 2010.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	discuss the importance, features and case histories of smart cities in India	Understanding (K2)
CO2	describe mobility and energy in smart city	Understanding (K2)
CO3	explain water and waste management techniques in smart city	Understanding (K2)
CO4	model smart environment and smart buildings	Applying (K3)
CO5	plan e-governance and ICT in smart city	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	2	2											
CO3	3	2	2				3							
CO4	3	2	2				3							
CO5	3	2	2				3							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	10	30	60				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEO04 - ENVIRONMENTAL HEALTH AND SAFETY**

(Offered by Department of Civil Engineering)

Programme & Branch	All BE/BTech Branches except Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	OE	3	0	0	3

Preamble	To enhance the knowledge in regulation and statutory requirements relevant to Environmental, Health and Safety.						
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<b>Unit - I</b>	<b>Occupation, Safety and Management:</b>	<b>9</b>
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Occupational Safety - Health and Environmental Safety Management - Principles & practices - Role of Management in Industrial Safety - Organization Behaviour - Human factors contributing to accident.

<b>Unit - II</b>	<b>Monitoring for Safety, Health &amp; Environment:</b>	<b>9</b>
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Bureau of Indian Standards on Safety and Health: 14489 - 1998 and 15001 - 2000 - ILO and EPA Standards - Principles of Accident Prevention - Definitions - Incident - accident - injury - dangerous - occurrences - unsafe acts - unsafe conditions - hazards - error - oversight - mistakes.

<b>Unit - III</b>	<b>Education, Training and Employee Participation in Safety:</b>	<b>9</b>
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Element of training cycle - Techniques of training, design and development of training programs - Training methods and strategies types of training - Competence Building Techniques (CBT) - Employee Participation: Purpose - methods - Role of trade union in SHE.

<b>Unit - IV</b>	<b>Management Information System:</b>	<b>9</b>
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Sources of information on Safety, Health and Environment - Compilation and collation of information - Analysis & use of modern methods of programming - storing and retrieval of MIS for Safety, Health and Environment - QCC HS Computer Software Application and Limitations.

<b>Unit - V</b>	<b>Legislation on Safety, Health &amp; Environment:</b>	<b>9</b>
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Overview of SHE - The factories act, 1948 (Amended) and Rules - Contract Labour Act - Social Accountability - SA 8000 - Water (Prevention & Control of Pollution) Act 1974 and Rules - Air (Prevention & Control of Pollution) Act 1981 and Rules - Environment Protection Act.

**Total:45****TEXT BOOK:**

1.	Narayanan K.T., "Safety, Health and Environment Handbook", 1 <sup>st</sup> Edition, McGraw Hill, New Delhi, 2017.
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**REFERENCES:**

1.	Nicholas P.Cheremisinoff & Madelyn L. Graffia, "Environmental and Health & Safety Management- A Guide to Compliance", 1 <sup>st</sup> Edition, William Andrew Publisher, Norwich, 1995.
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2.	David Yates W., "Safety Professional's Reference & Study Guide", 2 <sup>nd</sup> Edition, CRC Press Publishers, New Delhi, 2015.
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<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	apply the concept of EHS and their framework.	Applying (K3)
CO2	identify the monitoring principles in workplace systems.	Applying (K3)
CO3	choose the need of training and methods of EHS.	Applying (K3)
CO4	organize the safety auditing management systems and their prevention techniques.	Applying (K3)
CO5	identify the key steps involved in HSE legislations.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3										
CO2	3	2	3	2										
CO3	3	2	3	2										
CO4	3	2	2	3										
CO5	3	2	2	3										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	15	40	45				100
CAT3	25	40	35				100
ESE	20	45	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEO05 - INFRASTRUCTURE PLANNING AND MANAGEMENT**

(Offered by Department of Civil Engineering)

Programme & Branch	All BE/BTech Branches except Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	OE	3	0	0	3

Preamble	To understand and explain the basic concepts of infrastructure and the challenges to successful infrastructure planning and implementation.						
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<b>Unit - I</b>	<b>Basic Concepts Related to Infrastructure:</b>	<b>9</b>
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Introduction to infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems

<b>Unit - II</b>	<b>Infrastructure Planning:</b>	<b>9</b>
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Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding

<b>Unit - III</b>	<b>Private Involvement in Infrastructure:</b>	<b>9</b>
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Overview of Infrastructure Privatization - Benefits of Infrastructure Privatization - Problems and Challenges in Infrastructure Privatization

<b>Unit - IV</b>	<b>Challenges to Successful Infrastructure Planning and Implementation:</b>	<b>9</b>
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Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks - Political Risks - Socio-Environmental Risks - Cultural Risks in International Infrastructure Projects - Legal and Contractual Issues in Infrastructure - Challenges in Construction and Maintenance of Infrastructure.

<b>Unit - V</b>	<b>Strategies For Successful Infrastructure Project Implementation:</b>	<b>9</b>
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Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

**Total:45****TEXT BOOK:**

1.	Neil S Grigg, "Infrastructure Engineering and Management", 1 <sup>st</sup> Edition, John Wiley & Sons, 1988.
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**REFERENCES:**

1.	Ronald Hudson W., Ralph Haas & Waheed Uddin, "Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation", 1 <sup>st</sup> Edition, McGraw-Hill, New Delhi, 1997.
2.	World Development Report: Infrastructure for Development, 1994.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	explain the basic concepts related to Infrastructure	Understanding (K2)
CO2	demonstrate the various analysis techniques in infrastructure planning	Applying (K3)
CO3	explain the role of private sector in infrastructure growth	Understanding (K2)
CO4	explain the challenges in infrastructure planning and management	Understanding (K2)
CO5	carry out strategic planning for successful Infrastructure Project implementation.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CEO06 - ENVIRONMENTAL LAWS AND POLICY**

(Offered by Department of Civil Engineering)

Programme & Branch	All BE/BTech Branches except Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

Preamble	To enhance the basic concepts of environmental regulations to ensure environmental safety along with the amendments.						
<b>Unit - I</b>	<b>Overview of Environment &amp; Law:</b>						<b>9</b>
Origin of Environmental Law - Indian Constitution and Environmental Protection - Multilateral Environmental agreements and Protocols - Montreal Protocol, Kyoto agreement, Rio declaration - Environmental Protection Acts.							
<b>Unit - II</b>	<b>Environment Protection Mechanisms:</b>						<b>9</b>
Introduction to Public Interest Litigation - Forest Cases & Responses (Case Laws) - Right to Information Act - Introduction to Environment Tribunals - The National Green Tribunal Act, 2010.							
<b>Unit - III</b>	<b>National Environmental Laws:</b>						<b>9</b>
Environmental Law and the Indian Constitution - The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and Forest Conservation Act, 1980 - Panchayats Extension to Scheduled Areas (PESA) Act 1996 - Wildlife Protection Act, 1972 - Land Acquisition Act, 1894 - Tenure & Property Rights and Community Rights.							
<b>Unit - IV</b>	<b>Environment (Protection) Act 1986:</b>						<b>9</b>
Provisions of Act - Delegation of powers - Role of state and central government - Siting of industries - Coastal zone regulations - Responsibilities of local bodies - Legislation's on Solid waste Management (MSW, Biomedical, Plastic, E-waste & Hazardous waste).							
<b>Unit - V</b>	<b>Role of Regulatory Boards:</b>						<b>9</b>
Sustainable Development - Roles and functions of Regulatory bodies and Local bodies - Significance - Organisational setup - TNPCB - CPCB - TWAD Board - CMWSSB - Case Studies.							

**Total:45****TEXT BOOK:**

1.	Aruna Venkat, "Environmental Law and Policy", 1 <sup>st</sup> Edition, PHI learning Pvt. Ltd., New Delhi, 2011.
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**REFERENCES:**

1.	CPCB, "Pollution Control Acts, Rules and Notifications issued there under Pollution Control Series -PCL/2/1992", 1 <sup>st</sup> Edition, Central Pollution Control Board, New Delhi, 1997.
2.	Shyam Divan & Armin Roseneranz, "Environmental law and policy in India", 1 <sup>st</sup> Edition, Oxford University Press, New Delhi, 2001.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	interpret the origin and behaviour of environmental protection acts.	Understanding (K2)
CO2	illustrate the environmental protection mechanisms based on environmental indicators.	Understanding (K2)
CO3	describe the national environmental policies for enhanced ecology.	Understanding (K2)
CO4	classify the significance of federal and state environmental protection acts.	Understanding (K2)
CO5	recommend the code of ethics given by pollution regulatory boards to safeguard the environment.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2											
CO2	3	2	2	2										
CO3	3	2	2	2										
CO4	3	2	2	2										
CO5	3	3	3	2										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	40	45	15				100
CAT3	35	40	25				100
ESE	35	40	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	To impart the basic knowledge in linear algebra, decomposition of matrices, continuous optimization, linear regression and support vector machines which provide the foundations for machine learning and deep learning.						
<b>Unit - I</b>	<b>Vector Spaces:</b>						<b>9+3</b>
Definition – Subspaces – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity							
<b>Unit - II</b>	<b>Linear Transformations:</b>						<b>9+3</b>
Introduction – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity.							
<b>Unit - III</b>	<b>Inner Product Spaces:</b>						<b>9+3</b>
Norms – Inner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Rotations.							
<b>Unit - IV</b>	<b>Matrix Decomposition And Continuous Optimization:</b>						<b>9+3</b>
Cholesky decomposition – Singular Value Decomposition, Continuous Optimization: Introduction – Unconstrained Optimization – Gradient Descent method – Constrained Optimization – Lagrange Multipliers method – Convex Optimization							
<b>Unit - V</b>	<b>Linear Regression And Support Vector Machines:</b>						<b>9+3</b>
Parameter Estimation – Maximum Likelihood estimation – Bayesian linear regression – Bayesian parameter estimation of Gaussian distribution, Support Vector Machines: Introduction – Margin and support vectors – Kernels – Primal support vector machine – Dual support vector machine.							

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1.	Howard Anton and Chris Rorres, "Elementary Linear Algebra", 9 <sup>th</sup> Edition, John Wiley and Sons, New Delhi, 2011 for Units I, II, III.
2.	Deisenroth M.P., Faisal A.A. and Ong C.S., "Mathematics for Machine Learning", 1 <sup>st</sup> Edition, Cambridge University Press, 2019 for Units IV, V.

**REFERENCES:**

1.	David C. Lay, Steven R. Lay and Judith McDonald, "Linear Algebra and its Applications", 5 <sup>th</sup> Edition, Pearson Education, New Delhi, 2016.
2.	Ethem Alpaydin, "Introduction to Machine Learning(Adaptive Computation and Machine Learning series)", 4 <sup>th</sup> Edition, MIT Press, USA, 2020.
3.	Duda R.O., Hart E. and Stork D.G., "Pattern Classification", 2 <sup>nd</sup> Edition, John Wiley and Sons, New Delhi, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the concepts of vector spaces.	Understanding (K2)
CO2	apply the concepts of linear mappings in machine learning.	Applying (K3)
CO3	use the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Applying (K3)
CO4	apply the knowledge of factorisation of matrices and optimization techniques in clustering and classification of data.	Applying (K3)
CO5	describe the concepts of parameter estimation and support vector machine.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	1												
CO3	3	2												
CO4	3	3	1	1	1									
CO5	3	2	2	2	1									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	5	25	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18MAO02 - GRAPH THEORY AND ITS APPLICATIONS**

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	To develop rigorous logical thinking and analytical skills by graph theoretic concepts which helps for solving real time engineering problems in networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem.						
<b>Unit - I</b>	<b>Graphs:</b>						<b>9+3</b>
Introduction – Definition – Types of graphs – Degree of vertex – Walk, path and cycle – Isomorphism – Connected graph – Hamiltonian graph – Euler graph – Digraph – Representations of graphs: Adjacency matrix – Incidence matrix.							
<b>Unit - II</b>	<b>Trees:</b>						<b>9+3</b>
Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm – Tree traversal.							
<b>Unit - III</b>	<b>Graph Coloring:</b>						<b>9+3</b>
Vertex coloring – Chromatic number – Chromatic partitioning – Independent sets – Chromatic polynomial – Matching – Covering – Four color problem (statement only) – Simple applications.							
<b>Unit - IV</b>	<b>Basic Algorithms:</b>						<b>9+3</b>
Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm – Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Krushkal's algorithm – Optimal assignment – Kuhn and Munkres algorithm – Travelling salesman problem: Two optimal algorithm – Closest Insertion Algorithm.							
<b>Unit - V</b>	<b>Network Flows and Applications:</b>						<b>9+3</b>
Flows and cuts in networks - Max-flow Min-cut Theorem – Algorithms: Flow Augmenting Path – Ford-Fulkerson Algorithm for Maximum Flow – Edmonds and Karp algorithm.							

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, New Delhi, 2010.

**REFERENCES:**

1. Douglas B.West, "Graph Theory", 2<sup>nd</sup> Edition, Prentice Hall, New Delhi, 2017.
2. Jonathan L. Gross & Jay Yellen, "Graph Theory and its Applications", 2<sup>nd</sup> Edition, CRC Press, New York, 2006.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain the types of graphs and illustrate isomorphism on graphs.	Understanding (K2)
CO2	use the concepts and properties of different types of trees in data structures.	Applying (K3)
CO3	estimate the chromatic partition, chromatic polynomial and matching of a given graph.	Applying (K3)
CO4	apply various graph theoretic algorithms to communication and network problems.	Applying (K3)
CO5	identify the maximal flow in network by means of algorithms.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1												
CO3	3	1												
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



<b>Programme &amp; Branch</b>	<b>All Engineering and Technology Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>OE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To provide the skills for applying various number theoretic algorithms, congruences, primality tests in cryptography and network security and impart knowledge of basic cryptographic techniques.						
<b>Unit - I</b>	<b>Divisibility Theory and Canonical Decompositions:</b>						<b>9+3</b>
Division algorithm- Base-b representations – number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers – GCD – Euclidean Algorithm – Fundamental theorem of Arithmetic – LCM.							
<b>Unit - II</b>	<b>Theory of Congruences:</b>						<b>9+3</b>
Basic concepts – Properties of congruences – Linear congruences – Solution of congruences – Fermat's Little theorem – Euler's theorem – Chinese remainder theorem.							
<b>Unit - III</b>	<b>Number Theoretic Functions:</b>						<b>9+3</b>
Introduction – Functions $\tau$ and $\sigma$ – Mobius function – Greatest integer function – Euler's Phi function – Euler's theorem – Properties of Euler's function – Applications to Cryptography.							
<b>Unit - IV</b>	<b>Primality Testing and Factorization:</b>						<b>9+3</b>
Primality testing: Fermat's pseudo primality test – Solvay-Strassen test – Miller-Rabin test – Fibonacci test – Lucas test – Integer factorization: Trial division – Pollard's Rho method – Quadratic sieve method.							
<b>Unit - V</b>	<b>Classical Cryptographic Techniques:</b>						<b>9+3</b>
Introduction – Substitution techniques – Transposition techniques – Encryption and decryption – Symmetric and asymmetric key cryptography – Steganography.							

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1.	Thomas Koshy, "Elementary Number Theory with Applications", 2 <sup>nd</sup> Edition, Academic Press, Elsevier, USA, 2007 for Units I, II, III.
2.	William Stallings, "Cryptography and Network Security: Principles and Practice", 7 <sup>th</sup> Edition, Pearson Education, New Delhi, 2019 for Units IV, V.

**REFERENCES:**

1.	Ivan Niven, Herbert S. Zuckerman & Hugh L. Montgomery, "An Introduction to the Theory of Numbers", Reprint Edition, John Wiley & Sons, New Delhi, 2008.
2.	Bernard Menezes, "Cryptography and Network Security", 1 <sup>st</sup> Edition, Cengage Learning India, New Delhi, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand various the concepts of divisibility and canonical decompositions.	Understanding (K2)
CO2	obtain knowledge in theory of congruences and solution of linear congruences.	Applying (K3)
CO3	use different number theoretic function suitably in cryptography.	Applying (K3)
CO4	apply various Primality test and factorisation algorithms to network security problems.	Applying (K3)
CO5	identify the suitable cryptographic techniques to handle real time security issues.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	3	1												
CO3	3	1												
CO4	3	2	1		2									
CO5	3	2	1		2									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



<b>Programme &amp; Branch</b>	<b>All Engineering and Technology Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>7</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide the skills for applying linear equations, decomposition of matrices and linear transformations in real time engineering problems and impart knowledge of vector spaces.						
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<b>Unit - I</b>	<b>Linear Equations:</b>	<b>9</b>
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System of linear equations – Row reduction and echelon forms – Vector equations – Matrix equations – Solution sets of linear systems – Applications of Linear systems: Matrix operations – inverse of a matrix, Matrix factorization – Applications to computer graphics.

<b>Unit - II</b>	<b>Vector Spaces:</b>	<b>9</b>
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Definition – Subspaces – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity.

<b>Unit - III</b>	<b>Inner Product Space:</b>	<b>9</b>
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Inner products – Angle and Orthogonality in inner product spaces – Orthonormal Bases – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Least square technique.

<b>Unit - IV</b>	<b>Linear Transformations:</b>	<b>9</b>
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General linear transformation – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity.

<b>Unit - V</b>	<b>Eigenvalues and Eigenvectors:</b>	<b>9</b>
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Definition – Orthogonal Diagonalization – Quadratic forms – Quadratic surfaces – Singular value decomposition – Applications.

**Total: 45****TEXT BOOK:**

1.	Howard Anton & Chris Rorres, "Elementary Linear Algebra", 11 <sup>th</sup> Edition, John Wiley & Sons, USA, 2014.
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**REFERENCES:**

1.	David C. Lay, Steven R. Lay & Judith McDonald, "Linear Algebra and its Applications", 5 <sup>th</sup> Edition, Pearson Education, New Delhi, 2016.
2.	Gareth Williams, "Linear Algebra with Applications", 8 <sup>th</sup> Edition, Jones & Barlett Learning, USA, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	use the concepts of matrices and vectors in the solution of a system of linear equations.	Applying (K3)
CO2	understand the concepts of vector spaces.	Understanding (K2)
CO3	understand the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Understanding (K2)
CO4	transform the system from one dimension to another and represent the pertinent linear transformation in matrix form.	Applying (K3)
CO5	apply the knowledge of quadratic forms and techniques of singular value decomposition for problems arising in power/control system analysis, signals and systems.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1												
CO3	3	1	1											
CO4	3	2	1											
CO5	3	2	2											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	30	60				100
CAT3	10	20	70				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18MAO05 - OPTIMIZATION TECHNIQUES**

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	OE	3	0	0	3

Preamble	To provide the skills for solving the real time engineering problems involving linear, non-linear, transportation and assignment problems and also impart knowledge in project management and game theoretic concepts.						
<b>Unit - I</b>	<b>Linear Programming:</b>						<b>9</b>
Introduction – Formulation of Linear Programming Problem – Advantages of Linear Programming methods – Limitations of Linear Programming models – Standard form of LPP – Graphical Method – Simplex Method – Artificial variable techniques – Big M Method.							
<b>Unit - II</b>	<b>Transportation Problem:</b>						<b>9</b>
Mathematical Formulation of Transportation Problem – Initial basic feasible solution – North West Corner Method – Least Cost Method – Vogel's approximation method – Optimal solution – MODI Method – Degeneracy – Unbalanced transportation problem – Maximization transportation problem.							
<b>Unit - III</b>	<b>Assignment Problem and Theory of Games:</b>						<b>9</b>
Assignment Problem: Mathematical model of Assignment problem – Hungarian Method – Unbalanced assignment problem. Theory of Games: Two-person zero-sum game – Pure strategies - Game with mixed strategies – Rules of Dominance – Solution methods: Algebraic method – Matrix method – Graphical method.							
<b>Unit - IV</b>	<b>Project Management:</b>						<b>9</b>
Basic Concept of network Scheduling – Construction of network diagram – Critical path method – Programme evaluation and review technique – Project crashing – Time-cost trade-off procedure.							
<b>Unit - V</b>	<b>Non-Linear Programming:</b>						<b>9</b>
Formulation of non-linear programming problem – Constrained optimization with equality constraints – Kuhn-Tucker conditions – Constrained optimization with inequality constraints.							

**Total: 45****TEXT BOOK:**

1.	Kanti Swarup, Gupta P.K. & Man Mohan, "Operation Research", 14 <sup>th</sup> Edition, Sultan Chand & Sons, New Delhi, 2014.
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**REFERENCES:**

1.	Sharma J.K., "Operations Research – Theory and Applications", 4 <sup>th</sup> Edition, Macmillan Publishers India Ltd., New Delhi, 2009.
2.	Gupta P.K. & Hira D.S., "Operations Research: An Introduction", 6 <sup>th</sup> Edition, S.Chand and Co. Ltd, New Delhi, 2008.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	formulate and solve linear programming problems.	Applying (K3)
CO2	apply transportation algorithms in engineering problems.	Applying (K3)
CO3	use assignment and game theory concepts in practical situations.	Applying (K3)
CO4	handle the problems of Project Management using CPM and PERT.	Applying (K3)
CO5	solve various types of Non-linear Programming problems.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1	1											
CO3	3	1												
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	10	85				100
CAT2	5	10	85				100
CAT3	5	10	85				100
ESE	5	10	85				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18PHO01 - THIN FILM TECHNOLOGY**

(Offered by Department of Physics)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course aims to impart the essential knowledge on deposition, characterization and application of thin films in various engineering fields, and also provides motivation towards innovations.						
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<b>Unit - I</b>	<b>Theories and models of thin film growth:</b>	<b>9+3</b>
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Introduction - Theories of thin film nucleation: Impingement, Adsorption and Thermal accommodation - The capillarity model - The atomistic models - Structural consequences of thin film nucleation - The four stages of film Growth - The incorporation of defects during growth.

<b>Unit - II</b>	<b>Vacuum technology:</b>	<b>9+3</b>
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Principle and working of vacuum pumps: Roots pump, Rotary pump, Diffusion pump, Turbo molecular pump, Cryogenic-pump, Ion pump, Ti-sublimation pump - Measurement of Pressure: Bayet-Albert gauge, Pirani and Penning gauge - Cold cathode and hot cathode ionization gauges - Pressure controlling system (qualitative).

<b>Unit - III</b>	<b>Deposition of thin films - Physical methods:</b>	<b>9+3</b>
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Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Ion plating – DC sputtering – RF sputtering – Magnetron sputtering – Reactive sputtering - Molecular beam epitaxy - Demonstration of deposition of thin films by RF sputtering.

<b>Unit - IV</b>	<b>Deposition of thin films – Chemical methods:</b>	<b>9+3</b>
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Chemical vapor deposition – Sol-gel method - Chemical bath deposition - Hydro thermal methods – Electroplating deposition - Electroless deposition - Spray Pyrolysis - Spin coating.

<b>Unit - V</b>	<b>Characterization and Applications of thin films:</b>	<b>9+3</b>
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Characterization: X-ray diffraction, Energy dispersive X-ray analysis, Atomic probe microscopy, UV-vis spectroscopy, Four probe resistivity – Applications (qualitative): Thin film resistors, Thin film capacitors, Thin film diodes, Thin film transistors, Thin film solar cells, Thin film gas sensors, Thin films for information storage and Optical coatings.

**Lecture:45, Tutorial:15,Total:60****TEXT BOOK:**

1.	Maissel L.I. and Glang R., "Hand book of Thin Film Technology", McGraw Hill Inc., 1970 for Units I,II,III, IV.
2.	Zhang S., Li L. and Kumar A., "Materials Characterization Techniques", CRC Press, 2009 for Unit V.

**REFERENCES:**

1.	Ohring M., "Material Science of Thin Films", Academic Press, 1992.
2.	Goswami A., "Thin Film Fundamentals", New Age International Pvt. Ltd., 2003.
3.	Chopra K.L., "Thin Film Phenomena", McGraw Hill Inc., 1969.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	utilize the appropriate theory and models to comprehend the thin film growth process.	Applying (K3)
CO2	apply the principle of vacuum pump to explain select methods to create vacuum and to make use of the principle of vacuum gauge to explain the measurement of vacuum by select methods.	Applying (K3)
CO3	describe the deposition of thin films by select physical methods using the principle of working of respective methods.	Applying (K3)
CO4	explain the deposition of thin films by select chemical methods using the principle of working of respective methods.	Applying (K3)
CO5	make use of select characterization techniques to comprehend the properties of thin films and also to illustrate the various device applications of thin films.	Applying (K3)

#### Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	20	40	40				100
CAT3	20	35	45				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18PH002 - STRUCTURAL AND OPTICAL CHARACTERIZATION OF MATERIALS**

(Offered by Department of Physics)

<b>Programme &amp; Branch</b>	<b>All BE/BTech Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>7</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	This course aims to impart the essential knowledge on the characterization of materials using X-ray diffraction, Raman spectroscopy, UV-visible spectroscopy, Electron microscopy and Scanning tunneling microscopy and their application in various engineering fields, and also provides motivation towards innovations.
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<b>Unit - I</b>	<b>Introduction to Characterization Techniques and X-Ray Diffraction:</b>	<b>9</b>
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Importance of materials characterization - Classification of characterization techniques - Destructive and non-destructive techniques - Crystalline materials - Reciprocal lattice - Theory of X-ray diffraction - Powder and Single crystal X-ray diffraction: Instrumentation, XRD pattern, Systematic procedure for structure determination, Particle size determination, Strain calculation - Applications of X ray diffraction measurements.

<b>Unit - II</b>	<b>Raman Spectroscopy:</b>	<b>9</b>
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Introduction – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of light and Raman effect – Structure determination – Instrumentation – Near-Infra-Red FT Raman Spectroscopy.

<b>Unit - III</b>	<b>Electron Microscopy:</b>	<b>9</b>
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Need of Electron Microscopy - Electron Specimen interaction: Emission of secondary electrons, Backscattered electrons, Characteristic X-rays, Transmitted electrons, Specimen interaction volume - Resolution - Scanning electron microscope and Transmission electron microscope: Schematic diagram, Short details of each component and working - Field Emission Gun - Field Emission Scanning electron microscope - Merits of Transmission electron microscope.

<b>Unit - IV</b>	<b>Scanning Tunneling Microscopy:</b>	<b>9</b>
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Introduction to quantum mechanical tunneling - Basic principles of scanning tunneling microscopy - Two modes of scanning - Interpreting scanning tunneling microscopic images -Applications of scanning tunneling microscopy.

<b>Unit - V</b>	<b>Ultra Violet and Visible Spectroscopy:</b>	<b>9</b>
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Regions of UV-Visible radiation - Colour and light absorption - The chromophore concept - Beer's and Lambert's laws – Theory of electronic transition - Frank Condon principle – Instrumentation and Working of UV vis spectrometer - Applications of UV visible spectroscopy.

**Total:45****TEXT BOOK:**

1.	Cullity B.D. and Stock S.R., "Elements of X-ray diffraction ", 3rd Edition, Pearson Education, India, 2003 for I,II,III,IV.	Units
2.	Banwell C.N., "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill Publications, New Delhi, 2007 for Unit V.	

**REFERENCES:**

1.	Holt D.B. and Joy D.C., "SEM micro characterization of semiconductors", Academic Press, New Delhi, 1989.
2.	Willard H.H., Merritt L.L., John A. Dean and Settle F.A., "Instrumental Methods of Analysis", 7th Edition, CBS Publishers and Distributors, New Delhi.
3.	Elton N. Kaufman, "Characterization of Materials (Volume1&2)", Wiley-Interscience, 2003.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the concept of X-ray diffraction to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO2	make use of the concept of Raman effect and Raman spectroscopy to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO3	determine the micro-structural parameters of materials and to perform surface analysis of materials using the concept of matter waves and electron microscopy.	Applying (K3)
CO4	utilize the concept and phenomenon of quantum mechanical tunneling to interpret the surface image at the atomic level recorded using scanning tunneling microscopy.	Applying (K3)
CO5	apply the theory of UV-Vis spectroscopy to comprehend the working of UV-Vis spectrophotometer.	Applying (K3)

#### Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	35	45				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18CYO01 - CORROSION SCIENCE AND ENGINEERING**

(Offered by Department of Chemistry)

<b>Programme &amp; Branch</b>	<b>All BE/BTech Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>5</b>	<b>OE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	Corrosion science and engineering aims to equip the students to have wide range knowledge of corrosion and prevention methods in order to meet the industrial needs.
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<b>Unit - I</b>	<b>Corrosion and its units:</b>	<b>9+3</b>
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Importance of corrosion prevention in various industries: direct and indirect effects of corrosion –free energy and oxidation potential criterion of uniform corrosion –Pilling Bedworth ratio and its consequences –units corrosion rate – mdd (milligrams per square decimeter per day) and mpy (Mils per year) –importance of pitting factor – Pourbaix diagrams of Mg, Al and Fe – and their limitations.

<b>Unit - II</b>	<b>Mechanism of Corrosion:</b>	<b>9+3</b>
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Localized corrosion: electro chemical mechanism Vs. chemical mechanism – Galvanic corrosion – Area effect in anodic and cathodic metal coatings, Organic coatings of bimetallic systems – prediction using emf Series and Galvanic series – Crevice corrosion – Mechanism of differential oxygenation corrosion – Auto catalytic mechanism of pitting due to crevice or differential oxygenation corrosion – Principles and procedures of cathodic protection: Sacrificial anodes and external cathodic current impression – stray current corrosion.

<b>Unit - III</b>	<b>Types of Corrosion:</b>	<b>9+3</b>
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Inter-granular corrosion: Stainless steels – cause and mechanism (Cr- Depletion theory) – Weld decay and knife line attack – Stress corrosion and fatigue corrosion – Theory of critical corrosion rate in corrosion fatigue. Cavitation damage – Fretting damage – Atmospheric corrosion – Bacterial corrosion – Marine corrosion –High temperature oxidation of metals – Ionic diffusion through protective oxides.

<b>Unit - IV</b>	<b>Kinetics of Corrosion:</b>	<b>9+3</b>
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Kinetic aspects of corrosion: Over potential activation and concentration over potentials – Exchange current density – Mixed potential theory – corrosion rates of Fe and Zn in air – free acid – effect of oxidizing agents – Phenomenon of passivation – Theories – effect of oxidizing agents and velocity of flow on passivating metals – effect of galvanic coupling of Fe and Ti respectively with Platinum – Noble metal alloying – anodic protection.

<b>Unit - V</b>	<b>Prevention of Corrosion:</b>	<b>9+3</b>
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Corrosion in inhibition: Inhibitors of corrosion – passivators, adsorbing inhibitors, V.P. inhibitors. Prevention of galvanic crevice, inter granular, Stress and fatigue corrosion at the design stage and in service conditions – control of catastrophic oxidation and Hydrogen disease -control of Bacterial corrosion – Langelier saturation Index and its uses. Corrosion prevention by Coatings – Surface pre- treatment – Hot dip, diffusion and clad coatings – Phosphating and its uses.

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1.	Winston R. & Uhlig H.H., "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, A John Wiley & Sons Inc. Publication, New Jersey, 2008.
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**REFERENCES:**

1.	McCafferty E., "Introduction to Corrosion Science", Springer, New York, 2010.
2.	Fontanna, "Corrosion Engineering (Materials Science and Metallurgy Series)", McGraw Hill International Education, Singapore, 2005.
3.	Pietro Pedferri, "Corrosion Science and Engineering", Springer Nature Switzerland AG, Switzerland, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	illustrate the importance of direct and indirect corrosion to familiarize for industrial needs.	Understanding (K2)
CO2	demonstrate the mechanism of different types of corrosion with respect to the environment.	Applying (K3)
CO3	organize the various types and theory of corrosion to understand the corrosion problems.	Applying (K3)
CO4	utilize the theories and kinetics of corrosion to interpret with the real time applications.	Applying (K3)
CO5	summarize the corrosion prevention methods to avoid corrosion related issues.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CYO02 - INSTRUMENTAL METHODS OF ANALYSIS**

(Offered by Department of Chemistry)

<b>Programme &amp; Branch</b>	<b>All BE/BTech Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>6</b>	<b>BS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries.
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<b>Unit - I</b>	<b>Absorption and Emission Spectroscopy:</b>	<b>9+3</b>
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Basic concepts of Absorption and emission spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of atomic absorption, atomic fluorescence and atomic emission spectroscopy.

<b>Unit - II</b>	<b>IR, Raman and NMR Spectroscopy:</b>	<b>9+3</b>
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Infrared spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis. Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis. Nuclear magnetic resonance spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – elucidation of NMR spectra and quantitative analysis.

<b>Unit - III</b>	<b>Surface Studies:</b>	<b>9+3</b>
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Surface study – x-ray emission spectroscopy ( XES), electron spectroscopy for chemical analysis (ESCA) - UV photo electron spectroscopy (UPS)- X- ray photo electron spectroscopy (XPS) - Auger emission Spectroscopy (AES) - Transmission Electron microscopy (TEM) - Scanning Electron microscopy (SEM) - Surface tunneling microscopy (STEM) - Atomic force microscopy (AFM).

<b>Unit - IV</b>	<b>Mass Spectroscopy:</b>	<b>9+3</b>
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Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure. Instrumentation design and application of Fourier transform mass spectroscopy (FT-MS)- Inductively coupled plasma mass spectroscopy (ICP-MS) - Secondary Ion Mass Spectroscopy (SIMS) and Ion microprobe mass analyzer (IMMA).

<b>Unit - V</b>	<b>Thermal Analysis:</b>	<b>9+3</b>
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Thermal analysis: principles and instrumentations and applications of thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, thermo mechanical analysis and Thermometric titrimetry.

**Lecture:45, Tutorial:15, Total:60****TEXT BOOK:**

1.	Willard H.H., Merritt L.L., Dean J.A & Settle F.A., "Instrumental Methods of Analysis", 7th Edition, CBS Publishers & Distributors, New Delhi, 2012.
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**REFERENCES:**

1.	Chatwal G.R. & Anand Sham K., "Instrumental Methods of Chemical Analysis", 5th Edition, Himalaya Publishing House, Girgaon, Mumbai, 2019.
2.	Srivastava A.K. & Jain P.C., "Instrumental Approach to Chemical Analysis", 4th Edition, S Chand and Company Ltd, New Delhi, 2012.
3.	Sharma B.K., "Instrumental Method of Chemical Analysis", Krishna Prakashan Media Pvt. Ltd., Meerut, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques.	Understanding (K2)
CO2	apply the IR, Raman and NMR for quantitative analysis of the sample.	Applying (K3)
CO3	apply the various techniques for the better understanding of surface morphology.	Applying (K3)
CO4	explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample.	Understanding (K2)
CO5	illustrate the thermal analysis for the identification of thermal stability of the compounds.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	1												
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18CYO03 - WASTE AND HAZARDOUS WASTE MANAGEMENT**  
(Offered by Department of Chemistry)

<b>Programme &amp; Branch</b>	<b>All BE/BTech Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>7</b>	<b>BS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	Waste and Hazardous waste management aims to equip the students to have a wide-range knowledge on waste management							
<b>Unit – I</b>	<b>Solid Waste Management:</b>							<b>9</b>
Solid wastes: Definition, types, sources, classification and composition of solid waste- Solid waste management system – Factors affecting solid waste management system – Solid waste processing technologies – incineration, combustion, stabilization, solidification, chemical fixation, encapsulation, composting, vermicomposting – Energy from waste –Biogasification –Anaerobic digestion, pyrolysis, refuse derived fuels; Landfill leachate and gas management, Landfill bioreactors – Recycling of household and commercial waste, recycling of paper, recycling of tire, recycling of plastics – Health and Environmental effects of Solid Waste – SWM: Indian scenario –Characteristics and quantity of various wastes.								
<b>Unit – II</b>	<b>Hazardous Waste Management:</b>							<b>9</b>
Hazardous waste Management: Identification and sources – characteristics and categorization – collection, segregation, packaging, labelling, transportation, processing (3R) – risk assessment and waste management treatment and disposal – storage and leak detection – site selection criteria, manifest system and records – Indian scenario – Responsibilities of various authorities. Radioactive Waste Management: Definition, sources, classification, collection, segregation, treatment and disposal.								
<b>Unit – III</b>	<b>E-Waste and Biomedical Waste Management:</b>							<b>9</b>
E-Waste Management: Definition, sources, classification, collection, segregation, treatment and disposal. Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste – categories and classification of biomedical waste – hazard of biomedical waste – need for disposal of biomedical waste – waste minimization – waste segregation and labelling – waste handling and collection- Treatment – autoclaving, Incineration, Chemical Disinfection – Disposal – Infection control Practices-status in India.								
<b>Unit – IV</b>	<b>Pollution from Major Industries and Management:</b>							<b>9</b>
Introduction- sources and characteristics – waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts.								
<b>Unit – V</b>	<b>Solid Waste Management Legislation:</b>							<b>9</b>
Solid waste management plan – Solid Waste (Management and Handling) Rules, 2000, 2016 and amendments if any – Biomedical Waste (Management and Handling) Rules, 2016; Notification of Ash utilization 1999, 2003, 2009, 2015 and amendments if any – Plastic Waste Management Rules, 2016 – E-Waste Management Rules, 2016 – Bio-Medical Waste Management Rules, 2016 – Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 – Construction and Demolition Waste Management Rules, 2016.								
<b>Total:</b>							<b>45</b>	

**TEXT BOOK:**

1.	John Pichtel, "Waste Management Practices: Municipal, Hazardous, and Industrial", 2 <sup>nd</sup> Edition, CRC Press, Boca Raton, Florida, 2014 for Unit II, III.
2.	Sharma U.C. & Neetu Singh, "Environmental Science and Engineering, Volume 5: Solid Waste Management", 2 <sup>nd</sup> Edition, Studium Press, United State of America, 2017 for Unit I,IV,V.

**REFERENCES:**

1.	VanGuilder & Cliff, "Hazardous Waste Management: An Introduction", Har Cdr Edition, Mercury Learning & Information, Herndon, VA, 2011.
2.	Karen Hardt, "Solid Waste Management", 1st Edition, Callisto Reference, Germany, 2018.
3.	Majeti Narasimha Vara Prasad, Meththika Vithanage & Anwasha Borthakur, "Handbook of Electronic Waste Management: International Best Practices and Case Studies", 1st Edition, Butterworth-Heinemann, United Kingdom, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the technical points that are required to set up a solid waste management system.	Applying (K3)
CO2	select the various disposal methods of hazardous wastes like radioactive wastes.	Understanding (K2)
CO3	organize the appropriate method for managing e-waste and biomedical wastes.	Applying (K3)
CO4	identify to plan minimization of industrial wastes.	Applying (K3)
CO5	relate the legal legislation to solid waste management.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1			3							
CO2	2	1					3							
CO3	3	2	1	1			3							
CO4	3	2	1	1			3							
CO5	2	1					3							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**18GEO01 – GERMAN LANGUAGE LEVEL 1**

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Basics of Language	5,6,7,8	HS	4	0	0	4

Preamble	To acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations.						
<b>Unit - I</b>	<b>Contacts (Kontakte):</b>						<b>12</b>
Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.							
<b>Unit - II</b>	<b>Accommodation (Die Wohnung):</b>						<b>12</b>
Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with <i>sehr/zu</i> , Adjective with Accusative, prepositions with Dative							
<b>Unit - III</b>	<b>Working Environment Communication (ArbeitenSie):</b>						<b>12</b>
Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – <i>und, oder, aber</i> .							
<b>Unit - IV</b>	<b>Clothes and Style (Kleidung und mode) :</b>						<b>12</b>
Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative.							
<b>Unit - V</b>	<b>Health and Vacation (Gesundheit und Urlaub):</b>						<b>12</b>
Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with <i>du/Ihr</i> , Modal verbs – <i>sollen, müssen, nichtdürfen, dürfen</i> . Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: <i>man</i> , Question words – <i>Wer, Wen, Was, Wem</i> , Adverbs – <i>Zuerst, dann, Später, ZumSchl</i>							

**Total:60****TEXT BOOK:**

1.	"Stefanie Dengler, Paul Rusch, Helen Schmitz, TanjaSieber, "Netzwerk Deutsch alsFremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015.
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**REFERENCES:**

1.	<a href="https://ocw.mit.edu">https://ocw.mit.edu</a> – Massachusetts Institute of Technology Open Courseware Refer: German 1 for undergraduate students
2.	<a href="https://www.dw.com/en/learn-german">https://www.dw.com/en/learn-german</a> - Deutsche Welle , Geramany's International Broadcaster



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understanding letters and simple texts	Remembering (K1)
CO2	assimilating vocabulary on accommodation and invitation	Understanding (K2)
CO3	comprehend concept of time, telephonic conversation and job-related information	Understanding (K2)
CO4	understanding how to do shopping in a German store	Understanding (K2)
CO5	understanding body parts and how to plan personal travel	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18GEO02 – JAPANESE LANGUAGE LEVEL 1**  
(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering & Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Basics of Language	5,6,7,8	HS	4	0	0	4

Preamble	To understand the basics of Japanese language which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form						
<b>Unit - I</b>	<b>Introduction to groups of verbs:</b>						<b>12</b>
tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions							
<b>Unit - II</b>	<b>Introduction to Casual Form:</b>						<b>12</b>
nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style							
<b>Unit - III</b>	<b>Express opinions and thoughts:</b>						<b>12</b>
Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications							
<b>Unit - IV</b>	<b>Introduction to If clause and Kanjis:</b>						<b>12</b>
If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-110 Kanjis							
<b>Unit - V</b>	<b>Introduction to Counters:</b>						<b>12</b>
How to use numbers-How to use quantifiers-Past form of adjectives and Nouns-Way to say preference-Way of expression degrees of an action-Other necessary particles-How to use numbers-How to use quantifiers-Past form of adjectives							

**Total:60**

**TEXT BOOK:**

1. "MINNA NO NIHONGO–Japanese for Everyone", 2 <sup>nd</sup> Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.
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**REFERENCES:**

1. MargheritaPezzopane, "Try N5", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2017.
2. Sayaka Kurashina, "Japanese Word Speedmaster", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	read and understand typical expression in Hiragana and Katakana	Remembering (K1)
CO2	understand Polite form and Casual form of Japanese	Understanding (K2)
CO3	comprehend personal communication and express greetings	Understanding (K2)
CO4	understand the Kanjis in Japanese Script	Understanding (K2)
CO5	comprehend concept of time, counters and job-related information	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	7	OE	3	0	0	3

Preamble	In this course, systematic process of thinking which empowers even the most traditional thinker to develop new, innovative solutions to the problem at hand are studied with an emphasis on bringing ideas to life based on how real users think, feel and behave.
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<b>Unit - I</b>	<b>Introduction::</b>	<b>9</b>
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Introduction – Need for design thinking – Design and Business – The Design Process – Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.

<b>Unit - II</b>	<b>Visualization:</b>	<b>9</b>
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Introduction – Visualization – Journey Mapping – Value Chain Analysis – Mind Mapping – Empathize –Observations – Need Finding – User Personas.

<b>Unit - III</b>	<b>Brainstorming:</b>	<b>9</b>
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Introduction – Brainstorming – Concept Development – Experiment – Ideation – Prototyping – Idea Refinement.

<b>Unit - IV</b>	<b>Assumption Testing:</b>	<b>9</b>
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Introduction – Assumption Testing – Rapid Prototyping – Engage – Storyboarding.

<b>Unit - V</b>	<b>Customer Co-Creation Learning Launch:</b>	<b>9</b>
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Introduction – Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems – Quick Wins.

**Total:45****TEXT BOOK:**

1.	Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.
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**REFERENCES:**

1.	Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017.
2.	Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the basic concepts of design thinking	Understanding (K2)
CO2	make use of the mind mapping process for designing any system	Applying (K3)
CO3	develop many creative ideas through structured brainstorming sessions.	Applying (K3)
CO4	develop rapid prototypes to bring the ideas into reality	Applying (K3)
CO5	plan the implementation of the any system considering the real time feedback	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	70	20				100
CAT2	10	30	60				100
CAT3	10	20	70				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

<b>Preamble</b>	This course will inspire the students to think innovation concepts and ideas for business model developments.						
<b>Unit - I</b>	<b>Innovation and Design Thinking:</b>						<b>9</b>
Innovation and Creativity– Types of innovation – challenges in innovation- steps in innovation management- 7 concerns of design. Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping							
<b>Unit - II</b>	<b>User Study and Contextual Enquiry:</b>						<b>9</b>
Explanatory research – primary and secondary data – classification of secondary data – sources of secondary data – qualitative research – focus groups – depth interviews – analysis of qualitative data – survey methods – observations- Process of identifying customer needs –organize needs into a hierarchy –establish relative importance of the needs- Establish target specifications							
<b>Unit - III</b>	<b>Product Design:</b>						<b>9</b>
Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction							
<b>Unit - IV</b>	<b>Business Model Canvas (BMC):</b>						<b>9</b>
Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies							
<b>Unit - V</b>	<b>IPR and Commercialization:</b>						<b>9</b>
Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing							

**Total:45****TEXT BOOK:**

1.	Rishiksha T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.
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**REFERENCES:**

1.	Peter Drucker, “Innovation and Entrepreneurship”, Routledge CRC Press, London, 2014.
2.	Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7 <sup>th</sup> Edition, McGraw-Hill Higher Education, 2020.
3.	Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1 <sup>st</sup> Edition, John Wiley and Sons; 2010.
4.	Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand innovation need and design thinking phases	Understanding (K2)
CO2	identify, screen and analyse ideas for new products based on customer needs	Analysing (K4)
CO3	develop and analyse the product concepts based on the customer needs and presents the overall architecture of the product.	Analysing (K4)
CO4	predict a structured business model for MVP	Applying (K3)
CO5	practice the procedures for protection of their ideas' IPR	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2			2						3	2	2
CO2	3	3	3	3	2	2	2	2	3	3	3	3	2	2
CO3	2	2	3	3	3	3	3	3	3	3	3	3	2	2
CO4				3	2	2	2	3	3	3	3	3	2	2
CO5				3	2	2		3	2	3	3	3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	40	10			100
CAT2	20	30	40	20			100
CAT3	30	30	40				100
ESE	20	30	30	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 1	5/6/7/8	HS	4	0	0	4

Preamble	This course aims to help the learner to acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations.						
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<b>Unit - I</b>	<b>Contacts(Kontakte):</b>	<b>12</b>
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Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.

<b>Unit - II</b>	<b>Accommodation(Die Wohnung):</b>	<b>12</b>
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Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative

<b>Unit - III</b>	<b>Are you Working?(Arbeiten Sie):</b>	<b>12</b>
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Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber*.

<b>Unit - IV</b>	<b>Clothes and Style(Kleidung und mode):</b>	<b>12</b>
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Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative

<b>Unit - V</b>	<b>Health and Vacation(Gesundheit und Urlaub):</b>	<b>12</b>
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Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – *sollen, müssen, nicht dürfen, dürfen*. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, Zum Schl*

**Total: 60****TEXT BOOK:**

1	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015.
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**REFERENCES:**

1	<a href="https://ocw.mit.edu">https://ocw.mit.edu</a> – Massachusetts Institute of Technology Open Courseware
2	<a href="https://www.dw.com/en/learn-german">https://www.dw.com/en/learn-german</a> - Deutsche Welle , Germany's International Broadcaster



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	understand letters and simple texts	Remembering (K1)
CO2	assimilate vocabulary on Accommodation and invitation	Understanding (K2)
CO3	comprehend concept of time, telephonic conversation and job-related information	Understanding (K2)
CO4	understand how to do shopping in a German store	Understanding (K2)
CO5	understand body parts and how to plan personal travel	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 2	5/6/7/8	HS	3	0	0	3

Preamble	This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations.						
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<b>Unit - I</b>	<b>All about food (Rund Ums Essen):</b>	<b>9</b>
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Understand information about person, Speak about food, Introduce self and others, Understand and explain a picture base story, To justify something, To speak about feelings, To express opinions, To answer questions on a text, To describe a restaurant. Grammar: Possessive Articles in Dative, Yes/No questions, Reflexive verbs, Sentence with 'weil'

<b>Unit - II</b>	<b>School days ( Nach der Schulzeit):</b>	<b>9</b>
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Understand School reports, Speak and write comments about schooldays, To speak about habits, Understand and provide City-Tips, To Understand School types in Germany and speak about it. Grammar: Modal verbs in Past tense, Positional Verbs, Two-way prepositions in Dativ and Akkusativ.

<b>Unit - III</b>	<b>Media in everyday life (Medien in Alltag):</b>	<b>9</b>
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To speak about advantages and disadvantages of Media, formulate comparisons, Express your own opinion, Talk about Movies, Understand and Write Movie reviews. Grammar: Comparative degree, Comparative Sentences with 'Als' and 'Wie', Subordinate clause with 'dass', Superlative degree.

<b>Unit - IV</b>	<b>Feelings and expressions (Gefühle):</b>	<b>9</b>
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Express thanks and congratulations, Talk about feelings, To understand information about festivals and speak about it, To describe a city, Express joy and regrets, Understand and write Blog entries, Write appropriate heading. Grammar: Subordinate Clause with 'Wenn', Adjectives to be used along with definite articles.

<b>Unit - V</b>	<b>Profession and Travel ( Beruf und Reisen):</b>	<b>9</b>
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To have a conversation at ticket counter, To talk about leisure activities, To gather information from Texts, Introduce people, Express career preferences, Ideate the dream job, To prepare and make telephone calls, To understand text about Workplace. Ask for information, Express uncertainty, Understand and give directions, Understand a newspaper article, Say your own opinion, Talk about the way to work, Describe a statistic, Understand information about a trip, Talk about travel. Grammar: Adjective to be used along with indefinite articles, Prepositions, verb – 'werden', Subordinate clause – indirect questions, All units will include elements for reading, writing, speaking and listening.

**Total: 45****TEXT BOOK:**

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1-ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015.
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**REFERENCES:**

1.	Rosa-Maria Dallapiazza , Eduard von Jan, Till Schonherr, "Tangram 2 (German)" , Goyal Publishers, Delhi, 2011.
2.	<a href="https://www.dw.com/en/learn-german - Deutsche Welle">https://www.dw.com/en/learn-german - Deutsche Welle</a> , Geramany's International Broadcaster



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand German food style, restaurant and be able express oneself.	Remembering (K1)
CO2	understand German school system and discuss about habits and provide City-Tipps.	Understanding (K2)
CO3	analyze and compare media in everyday life.	Understanding (K2)
CO4	express feelings, describe a city and write blog entries.	Understanding (K2)
CO5	seek and provide information in a professional setup, give directions to others and talk about travel.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**18GEO07 - GERMAN LANGUAGE LEVEL 4**

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 3	5/6/7/8	HS	3	0	0	3

Preamble	This course imparts knowledge about interacting with external world, understanding various cultural aspects, behaviour and addressing relationships in personal and professional front. It helps one to understand reports from various media and at work. Enhance learner's grammatical exposure and cover the core basic grammatical concepts which would lay the foundation to have a better hold of the language. With focused learning one should be able to read and respond to reports, write simple formal and informal letters and text messages and be able to engage in simple conversations in known situations.
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<b>Unit - I</b>	<b>Learning (Lernen):</b>	<b>9</b>
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Understanding and describing learning problems, Understanding and giving advice, Giving reasons, Understanding reports about everyday work life, Talking about everyday working life, Understanding a radio report, Understanding and making a mini-presentation. Grammar: Conjunctions- denn,weil, Konjunktiv II: Sollte( suggestions), Genitive, Temporal prepositions – bis, über + Akkusativ,ab+dativ

<b>Unit - II</b>	<b>Athletic (Sportlich):</b>	<b>9</b>
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Expressing enthusiasm, hope, disappointment, Understanding and writing fan comments, Formulating follow-ups, Making suggestions and reacting, Making an appointment, Understanding a report about an excursion, Understanding difficult texts, Introducing a tourist attraction. Grammar: Conjunctions – deshalb, trotzdem, Verbs with Dativ and Akkusativ

<b>Unit - III</b>	<b>Living Together (Zusammen Leben):</b>	<b>9</b>
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To complain, apologize & give in, As for something, Understand experience reports, Report on the past, Talk about pets, Respond to information, Write and correct a story. Grammatik: Konjunktiv II- könnte, Subordinate clauses – als and Wenn.

<b>Unit – IV</b>	<b>Good Entertainment (Gute Unterhaltung):</b>	<b>9</b>
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Talk about music style, Buy concert tickets, Introduce a musician / band, Understand newspaper reports, Give more detailed information about a person, Understand information about painting, Understand description of a picture, Describe a picture. Grammatik: Interrogative Articles: Was fuer eine? , Pronouns – man/jemand/niemand and alles/etwas/nichts , Relative sentences in Nominativ.

<b>Unit - V</b>	<b>Passage of time and Culture (Zeitablauf &amp; Kultur):</b>	<b>9</b>
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Talk about wishes, Express wishes, Give Suggestions, Understand a conversation, Plan something together, To ask others something, Understand a text, Exchange information, Talk about proverbs, write a story. Understand information about other cultures, Discuss about behavior, Express intentions, Use the appropriate salutation, Understand tips in a text, Talk about forms of addressing others, Give more information, Discuss about clichés and write about them. All units will include elements for reading, writing, speaking and listening. Grammatik: Konjunktiv II (Wishes, Suggestions), Verbs with prepositions, W- questions with prepositions, Relative sentences in Akkusativ, Subordinate clauses with damit and Um...Zu.

**Total: 45****TEXT BOOK:**

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch", Goyal Publishers, Delhi, 2015.
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**REFERENCES:**

1.	Rosa-Maria Dallapiazza, Eduard von Jan, Till Schonherr, "Tangram 2 (German)", Goyal Publishers, Delhi, 2011.
2.	<a href="https://www.dw.com/en/learn-german - Deutsche Welle, Geramany's International Broadcaster">https://www.dw.com/en/learn-german - Deutsche Welle, Geramany's International Broadcaster</a>



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	leverage learning in Workplace, understanding reports and make presentation.	Remembering (K1)
CO2	reciprocate to different situations, make appointment and understand texts.	Understanding (K2)
CO3	handle relationships and respond appropriately to exchange information	Understanding (K2)
CO4	familiarize to various channels of entertainment	Understanding (K2)
CO5	know about various cultural aspects, usage of proverbs and cliches.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 1	5/6/7/8	HS	4	0	0	4

Preamble	The basic level of Japanese which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form						
<b>Unit - I</b>	<b>Introduction to groups of verbs:</b>						<b>12</b>
tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions							
<b>Unit - II</b>	<b>Introduction to Casual Form:</b>						<b>12</b>
nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style							
<b>Unit - III</b>	<b>Express opinions and thoughts:</b>						<b>12</b>
Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications							
<b>Unit - IV</b>	<b>Introduction to If clause and remaining Kanjis:</b>						<b>12</b>
If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-50 Kanjis							
<b>Unit - V</b>	<b>Introduction to giving and receiving with te form and “when, even if” usages:</b>						<b>12</b>
Providing to and getting from differences - Understanding of situations and framing sentences using when and even if..etc.							

**Total: 60****TEXT BOOK:**

1.	“MINNA NO NIHONGO–Japanese for Everyone”, 2 <sup>nd</sup> Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.
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**REFERENCES:**

1.	Margherita Pezzopane, “Try N5”, 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2017.
2.	Sayaka Kurashina, “Japanese Word Speedmaster”, 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	differentiate groups of verbs and its forms	Remembering (K1)
CO2	understand Polite form and Casual form of Japanese	Understanding (K2)
CO3	comprehend personal communication and express greetings	Understanding (K2)
CO4	understand the Kanjis in Japanese Script and If clause	Understanding (K2)
CO5	comprehend concept of “even if”, “when” and job-related information	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 2	5/6/7/8	HS	3	0	0	3

Preamble	The intermediate level of Japanese which provides understanding of all forms of verbs, adverbs, conjunctions, etc. which includes 150 Kanji's and provides the ability to comprehend conversations encountered in daily life						
<b>Unit - I</b>	<b>Introduction to Potential verbs:</b>						<b>9</b>
Causes and Reasons-Favouring Expressions-Expressing a State-Potential Verb Sentences-Simultaneous actions-Verb Groups-te Form-Customary Actions-Nouns-Basic Questions and Kanji's.							
<b>Unit - II</b>	<b>Introduction to Transitive and Intransitive verbs:</b>						<b>9</b>
Consequence of verbs- Embarrassment about Facts- Consequence of Verbs with an Intentions-Affirmative Sentences-Conjunctions-Basic Questions and kanji's.							
<b>Unit - III</b>	<b>Introduction to Volitional forms:</b>						<b>9</b>
Expressions of Speakers Intention-Expressing Suggestion or Advice-Usage of Adverbs and Quantifiers-Basic Questions and kanji's.							
<b>Unit - IV</b>	<b>Introduction to Imperative and Prohibitive verbs:</b>						<b>9</b>
Commanding person- Interrogatives-Expressions of Third Person-Actions and its Occurrence - Possibilities of an Action-Changing of States Basic Questions and Kanji's.							
<b>Unit - V</b>	<b>Introduction to Conditional form and Passive verbs:</b>						<b>9</b>
Description of Requirement and Speaker's Judgement, Habitual Actions, Directions and suggestions-Passive forms of Verbs-Basic Questions and Kanji's.							

**Total: 45****TEXT BOOK:**

1. "MINNA NO NIHONGO–Japanese for Everyone", 2 <sup>nd</sup> Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.
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**REFERENCES:**

1. Margherita Pezzopane, "Try N5", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2017.
2. Sayaka Kurashina, "Japanese Word Speedmaster", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	read and understand BasicVocabularies.	Remembering (K1)
CO2	understand Conversations used in daily life.	Understanding (K2)
CO3	comprehend personal communication and express greetings.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script.	Understanding (K2)
CO5	comprehend Coherent conversations in everyday situations.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\*  $\pm 3\%$  may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 3	5/6/7/8	HS	3	0	0	3

Preamble	The intermediate level of Japanese provides understanding of expressions of verbs, its pattern, Relationships which also includes 150 Kanji's and also provides the ability to understand relationship among the people.						
<b>Unit - I</b>	<b>Introduction to Reasoning:</b>						<b>9</b>
	Causes and Sequences-Causes and Effects-Interrogative Patterns-Adjective as a Noun -Basic Questions and Kanji's.						
<b>Unit - II</b>	<b>Introduction to Exchanging of things:</b>						<b>9</b>
	Expressions for Giving and Receiving of Things-Polite Expression of Request-Indicating a Purpose of Actions-Basic Quantifiers-Basic Questions and kanji's.						
<b>Unit - III</b>	<b>Introduction to States of an Action:</b>						<b>9</b>
	Sentence Pattern to Indicate Appearance-Degree of Action and State-Adjectives as Adverbs- Convey information -Basic Questions and kanji's.						
<b>Unit - IV</b>	<b>Introduction to Causative Verbs:</b>						<b>9</b>
	Causative Forms of Verbs-Asking Opportunity to do something-Hypothetical Questions-Judgement and Course of an actions-Basic Questions and Kanji's.						
<b>Unit - V</b>	<b>Introduction to Relationship in Social Status:</b>						<b>9</b>
	Honorific expressions- Respectful expressions- Humble expressions-Polite expressions-Basic Questions and Kanji's.						

**Total: 45****TEXT BOOK:**

1.	"MINNA NO NIHONGO–Japanese for Everyone", 2 <sup>nd</sup> Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.
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**REFERENCES:**

1.	Margherita Pezzopane, "Try N5", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2017.
2.	Sayaka Kurashina, "Japanese Word Speedmaster", 2 <sup>nd</sup> Edition, Tankobon Softcover, Japan, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	read and Understand Relationship of a Person.	Remembering (K1)
CO2	understand Conversations Used in Everyday Activities.	Understanding (K2)
CO3	comprehend Contents at Near Natural Speed.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script.	Understanding (K2)
CO5	comprehend Orally Presented Materials.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

\*  $\pm 3\%$  may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)





**18GEO11 - NCC Studies(Army Wing) – I**  
**(Offered by Department of Electrical and Electronics Engineering )**

<b>Programme &amp; Branch</b>	<b>All BE/BTech Engineering and Technology Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5 / 6</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training.
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<b>Unit - I</b>	<b>NCC Organisation and National Integration:</b>	<b>9</b>
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NCC Organisation – History of NCC- NCC Organisation- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

<b>Unit - II</b>	<b>Basic physical Training and Drill:</b>	<b>9</b>
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Basic physical Training – various exercises for fitness( with Demonstration)-Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.( WITH DEMONSTRATION)

<b>Unit - III</b>	<b>Weapon Training:</b>	<b>9</b>
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Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing( WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.

<b>Unit - IV</b>	<b>Social Awareness and Community Development:</b>	<b>9</b>
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Aims of Social service-Variou Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY- NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility

<b>Unit - V</b>	<b>Specialized Subject (ARMY):</b>	<b>9</b>
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Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading including practical.

**Lecture :45, Practical:30, Total:75**

**TEXT BOOK:**

1. "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.
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**REFERENCES:**

1. "Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi.
2. "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi.
3. "NCC OTA Precise", published by DG NCC, New Delhi.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	Applying (K3)
CO2	demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders..	Applying (K3)
CO3	basic knowledge of weapons and their use and handling.	Applying (K3)
CO4	understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	Applying (K3)
CO5	acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3	3				
CO2					3									
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks.						



**18GEO12 - NCC STUDIES (AIR WING) – I**  
(Offered by Department of Information Technology)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5 / 6	OE	3	0	2	4

Preamble	This course is designed especially for NCC Cadets. This course will help develop character , camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.						
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<b>Unit – I</b>	<b>NCC Organization and National Integration:</b>	<b>9</b>
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NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors’ and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF-Indo-Pak War-1971-Operation Safed Sagar. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

<b>Unit – II</b>	<b>Drill and Weapon Training:</b>	<b>9</b>
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Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION). Main Parts of a Rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing (WITH PRACTICE SESSION).

<b>Unit – III</b>	<b>Principles of Flight:</b>	<b>9</b>
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Laws of motion-Forces acting on aircraft–Bernoulli’s theorem-Stalling-Primary control surfaces – secondary control surfaces-Aircraft recognition.

<b>Unit - IV</b>	<b>Aero Engines:</b>	<b>9</b>
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Introduction of Aero engine-Types of engine-piston engine-jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.

<b>Unit – V</b>	<b>Aero Modeling:</b>	<b>9</b>
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History of aero modeling-Materials used in Aero-modeling-Types of Aero-models – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aero-models.

**Lecture :45, Practical30, Total:75**

**TEXT BOOK:**

1	“National Cadet Corps- A Concise handbook of NCC Cadets” by Ramesh Publishing House, New Delhi,2014.
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**REFERENCES:**

1	“Cadets Handbook – Common Subjects SD/SW” by DG NCC, New Delhi.
2	“Cadets Handbook – Specialised Subjects SD/SW” by DG NCC, New Delhi.
3	“NCC OTA Precise” by DGNCC, New Delhi.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.	Applying (K3)
CO2	demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling	Applying (K3)
CO3	illustrate various forces and moments acting on aircraft	Applying (K3)
CO4	outline the concepts of aircraft engine and rocket propulsion	Applying (K3)
CO5	design, build and fly chuck gliders/model airplanes and display static models.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3	3				
CO2					3									
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks.						