Programme Ordinance, POs, PSOs & Course Outcomes (COs)

DEPARTMENT OF CIVIL ENGINEERING
FACULTY OF ENGINEERING & TECHNOLOGY
UNIVERSITY OF LUCKNOW

PROGRAMME ORDINANCE

1. GENERAL INFORMATION:

The degree of Bachelor of Technology (B. Tech.) of University of Lucknow, Lucknow shall be conferred on the candidates who have pursued the prescribed course of study and have passed the examinations as prescribed in the ordinances. The course will be conducted on full time basis.

2. ELIGIBILITY FOR ADMISSION:

2.1 Admission to B. Tech. First year in First Semester (from 2017-18 and onwards) and lateral entry to B. Tech. Second year in Third Semester (from 2018-19 and onwards) will be made through U. P. State Entrance Examination conducted by AKTU, Lucknow, or as decided by Executive Council of the University.

2.2 The minimum academic qualification for appearing in the Entrance Examination will be a pass in the final examination of 10+2 system or its equivalent with Chemistry, Mathematics and Physics or as notified. The candidate should be domiciled of U.P.

2.3 For admission to B. Tech. Second year (lateral entry) in third semester, candidate who have passed 3/4 Year Diploma (with minimum 60% marks) from institutions recognized by the U.P. Board of Technical Education in any branch of Engineering /Technology except Agriculture Engineering are eligible.

2.4 Up to 5% of the seats may be filled by NRI / direct / sponsored admission. These shall be supernumerary seats. They shall be admitted without any entrance examination on the basis of past academic record as notified. The fee structure for such students will be as notified.

2.5 In all cases, the admission of an applicant to the B. Tech, program requires that the applicant has:

a) The minimum academic qualification as notified,
b) Fulfilled the prescribed admission procedure and paid the prescribed fees.

3. ATTENDANCE:

3.1 Students are required to attend 100% classes. Any relaxations in attendance are subject to the satisfaction of concerned HOD/Dean. Normally student shall not be allowed to appear in a semester examination unless he / she has an overall average 75% attendance and 60% attendance in each of the theory / practical subjects in that semester. Attendance for dissertation work shall be verified by the supervisor / guide. However, an additional shortage by an amount not exceeding 15% of the total number of lectures delivered or practical work done in each subject may be condoned for special reasons as given below.

(a) A shortage up-to 5% of the total number of lectures delivered or practical work done in each subject may be condoned by the Head of the Department.
(b) A further shortage upto 10% may be condoned by the Dean of the Faculty on the specific recommendation of the concerned Head of Department.

3.2 No student will be allowed to appear in the end semester examination if he/she does not satisfy the overall average attendance requirements of Clause Nos. 3.1 and such candidate(s) shall be treated as having failed and will be further governed by clause no. 4.2 & 4.3.

3.3 The attendance shall be counted from the date of admission in the Faculty or start of academic session whichever is later.
(Note: For the purpose of the attendance not more than three periods including lecture and tutorial in the same subject shall be counted on any one day).

4. DURATION OF COURSES:

4.1 Total duration of the B. Tech. Course shall be 4 years, each year comprising of two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by A.I.C.T.E. from time to time.

4.2 A candidate, who has failed twice in first year due to any reason, including due to his/her non-appearance or he/she being not permitted to appear in semester examinations, shall not be allowed to continue his/her studies further subject to clause 8.
Provided further that if a student wishes to continue third time in first year he/she may be allowed on the recommendation of a committee constituted by the Vice Chancellor. However, the maximum time allowed for completing the course shall remain the same as in clause 4.3.

4.3 The maximum time allowed for a candidate admitted in 1st /3rd semester (for lateral entry) for completing the B. Tech. course shall be 7 (seven)/ 6 (Six) years respectively, failing which he/she shall not be allowed to continue for his/her B. Tech. degree.

4.4 The minimum credit requirement for B. Tech. degree is 192. The lower and upper limit for course credit registered in a semester by a full time student are :
Lower limit - 16 credits & Upper limit - 28 credits

5. CHANGE OF BRANCH:

5.1 Change of branch may be allowed against the vacant seats at the following two stages, provided criteria in the following sub clauses are satisfied.

(i) In first year, after the last date of admission to the B. Tech. 1st semester, on the basis of merit of entrance examination on vacant seats subject to clause 5.2

(ii) In the second year, on the basis of merit at the B. Tech. first year examination for those who are passed without any carry over papers subject to clause 5.2

5.2 After change of branch, number of students in branch (s) shall neither increase over the approved intake nor will it decrease below 75% of approved intake.

5.3 Change of branch is not applicable to the candidates admitted in Second Year of B. Tech. courses (lateral entry) as per clause 2.

5.4 The change of branch if allowed will become effective from B. Tech. 3rd semester.

5.5 Further change of branch shall not be permitted.

6. CURRICULUM:

6.1 The 4 year curriculum has been divided into 8 semester and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the Institute from time to time.

6.2 The curriculum shall also include such other curricular, co-curricular and extracurricular activities as may be prescribed by the Faculty from time to time.

7. CURRICULUM STRUCTURE OF THE PROGRAMME:

The Faculty shall follow credit-based semester system. Every programme will have a specific curriculum for all semesters (semester I to semester VIII) with a syllabi consisting of theory, practical, project work, etc. and shall be in accordance with the prescribed syllabus. The courses

shall be covered through lectures, tutorials, laboratory classes, seminar, industrial and practical training, project, tours etc.

7.1 Course Coverage

The course coverage for all the B. Tech. Programmes shall have the following categories:

(i) Humanities and Social Sciences (HS)
(ii) Management (M)
(iii) Basic Applied Sciences (BAS)
(iv) Basic Engineering Sciences (BES)
(v) Departmental Core (DC)
(vi) Departmental Electives (DE)
(vii) Open Electives (OE)
(viii) Project Work, Seminar and Industrial Training (PST)
(ix) Mandatory Audit Courses (MAC)
(x) Few audit courses as per demand and requirement of students may be offered.

Each course is assigned a certain number of credits as follows.

(a) 1 credit per lecture hour per week
(b) 1 credit per tutorial hour per week
(c) 1 credit per 2 hours laboratory/practice/project per week.
(d) 2 credits per 3 hours laboratory/practice/project per week.

7.2 Grading System and Assessment Procedure:

An **Absolute Grading System** wherein the marks shall be converted into grades and the result of each semester will be declared with **Semester Grade Point Average** (SGPA) and **Cumulative Grade Point Average** (CGPA). The CGPA will be calculated for every semester, except the first semester. The grading system to be adopted with Letter Grades and Grade Points Scale shall be as given below:

Letter Grade	**Description**	**Grade Point**	**% (Marks Range)**
O	Outstanding	10	Greater than or equal to 90
A^+	Excellent	09	Less than 90 but greater than or equal to 80
A	Very Good	08	Less than 80 but greater than or equal to 70
B^+	Good	07	Less than 70 but greater than or equal to 60
B	Above Average	06	Less than 60 but greater than or equal to 50
C	Average	05	Less than 50 but greater than or equal to 45
P	Poor	04	Less than 45 but greater than or equal to 40
F	Fail	00	Less than 40
U	Short Attendance	-	-
W	Withdrawal	-	-
I	Incomplete	-	-
UFM	Unfair Means	-	-
AP	Audit Pass	-	-
AF	Audit Fail	-	-
S	Satisfactory Completion	-	-
Z	Course Continuation	-	-

Rounding of the numeric value of grades obtained will be done till two places of decimal.

7.3 Tests & Examinations

The theory and practical examinations shall consist of continuous assessment throughout the semester in all subjects. The End Semester Examination (ESE) will be conducted by University at the end of the semester. The assessment of courses will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks obtained by the candidate as detailed below.

7.4 Marks Distribution:

S. No.	Exam Category	Evaluation									
		Sessional								ESE	Grand Total
		CT		TA					Total		
		CT 1	CT 2	V	V	W	R	CP			
01	Theory Subject	10	10					10	30	70	100
02	Lab			05	05			10	20	30	50
03	Industrial Training				10	20	20		50		50
04	Seminar				10	20	20		50		50
05	Project 1			20	20	40	20		100		100
06	Project 2			25	25	50	50		150	100	250
07	MAC	10	10						20	30	50

CT: Class Test; TA: Teacher's Assessment; ESE: End Semester Examination; V 1: Viva-Voce 1; V 2: Viva-Voce 2; W: work; R: Report; CP: Class Performance (Tutorial + Attendance)

Notes:

A. The course coverage for Class Test-I, Class Test-II and End Semester Exam (ESE) will be respectively 40%, 80% and 100% of the syllabus.

B. Students who remain absent in either of the class tests on genuine grounds such as medical reasons. Institute representation in academic/extra-curricular activities with prior permission of the concerned Head of Department may be permitted for a special test. Students, who remain absent in both the class tests with prior permission will be allowed one special test covering 80% of the syllabus.

C. Class Performance will be based on assignments/tutorials, quizzes/viva-voce and attendance.

7.5 General Proficiency:

A **qualitative Assessment Remark** for General Proficiency as detailed in the table below will be given in the transcript on the basis of cumulative percentages of marks scored by the student during each semester through various components. Distribution / Weightage for award of marks in each component is prescribed in the subsequent table.

S.N.	Assessment	Weightage of Marks	Marks
1.	Discipline/Behavior of Students Inside/Outside Institute campus by DSW	40%	20
2.	Games/Sports/Cultural/Literary/PFAC/Hobby Events by Chairman, CSA	40%	20
3.	Academic Activities/Special Lecture/ Industrial Visits by HOD	20%	10

S.N.	Marks Secured	Remark
1.	80-100%	Excellent
2.	60-79%	Very Good
3.	40-59%	Good
4.	20-39%	Satisfactory
5.	<20%	Poor

8. CRITERIA FOR PASSING:

The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous assessment (sessional marks) shall be awarded at the end of the semester. The end semester examination shall comprise of written papers, practical and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

The distribution of marks for sessional, end semester theory papers, practical and other examinations, seminar, project and industrial training shall be as prescribed in the course structure. The practical, viva-voce, projects and reports shall be examined/evaluated through internal and external examiners as and when required.

The marks obtained in a subject shall consist of marks allotted in end semester theory paper and sessional work.

8.1 A Student who secures Grade O to P shall be considered as passed. If a student secures "F" grade, he /she has to reappear for the concerned subject examination. It is mandatory for a student to earn the required credits as mentioned in each semester.

(a) To pass in a Theory Subject, a student shall have to secure minimum 30% of the maximum marks prescribed for the End Semester Examination (ESE) and 40% of marks in the aggregate of End Semester Examination (ESE) and sessional marks assigned for that particular subject, i.e. **Minimum Passing Grade** shall be **"P".**

(b) For passing a Practical/Internship/Project/Viva-voce examination, a student shall have to secure a minimum of 50% of the prescribed maximum marks in the End Semester Examination of Practical/Internship/Project/Viva-voce and 50% of marks in the aggregate of Practical/Internship/Project/Viva-voce ESE and assigned sessional marks i.e. Minimum Passing Grade shall be "B".

(c) To pass in Seminar, a student shall require to secure a minimum of 50% of the maximum marks prescribed, i.e. Minimum Passing Grade shall be "B".

8.2 The student who do not satisfy the condition 8.1 or the student who remains absent shall be deemed to have failed in that subject and may appear for the University examination in the subsequent examinations the sessional marks awarded to the student/s at previous attempt in the concerned subject will be carried forward. However, if the student has secured less than 40% marks in the sessional, he/she will also be required to complete the sessional work of the concerned subject by way of assignments, quizzes and both class tests. The SGPA of the concerned semester will be calculated on the basis of the new grade secured by the student in the repeat examination of the subject (with new or old sessional marks as the case may be). Number of attempts taken to pass a subject/s shall be recorded in the transcript.

8.3 A student may, at his/her desire, opt to abandon his/her performance of a semester in following manner.

(a) A student may opt to abandon his/her performance only in University Examination of the Semester.

(b) A student may opt to abandon his/her total performance of the Semester which includes performance in University Examination and Sessional Marks.

(c) A student may opt of abandon his/her performance in University Examination of any or both semester of the same academic year only.

(d) A student shall be allowed to abandon the performance maximum twice during the entire course of study.

(e) Performance of a semester, once abandoned, cannot be claimed again.

8.4 The student, who opts to abandon the performance of a semester as per clause 8.3, shall abandon performance in all the courses of that semester, irrespective of fact whether the student has passed or failed in any subject of that semester.

8.5 A student, who opt to abandon the total performance of the semester including sessional marks, has to take readmission for the relevant semester. Readmission to the First semester in such cases shall not be considered as fresh admission i.e., the student will continue to have the same University Roll Number, which was allotted earlier.

8.6 The Student, who opted to abandon his/her performance only in the University examination of a semester and does not desire readmission, shall be permitted to re-appear for examinations of all the subjects of the semester in the subsequent examinations as an Ex-Student, However, the sessional marks obtained by the student in the abandoned semester shall be retained as per clause 8.2.

8.7 Such students who opted to abandon the performance at final year are eligible for the award of Class and Distinction at the B. Tech. degree level.

8.8 A student shall be declared to have completed the programme of B. Tech. degree, provided the student has undergone the stipulated course work as per the regulations and has earned atleast 192 Credits.

8.9 A student can avail one chance to improve his/her grade in one subject of just preceding semester in the next corresponding End Semester Examination, provided that he/she has secured P or higher grade in that subject. The grade secured in **"Improvement Attempt"** will be used for calculation of SGPA of the concerned semester and old grade secured in that particular subject will stand nullified.

8.10 For Audit Courses, Grade AP (Audit Pass) or AF (Audit Fail) shall be awarded and this will not be counted for the computation of SGPA/CGPA. Audit Fail students have to pass the course as per clause 8.2.

9. ELIGIBILITY FOR PROMOTION:

9.1 There shall not be any restriction for promotion from an odd semester to the next even semester.

9.2 For promotion from even semester to the next odd semester (i.e. of the next academic year) the student has to secured 24 credits in the immediately preceding two semesters including theory and practical credits.

Minimum Credit Threshold for Promotion

Check Point	Credit Threshold
First Year to Second Year	24 Credits in First Year
Second Year to Third Year	24 Credits in Second year
Third Year to Fourth Year	24 Credits in Third year

9.3 The result of the semester shall be declared pass only on securing P or above grades in all subjects and minimum semester Grade Point Average (SGPA) is 5.0.

9.4 Student himself can decide to abandon the performance of any or both the semesters of same academic year as per clause 8.3 and reappear in abandoned semester examination as per clauses 8.4, 8.5, & 8.6.

10. COMPUTATION OF SGPA AND CGPA :

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

$$\boldsymbol{SGPA(S_i)} = \sum(\boldsymbol{C_i} \times \boldsymbol{G_i}) / \sum \boldsymbol{C_i}$$

Where $\boldsymbol{C_i}$ is the number of credits of the ith course and $\boldsymbol{G_i}$ is the grade point scored by the student in the ith course.

(i) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

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

Where $\boldsymbol{S_i}$ is the SGPA of the ith semester and $\boldsymbol{C_i}$ is the total number of credits in that semester.

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

(iii) Formula for the conversion of CGPA into percent marks is CGPA x 10 = (% Marks)

11. AWARD OF DIVISION &RANK :

Division shall be awarded only after the eighth and final semester examination based on integrated performance of the candidate for all the eight semesters (six semesters for lateral entry) as per following details:

11.1 A candidate who qualifies for the award of the degree securing P or above grades in all subjects pertaining to all semesters in first attempt within eight consecutive semesters (four academic years)/ six consecutive semesters (three academic years) as applicable, and in addition secures a CGPA of 7.5 and above for the semesters I to VIII or IE to VIE shall be

declared to have passed the examination in **FIRST DIVISION WITH HONOURS.**

11.2 A candidate who qualifies for the award of the degree by securing P or above grades in all subjects of all the semesters within maximum permissible period and secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST DIVISION.**

11.3 All other candidates who qualify for the award of degree by securing P or above grades in all subjects of all semesters and secures CGPA not less than 5.0 shall be declared to have passed the examination in **SECOND DIVISION.**

11.4 For award of ranks in a branch, the first **Three** students will be awarded ranks, provided they have secured Grade P or above in all subjects pertaining to all semesters in first attempt within eight consecutive semesters (four academic years)/ six consecutive semesters (three academic years) as applicable.

12. SCRUTINY AND RE-EVALUATION:

12.1 Scrutiny shall be permitted within two weeks after declaration of result and will only be allowed in theory papers on the request of a student after deposition of prescribed fee for each subject decided by the University.

12.2 Re-evaluation of theory/practical papers is not permitted.

13. UNFAIR MEANS:

Cases of unfair means in the End Semester Examinations and Mid-Term Tests shall be dealt as per the rules of the University of Lucknow.

14. EX-STUDENTSHIP:

14.1 A candidate opting for ex-studentship shall be required to fulfill the conditions 8.3, 8.4, 8.5 & 8.6 and to appear in all the theory & practical subjects in the End Semester Examinations of both semesters of the same Academic Year. However, the marks of Sessional, Industrial Training, Seminar and General Proficiency shall remain the same as those secured by him/her in the previous Academic Year(s) as per clause 8.2.

14.2 A candidate opting for ex-studentship shall be required to apply to the Dean's office by paying only examination fee within 15 days from the start of new session.

15. RE-ADMISSION:

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

15.1 A candidate is declared failed.

15.2 A candidate did not appear in a semester examination/or he/she was not granted permission to appear in the examination.

15.3 A candidate has been detained by the University and subsequently has been permitted to take re-admission.

15.4 A candidate promoted with carry over subjects and he/she opted for readmission.

16. CANCELLATION OF ADMISSION:

The admission of a student at any stage of study shall stand cancelled if:

(i) He/she is not found qualified as per AICTE/State Government norms and guidelines or the eligibility criteria prescribed by the University.

or

(ii) If he/she fails to submit qualifying examination result/mark sheet after getting admission to B. Tech. First Semester/Third Semester (lateral entry) within a prescribed time.

or

(iii) He/she is found unable to complete the course within the stipulated time as prescribed in clause 4.2.

or

(iv) He/she is found involved in creating indiscipline in the University.

17. INTERPRETATION CLAUSE:

In case of any difficulty arising during the course of implementation of these ordinances or in case of any unforeseen circumstance, the interpretation/decision of the Vice-Chancellor shall be final.

18. The Academic Council shall have the power to relax/change any provision provided in the ordinance in any specific matter/situation.

19. Any legal issues arising out of the rules/provisions contained in the ordinances shall fall under the jurisdiction of District Lucknow.

PROGRAMME OUTCOMES (POs)

The graduates from the Civil Engineering Program will demonstrate that they have:

1. The ability to apply knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. The ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. The ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
4. The ability to acquire and apply new knowledge as needed, using appropriate learning strategies to appropriate provide solutions to engineering problems
5. Develop the ability to understand professional and ethical responsibility.
6. The ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
7. The ability to 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.
8. The ability to 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.
9. The ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. The ability to 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**.**

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. The student would have ability to use all instruments related to civil engineering. Student would be aware of all advantages and disadvantages of all tests performed on materials related to civil engineering.
2. Student would be able to identify weather the soil is capable of withstand the upcoming load, necessity of soil compaction and soil stabilization.
3. Student would be able to select the appropriate type of foundation for given structure and soil type.
4. Student would be able to design economic structure weather it would be a residential building, any type of foundation, a water tank, any type of slab, column, beam and dome etc.
5. Student would be able to draw and understand all necessary detailing diagrams, plans etc.
6. Student would have ability to take all decisions related to their projects so that they complete their work in time and without any drawback.
7. In spite of all technical abilities student would be able to work as a team and complete their project in time.

Course Structure and Evaluation Scheme for B.Tech.

SEMESTER-I

S. No.	Subject Code	Subject Name	L – T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 103	Engineering Mathematics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 101	Engineering Physics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	EE 101/ ME 101	Basic Electrical Engineering/ Elements of Mechanical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	AS 104 CS 101	Professional Communication/ Computer System & Programming in	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	EC 101/ AS 102	Basic Electronics/Engineering Chemistry	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 151/ AS 152	Engineering Physics Lab/ Engineering Chemistry Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	EE151/ ME 151	Basic Electrical Engineering Lab Elements of Mechanical Engineering Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
08.	AS 154/ CS 151	Professional Communication Lab/ Computer Programming . Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	ME 152/ CE 151	Workshop Practice/Computer Aided Engineering Graphics	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	General Proficiency	**-**	**-**	**-**	**50**	**-**	**50**	**-**
Total								**700**	**24**

Abbreviations: CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination

SEMESTER-II

S. No.	Subject Code	Subject Name	L - T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 203	Engineering Mathematics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 201	Engineering Physics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	ME 201/ EE 201	Elements of Mechanical Engineering/ Basic Electrical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	CS 201/ AS 204	Computer System & Programming in C/ Professional Communication	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	AS 202/ EC 201	Engineering Chemistry/ Basic Electronics	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 252/ AS 251	Engineering Chemistry Lab/ Engineering Physics Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	ME 251/ EE 251	Elements of Mechanical Engineering Lab/ Basic Electrical Engineering Lab	**0-0-2**	**—**	**20**	**20**	**30**	**50**	**1**
08.	CS 251/ AS254	Computer Programming. Lab/ Professional Communication Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	CE 251/ ME 252	Computer Aided Engineering Graphics/Workshop Practice	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	**General Proficiency**				**50**		**50**	
Total								**700**	**24**

SEMESTER – III

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS – 301	Mathematics – III	3--1--0	20	10	30	70	100	4
2.	CE - 301	Fluid Mechanics	3--1--0	20	10	30	70	100	4
3.	ME - 301	Strength of Materials	3--0--0	20	10	30	70	100	3
4.	CE - 302	Building Materials & Construction	3--0--0	20	10	30	70	100	3
5.	CE - 303	Surveying	3--0--0	20	10	30	70	100	3
6.	AS – 302/ AS - 303	Human Values & Ethics / Environment & Ecology	3—0--0	20	10	30	70	100	3
	Practical								
7.	CE - 351	Fluid Mechanics Lab	0--0--2	-	20	20	30	50	1
8.	ME - 351	Strength of Materials Lab	0--0--2	-	20	20	30	50	1
9.	CE - 352	Building Materials & Construction Lab	0--0--2	-	20	20	30	50	1
10.	CE - 353	Surveying Lab	0--0--2	-	20	20	30	50	1
11.	GP - 301	General Proficiency				50		50	
Total			**18-2-8**					**800**	**24**

SEMESTER - IV

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS – 401	Computer Oriented Numerical Techniques	3--1--0	20	10	30	70	100	4
2.	CE – 401	Hydraulics & Hydraulic Machines	3--1--0	20	10	30	70	100	4
3.	CE – 402	Engineering Geology	3--0--0	20	10	30	70	100	3
4.	CE- 403	Geo-infomatics	3--0--0	20	10	30	70	100	3
5.	CE - 404	Structural Analysis - I	3--0--0	20	10	30	70	100	3
6.	AS – 402/ AS - 403	Human Values & Ethics/ Environment & Ecology	3—0--0	20	10	30	70	100	3
	Practical								
7.	CE – 451	Hydraulics & Hydraulic Machines Lab	0--0--2	-	20	20	30	50	1
8.	CE – 452	Structural Analysis Lab – I	0--0--2	-	20	20	30	50	1
9.	CE- 453	Geo-infomatics Lab	0--0--2	-	20	20	30	50	1
10.	CE – 454	Numerical Technique Lab	0--0--2	-	20	20	30	50	1
11.	GP - 401	General Proficiency				50		50	
Total			**18-2-8**					**800**	**24**

SEMESTER-V

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	CE - 501	Design of Concrete Structures -I	**3--1—0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	CE – 502	Environmental Engineering-I	**3--1—0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	CE – 503	Transportation Engineering - I	**3--0—0**	**20**	**10**	**30**	**70**	**100**	**3**
04.	CE – 504	Geotechnical Engineering	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	CE - 505	Structural Analysis-II	**3--1--0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	CE - 551	Concrete Technology Lab	**0--0--3**	**-**	**40**	**40**	**60**	**100**	2
07.	CE – 552	Environmental Engineering Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	1
08.	CE – 553	Transportation Engineering Lab	**0--0--3**	**-**	**40**	**40**	**60**	**100**	2
09.	CE - 554	Geotechnical Engineering Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	1
10.	GP - 501	General Proficiency				50		50	
Total			**15-3-10**					**800**	**24**

SEMESTER-VI

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	CE - 601	Environmental Engineering-II	3--1—0	20	10	30	70	100	4
02.	CE – 602	Transportation Engineering - II	3--0—0	20	10	30	70	100	3
03.	CE – 603	Advanced Foundation Engg.	3--1—0	20	10	30	70	100	4
04.	CE – 604	Design of Concrete Structures – II	3--1—0	20	10	30	70	100	4
05.	CE – 605	Any one from the list (DE – 1)	3--0—0	20	10	30	70	100	3
	Practical								
06.	CE - 651	Structural Detailing Lab.	0--0—2	-	20	20	30	50	1
07.	CE – 652	Computer Aided Design Lab	0--0—2	-	20	20	30	50	1
08.	CE – 653	Triangulation Camp*****	0--0—3	-	40	40	60	100	2
09.	CE - 654	Mini Project	0--0—3	-	40	40	60	100	2
10.	GP - 601	General Proficiency				50		50	
Total			**15-3-10**					**800**	**24**

Note: Students have to undergo Industrial Training for a period of six weeks during summer vacation. The report of Industrial Training will be submitted to the Head of the Department in the beginning of seventh semester.

Departmental Elective – 1 :-

CE - 6051 Remote Sensing & GIS Application
CE - 6052 Integrated Waste Management
CE - 6053 Geosynthesis and Reinforced Soil Structures
CE - 6054 Modern Construction Materials
CE - 6055 Geo-Environmental Engineering

SEMESTER – VII

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
		Theory							
01.	CE-701	Design of Steel Structures	3-1-0	20	10	30	70	**100**	**4**
02.	CE-702	Engineering Hydrology	3-1-0	20	10	30	70	**100**	**4**
03.	CE-703	Water Resource Engineering	3-1-0	20	10	30	70	**100**	**4**
04.	CE-704X	Any one from the list (DE – 2)	3-1-0	20	10	30	70	**100**	**4**
05.	AS-701/ AS-702	Engineering Economics/ Industrial Management	3-0-0	20	10	30	70	**100**	**3**
		Practical							
06.	CE-751	Project Phase- I	0-0-3	-	-	150	-	**150**	**2**
07.	CE-752	Seminar	0-0-3	-	40	40	60	**100**	**2**
08.	CE-753	Industrial Training	0-0-2	-	-	50	-	**50**	**1**
09.	GP-701	General Proficiency				50		50	
		Total	**15-4-8**					**800**	**24**

Abbreviations:

CT - Class Test
TA - Teacher's Assessment
ESE - End Semester Examination
DE - Departmental Elective

Departmental Elective (DE-2):

CE-7041 Rural Development Engineering
CE-7042 Environmental Impact Assessment
CE-7043 Air & Noise Pollution Control
CE-7044 Earthquake Resistant Design
CE-7045 Tunnel Engineering

SEMESTER – VIII

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
		Theory							
01.	CE-80XX	Any one from the Open Elective list	3-1-0	20	10	30	70	**100**	**4**
02.	CE-801	Construction Technology & Management	3-1-0	20	10	30	70	**100**	**4**
03.	CE-802X	Any one from the list (DE – 3)	3-1-0	20	10	30	70	**100**	**4**
04.	AS-801/ AS-802	Engineering Economics/ Industrial Management	3-0-0	20	10	30	70	**100**	**3**
		Practical							
05.	CE-851	Project Phase- II	0-0-12	-	-	100	250	**350**	**8**
06.	CE-852	Quantity Surveying and Valuation Lab	0-0-2	-	20	20	30	**50**	**1**
07.	GP-801	General Proficiency				50		50	
		Total	**12-3-14**					**800**	**24**

Abbreviations:

CT - Class Test
TA - Teacher's Assessment
ESE - End Semester Examination
DE - Departmental Elective
OE- Open Elective

Departmental Elective (DE-3)

CE-8021	Urban Transportation System
CE-8022	Design of Hydraulic Structures
CE-8023	Ground Improvement Techniques
CE-8024	Concrete Technology

Open Electives: Refer list of Open Electives in APPENDIX.

AS 103
Engineering Mathematics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra, Understand the definitions of Vector Space and its linear Independence, Solve Eigen value problems and apply Cayley Hamilton Theorem.
- Study the functions of more than one independent variable and calculate partial derivatives along with their applications
- Explore the idea for finding the extreme values of functions and integrate a continuous function of two or three variables over a bounded region.
- Understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
- Calculate line integral, surface integral and volume integral and correlate them with the application of Stokes, Green and Divergence theorem.

Unit - 1: Matrix Algebra
Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form). Linear dependence. Consistency of linear system of equations and their solution, Characteristic equation. Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex and Unitary Matrices and its properties

Unit -2: Differential Calculus -I
Successive Differentiation, Leibnitz's theorem, Limit , Continuity and Differentiability of functions of several variables. Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 3: Differential Calculus – II
Taylor's and Maclaurin's Theorem, Expansion of function of several variables, Jacobian, Approximation of errors. Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).

Unit - 4: Vector Calculus
Point function. Gradient, Divergence and Curl of a vector and their physical interpretations. Vector identities. Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals. Applications of Green's, Stake's and Gauss divergence theorems (without proof).

Unit - 5: Multiple Integrals
Double and triple integrals. Change of order of integration. Change of variables. Application of integration to lengths, Surface areas and Volumes - Cartesian and Polar coordinates. Beta and Gamma functions, Dirichiefs integral and its applications.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics,John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. lyenger. Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmangadachari, Engineering Mathematics -1, Pearson Education.
5. **A.C.Srivastava&P.K.Srivastava, Engineering Mathematics, Vol.l, PHI Learning Pvt. Limited, NewDelhi.**

AS 101

Engineering Physics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To develop the concept of relativistic mechanics and to explain it in different domains.
- To develop the understanding of Modern Physics and their application in various micro and macro systems.
- To develop the understanding of Interference and Diffraction with different experimental results.
- To illustrate the nature of EM waves and to apply the ideas of production of different types of polarized light and to know about the components and types of laser i.e pulsed and continuous wave.
- To develop the understanding of components and types of optical fiber with light propagation mechanism and to illustrate construction and reconstruction of holograms.

Unit -1: Relativistic Mechanics 08 Hrs.

Inertial & non-inertial frames of reference, Galilean transformations, Michelson-Morley experiment, Einstein's postulates, Lorentz transformation equations. Length contraction & Time dilation. Relativistic addition of velocities; Variation of mass with velocity. Mass energy equivalence. Mass less particle.

Unit-II: Modem Physics 10 Hrs.

Black body radiation, Weins law and Rayleigh-Jeans law. Quantum theory of radiation, Planck's law. Wave-particle duality, de-Broglie matter waves, Bohr's quantization rule. Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications. Wave function and its significance, Time dependent and time independent Schrodinger's wave equations - particle in one dimensional potential box. Eigen values and Eigen function.

Unit - III: Wave Optics 10 Hrs.

Interference: Coherent sources, condition for sustained Interference in thin films (parallel and wedge shaped film), Newton's rings and its applications.

Diffraction: Types of diffractions, Single, double and N- Slit Diffraction, Diffraction grating. Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

Unit - IV: Polarization and Laser 08 Hrs.

Polarization: Phenomena of double refraction, Construction and working of Nicol prism. Production and analysis of plane, circular and elliptical polarized light. Retardation Plate, Optical Activity, Fresnel's theory. Specific rotation.

Laser: Spontaneous and stimulated emission of radiation, population inversion, Einstein's Coefficients, Coherence, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers , Laser applications.

Unit - V: Fiber Optics and Holography 06 Hrs.

Fiber Optics: Fundamental ideas about optical fiber. Propagation mechanism. Acceptance angle and cone.

Normalized frequency, Numerical aperture. Single and Multi Mode Fibers, Dispersion and Attenuation. Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:

c) Concepts of Modem Physics - AurthurBeiser (Mc-Graw Hill)
d) Introduction to Special Theory of Relativity- Robert Resnick (Wielly)
e) Optics -AjoyGhatak(Tata McGraw Hill Education Private Ltd. New Delhi)
f) Optics - Brijlal& Subramanian (S. Chand)
g) Engineering Physics- C. Mani Naidu(Pearson)
h) Lasers Principles, Types and Applications- K R Nambiar (New Age)
i) Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New.

AS 102/AS 202

Engineering Chemistry

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- The students will gain knowledge of basic theories of solid materials, nano-materials and liquid crystals.
- To demonstrate the knowledge of synthesis of polymeric material, which are required for engineering applications.
- Apply basic knowledge of Science and fundamental aspect of cell working, equations in solving electrochemistry problems, functioning of lubricants and the techniques controlling the corrosion.
- Analyze the water sample parameters & identify the impurities and its effects. Able to design process for purification of water that is concern with safety of public health & environment.
- Apply basic knowledge of fuels and experimental techniques used in identification of structure of organic/inorganic moieties.

Unit-1	Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications	**8**
Unit-2	Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradablepolymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Giignard Reagent) and their applications in polymerization.	**8**
Unit-3	Electrochemistry: Galvanic cell, electrode potential. Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants- Classification, mechanism and applications..	**8**
Unit-4	Hardness of water. Disadvantage of hard water. Boiler troubles. Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin. Reverse osmosis. Phase Rule and its application to water system.	**8**
Unit-5	Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter & Dulong's method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H^NMR spectral Techniques.	**8**

Text Book :

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books :

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India

5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education
11. Atkins' Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press.

EC101/EC 201

Basic Electronics Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Acquire basic knowledge on the working of various semi-conductor devices.
- Develop analysis capability in BJT and FET Amplifier Circuits.
- Identify functions of digital multimeter, voltmeter, Cathode ray oscilloscope and Digital storage oscilloscope in measurement of physical variables.
- Understand fundamentals of radio communication

Unit-I

PN junction diode: Introduction of Semiconductor Materials Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance. Diode Equivalent Circuits, Transition and Diffusion Capacitance, Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series, Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification. Clippers, Clampers, Zener diode as shunt regulator. Voltage-Multiplier Circuits Special Purpose two terminal Devices: Light-Emitting Diodes, Liquid-Crystal Displays.

12 Lectures

Unit-II

Bipolar Junction Transistor and Field Effect Transistor: Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration.Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic.

10 Lectures

Unit-III

Operational Amplifiers: Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits. Practical Op- Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator). **OP AMP Parameters: Input offset voltage, Output** offset **voltage, Input biased current. Input offset current** Differential and Common-Mode Operation.

6 Lectures

Unit-IV

Electronic Instrumentation and Measurements: Digital Voltmeter : Introduction, RAMP Techniques, Analog and Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.

6 Lectures

Unit-V

Fundamentals of Communication Engineering: Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, Introduction of various analog modulation techniques. Fundamentals of amplitude and frequency modulation. Modulation and Demodulation Techniques of AM.

6 Lectures

Text Books:

1. Robert L. Boylestand / Louis Nashelsky*"Electronic Devices and Circuit Theory" Latest*Edition, Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication,.
3. George Kennedy, "Electronic Communication Systems", Latest Edition, TMH,

Reference Books:

1. David A. Bell, *""Electronic Devices and Circuits",* Latest Edition, Oxford University Press.
2. Jacob Millman, C.C. Halkias, StayabrataJit, *""Electronic Devices and Circuits'",* Latest Edition , TMH.
3. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India.

ME101/ME 201

Elements of Mechanical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Problems by applying the fundamental principles of engineering mechanics and to proceed todesign and development of the mechanical systems.
- Understand the representation of forces and moments.
- Understand the concept of static equilibrium of particles and rigid bodies.
- Able to understand the concept of stress and strain.
- Understand the basic concepts of Thermodynamics

UNIT-I

Force System: Law of Parallelogram of forces, Lami's theorem. Principle of Transmissibility of forces. Moment of a force. Couple, Varignon's theorem. Resolution of a force into a force and a couple. Resultant and equilibrium of coplanar force system. Determination of reactions.Free body diagrams.
Concept of Centre of Gravity, Centroidand Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem

9 Lectures

UNIT-II

Plane Trnss: Perfect Deficient and Redundant Truss. Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

Beams: Types of beams., Shear force and bending moment in Statically Determinate Beams. Shear force and bending moment diagrams. Relationships between load, shear and bending moment.

8 Lectures

UNIT-III

Simple stress and strain: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials. Elastic constants. Strain energy.

Bending (Flexural) Stresses: theory of pure bending, neutral surface and neutral axis, stresses in beams .

Engineering Materials: Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

8 Lectures

UNIT-IV

Basic Concepts and Definitions of Thermodynamics: Introduction and definition of thermodynamics. Microscopic and Macroscopic approaches. System, surrounding and universe. Concept of continuum. Thermodynamic equilibrium. Thermodynamic properties, path, process and cycle. Quasi static process. Energy and its forms. Work and heat.

Zeroth law of thermodynamics: Temperature and its' measurement.

First law of thermodynamics: First law of thermodynamics. Internal energy and enthalpy. First law analysis for non-flow processes. Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process. Pumps etc.

8 **Lectures**

UNIT-V

Second law: Thermal reservoir, Kelvin Planck statement. Heat engines. Efficiency; Clausius' statement Heat pump, Refrigerator. Coefficient of Performance. Carnot cycle, Carnot theorem and it's corollaries.Clausius inequality. Concept of Entropy.

Properties of Pure Substances: P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

Internal Combustion Engines: Classification of I.C. Engines, working principle and comparison between 2 Stroke and 4 stroke engine , difference between SI and Cl engines. P- V and T-s diagramsof Otto and Diesel cycles, comparison of efficiency.

9 **Lectures**

Reference Books:

1. Engineering Mechanics: Statics by J.L Meriam , Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Thimoshenko& Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Introduction to Mechanical Engineering : Thermodynamics, Mechanics & strength of Material,Onkar Singh, New Age International (P) Ltd.
6. Engineering Thermodynamics by P.K.Nag, McGraw Hill
7. Thermodynamics An Engineering Approach by Cengel& Boles, McGraw Hill
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
10. Engineering Mechanics by R K Bansal, Laxmi Publications
11. Elements of Workshop Technology by Hajra Choudhary Media Promoter

EE101/EE 201

Basic Electrical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- To understand fundamentals of DC circuits and apply knowledge for Analyzing network theorems in DC circuits.
- To learn the fundamentals and analyze single phase AC circuits.
- To learn the fundamentals and analyze three phase AC circuits.
- To learn the basic operation and analyze the performance of single phase transformer.
- To understand the construction and basic operation of DC motors and generators.

Unit-I

Electrical Circuit Analysis:

Introduction, Circuit Concepts: Concepts of network. Active and passive elements. Voltage and current sources. Concept of linearity and linear network. Unilateral and bilateral elements. Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis. Star-delta transformation,

AC fundamentals: Sinusoidal, square and triangular waveforms - Average and effective values. Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Unit-II

Steady- State Analysis of Single Phase AC Circuits:

Analysis of series and parallel RLCCircuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers. Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

Network theorems (AC & DC with independent sources): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems)

Unit-III

Three Phase AC Circuits:

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations. Three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers), Single phase energy meter.

Power system: basic concept, power line diagram, concept of grid.

Unit-IV

Magnetic Circuits:

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

Single Phase Transformer: Principle of operation, Construction, EMF equation, Phaser diagram Equivalent circuit. Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit-V

Electrical Machines:

DC machines:Principle& Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor:Principle& Construction, Types, Slip-torque characteristics. Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text Books:

1 . Basic Electrical Engineering, S N Singh; Prentice Hall International
2. Basic Electrical Engineering, Kuldeep Sahay, New Age International Publishers
3. Fundamentals of Electrical Engineering, B Dwivedi, A Tripathi; Wiley India
4. Principles of Electrical Engineering, V. Del Toro,; Prentice Hall International
5. Electrical Engineering, J. B. Gupta, Kataria and Sons
6. Basic Electrical Engineering, T.K.Nagsarkar,M.S. Shukhija; Oxford University Press.

Reference Books:

1. Electrical and Electronics Technology, Edward Hughes; Pearson
2. Engineering Circuit Analysis, W.H. Hayt& J.E. Kimerly; Me GrawHill
3. Basic Electrical Engineering, C L Wadhwa; New Age International

CS 101/CS 201

Computer System and Programming in C

L	T	P
3	0	0

Course Outcomes (COs):

- This course will let students understand the basics of solving a problem using the computer system.
- Students will be able to solve simple and precise problems using the computer.
- Students can develop the attitude to solve the problems in hand in logical manner.
- To able to understand the basic concepts of digital computer, binary arithmetic.
- To be able to understand the importance of algorithm and flowcharts in programming.
- To be able to understand the basic concepts of writing a program in C language: write, compile, and run programs in C language.
- To understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
- To be able to write programs that involve decisions and iterations.
- To be able to understand how to use functions, arrays, pointers, preprocessor directives along with fare confidence in file handling.

Unit 1: **(10 Lectures)**

Basics of Computer: Introduction to digital computer, basic operations of computer, functional components of computer. Classification of computers.

Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function, services and types.

Number system: Binary, octal and hexadecimal number systems, their mutual conversions. Binary arithmetic.

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts. Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

Unit2: **(8 Lectures)**

Standard I/O in "C", **Fundamental data types-** Character type, integer, short, long, unsigned, single and double floating point. Storage classes- automatic, register, static and external. Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.

Fundamentals of C programming: Structure of C program, writing and executing the first C program. Components of C language. Standard I/O in C.

Units3: **(10 Lectures)**

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions.

Unit 4: **(6 Lectures)**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

Unit 5: **(8 Lectures)**

Pointers: Introduction, declaration, applications File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

Reference Books:

1. The C programming by Kemighan Brain W. and Ritchie Dennis M., Pearson Education .
2. Computer Basics and C Programming by V.Rajaraman, PHI Learning Pvt. Limited - 2015.
3. Programming in C by Kochan Stephen G. Pearson Education - 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

AS 104/AS 204

Professional Communication

L	T	P
3	0	0

Course Outcomes:
Students are able to demonstrate the following:

- Understand the communication system for specific purpose.
- Be able to communicate professionally.
- Be able to communicate across organizational levels and cultures effectively.
- Be able to negotiate with the odds and bring in best of the results with specific success.
- Be able to understand the human needs and adjust accordingly the set goals.

Unit-I: Fundamentals of Communications
Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group): Importance of technical communication; Barriers to Communication

Unit-II: Written Communication
Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc.

Unit-III: Business Communication
Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports.
Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.

Unit-IV: Presentation Strategies and Soft Skills.
Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills : Types; Methods for improving Listening Skills.

Unit –V: Value- Based Text Readings
Following essays from the prescribed text book with emphasis on Mechanics of writing.

1. Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
2. The Language of Literature and Science by A. Huxley
3. Man and Nature by J. Bronowski
4. Science and Survival by Barry Commoner
5. The Mother of the Sciences by A.J. Bahm.

Text Book:

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta

Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.

Reference Books:

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
2. Business Correspondence and Report Writing by Prof R.C.,Sharma& Krishna Mohan, Tata McGraw Hill & Co. Ltd. ,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
4. Developing Communication skills by Krishna Mohan, MecraBannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B. Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
7. Spoken English- A manual of Speech and Phonetics by R.K. Bansal & J.B. Harrison Orient Blackswan, 2013, New Delhi.

CE151/CE 251

Computer Aided Engineering Graphics

L	T	P
0	0	3

Course Outcomes (COs):

On successful completion of this course, a student would be able to:

- Produce geometric construction, Multiview, dimensioning and detail drawings of typical 3-D engineering objects.
- Apply the skill for preparing detail drawing of engineering objects.
- Understand and visualize the 3-D view of engineering objects.
- Understand and apply computer software to prepare engineering drawing.
- Able to visualize better and understand the various engineering problems

Introduction

Drawing Instruments and their uses, BIS conventions. Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines,Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.
2 - Sheets

Orthographic Projections Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths. True and apparent inclinations to reference planes.
2 - Sheets

Orthographic Projections of Plane Surfaces (First Angle Projection Only)Introduction, Definitions-projections of plane surfaces-triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change ofposition method only.
1 - Sheet

Projections of Solids (First Angle Projection Only) Introduction, Definitions - Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.
2-Sheets

Sections And Development of Lateral Surfaces of Solids Introduction, Section planes. Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.
1 - Sheet

Isometric Projection (Using Isometric Scale Only)
Introduction, Isometric scale, Isometric projection of simple plane figures. Isometric projection of tetrahedron, hexahedron(cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres.
1-Sheet

Text Books:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International Publishing House Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.

Reference Books:

1. Engineering Graphics - K.R. Gopalakrishna, 32”** edition, 2005- Subash Publishers Bangalore.

2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Engineering Drawing - M.B. Shah, B.C.Rana, 2nd Edition,2

AS 203

Engineering Mathematics - II

L	T	P
3	1	0

Course Outcomes (COs):
After the completion of the course, students are expected to have the ability to:

- Understand and implement the concept of differential equations and learn various methods to solve ordinary differential equation
- Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions
- Implement the integral transformation using the concept of Laplace transformation and application to solve differential equations
- Learn Fourier series and Fourier transformations for initial and boundary values problems.
- Application of Partial differential equation as heatequation,wave equation and Laplace equation.

Unit - 1: Ordinary Differential Equations
Linear differential equations of order with constant coefficients. Complementary function and Particular integral. Simultaneous linear differential equations. Solution of second order differential equations by changing dependent & independent variables. Method of variation of parameters. Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions
Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions. Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform
Laplace transform. Existence theorem, Laplace transforms of derivatives and integrals. Initial and final value theorems. Unit step function, Dirac- delta function, Laplace transform of periodic function. Inverse Laplace transform. Convolution theorem. Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations
Periodic functions, Dirichlet's Conditions, Fourier series of arbitrary periods, Euler's Formulae, Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.
Solution of first order Lagrange's linear partial differential equations. Second order linear partial differential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations
Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain& S.R.K. lyenger, Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. - II, PHI Learning Pvt. Ltd.
5. Rukmangadachari, Engineering Mathematics - II, Pearson Education.

AS 201
ENGINEERING PHYSICS - II

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To know about the fundamentals of crystal physics and illustrations of Nacl and diamond structures.
- To understand the concepts of dielectrics and its polarization and different properties of magnetic materials with their hysteresis curve.
- To formulate and solve the engineering problems on electromagnetism with the help of Maxwell's equations.
- To understand the basics of band theory of solids and discuss the Fermi energy for semiconductors.
- To develop the understanding of superconductors and its types, superconductivity with BCS theory and to understand the various applications of nanotechnology with the help of nano materials.

Unit -1: Crystal Structures and X-ray Diffraction 10Hrs.

Space lattice, basis. Unit cell. Lattice parameter. Seven crystal systems and Fourteen Bravais lattices. Co-ordination number. Atomic radius and Packing factor of different cubic structures. Crystal structure of NaCl and diamond. Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Compton Effect.

Unit - II: Dielectric and Magnetic Properties of Materials 10 Hrs.

Dielectric Properties: Dielectric constant and Polarization of dielectric materials. Relation between E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One-Dimensional), Claussius-Mossotti equation. Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material. Phenomena of hysteresis and its applications.

Unit - III: Electromagnetic Theory 06 Hrs.

Equation of continuity, Maxwell's Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

Unit - IV: Band Theory of Solids 06 Hrs.

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory. Density of states, Fermi-Dirac distribution, Concept of effective mass. Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy. Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

Unit - V: Physics of some technologically important Materials 08Hrs.

Superconductors: Temperature dependence of resistivity in superconducting materials. Effect of magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents. Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors. **Nano-Materials:** Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes. Properties and Applications of nanotubes.

Reference books:

1. Concept of Modem Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International).
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

AS - 301
MATHEMATICS- III

L	T	P
3	1	0

Course Outcomes (COs):

After completion of the course student will be able to:

- Deal with sequences and various types of series and their convergence,
- Determine whether a given complex function isdifferentiable, and if so find its derivative. Express complex- differentiable functions as power series, find the Singularities, Zeroes and Poles, Residue.
- Identify of Integral Transforms Fourier integral, Applications of Fourier transform and Z-transform and its application to solve difference equations.
- Analyze of different Statistical Techniques–I Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Correlation, Linear, nonlinear and multiple regression analysis,.
- Analysis of Statistical Techniques – II Binomial, Poisson and Normal distributions, Sampling theory, Tests of significations: Chi- square test, t-test, and Analysis of variance (one way), Application of. Time series and forecasting.

Unit- I: Sequences and Series **08**

Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for convergence, Standard infinite series, Geometric series and Harmonic series. Tests for convergence and divergence, Comparison test (only for series with positive terms), Cauchy's integral test, D'alembert's ratio test, Cauchy's nth root test, Raabe's test (higher ratio test), Logarithmic test, Demorgan's and Bertrand's tests, Alternating series Leibnitz's theorem (without proof), Absolute convergence and Conditional convergence, Power series.

Unit-II: Function of Complex variable **08**

Analytic function, C-R equations, Harmonic functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(cos\theta,\ sin\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$.

Unit- III: Integral Transforms **08**

Fourier integral, Complex Fourier transform, Inverse transform, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Unit- IV: Statistical Techniques – I **08**

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non-linear and multiple regression analysis, Probability theory.

Unit- V: Statistical Techniques – II **08**

Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tets of significations: Chi- square test, t-test, Analysis of variance (one way), Application to engineering, medicine, agriculture etc. Time series and forecasting (moving and semi- averages), Statistical quality control methods, Control charts, $\bar{X}$, R, p, np and c charts.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. J.N. Kanpur, Mathematical Statistics, S. Chand & company Ttd., 2000

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
2. Chandika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Gra Hill Education, 2016.
4. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
6. S.P. Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
7. Devore, Probability and Statistics, Thomson (Cengage) Learning, 2007.
8. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

CE – 301
Fluid Mechanics

Course Outcomes (COs):

After completion of the course student will be able to

- General introduction of different types of fluid and influence of pressure and temperature in different properties of fluid.
- Determination of value of acting pressure on plane and curved surfaces due to fluid. Calculation of pressure force and buoyancy force and their acting point in plane and curved surfaces in static condition.
- General understanding of different types of flows. Dimensional analysis and hydraulic similitude between model and prototype, model classification and important dimensionless numbers and their significance.
- Understand Bernoulli's equation and its application. Momentum equation and its application to pipe bends. Calculation of Kinetic energy and Momentum correction factors for laminar flow. Determine the relationship between shear and pressure gradient in laminar flow.
- Performance of Reynolds experiment and classification of flow by visual inspection and Reynold number value in pipe flow. Finding equation of motion for laminar flow through pips and between parallel plates.
- Measurement of scale and intensity of turbulence, velocity distribution in turbulent flow over smooth and rough surfaces. Major and minor losses in flow through pipes, drawing Energy and Hydraulic grade lines. Understand the concept of Boundary layer. Calculation of value of acting forces on submerged bodies.

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Unit – I

08

Introduction: Fluid and continuum, physical properties of fluids, rheology of fluids.
Fluid Statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

08

Kinematics of Fluid Flow: Continuum and free molecular flows, steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, ideal and real flow.
System versus control volume approach, fundamentals of flow visualization, streamlines, streak lines and path lines, continuity equation in Cartesian and polar co-ordinate system, rotation and circulation, stream function and potential function, flow nets.
Dimensional Analysis and Hydraulic Similitude: Rayleigh's method, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies, distorted and undistorted models.

Unit - III

08

Potential flow: source, sink, doublet and half-body, free and forced vortex flow.

Dynamics of Fluid Flow: Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, flow through orifices, mouthpieces, notches and weirs, aeration of nappe, momentum equation and its application to pipe –bends, flow through nozzles.

Unit - IV

08

Laminar Flow: Relation between shear and pressure gradient in laminar flow,introduction toNavier-Stokes equations, Reynolds experiment**,** equation of motion for laminar flow through pipes, flow between parallel plates, Kinetic energy and Momentum correction factors.

Turbulent Flow: Types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, Prandtl's mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces.

Flow through Pipes: Major and minor losses, energy and hydraulic grade lines, combination of pipes, flow through siphon pipes, pipe network, power transmission through pipes, surge tanks, water hammer.

Unit – V

08

Theory of Boundary Layer: Boundary layer thickness, boundary layer over a flat plate, application of Von-Karman integral momentum equation, laminar sub-layer, boundary layer separation and its control.

Forces on Submerged Bodies: Drag and lift, drag on a sphere and on a cylinder, development of lift on a circular cylinder and an aerofoil, Magnus effect.

Compressible Flow: Thermodynamic relations, basic equations of compressible flow, expression for velocity of sound wave in a fluid.

Text Books:

1. Bansal, R.K., 'Fluid Mechanics and Hydraulics Machines', Laxmi Pub. Ltd., New Delhi
2. Cengel&Cinbala,' Fluid Mechanics', TMH, New Delhi.

Reference Books:

1. Modi, L.P.N, Seth, S.M., 'Hydraulics and Fluid Mechanics', Std. Book House Pub.
2. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N. 'Fluid Mechanics and Machinery', Oxford University Press.
3. R. W. Fox, P. J. Pritchard, A. T Mcdonald, Introduction to Fluid Mechanics, John Wiley
4. F. M White, Fluid Mechanics, Tata McGraw Hill Eduction.
5. Munsan et.al, 'Fundamentals of Fluid Mechanics', Wilay New York.
6. Garde, R.J., 'Fluid Mechanics'.
7. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi.

ME- 301
STRENGTH OF MATERIALS

Course Outcomes (COs):

After completion of the course student will be able to

- To understand the concept of stress and strain under different conditions of loading.
- To determine the principal stresses and strains in structural members.
- To determine the stresses and strains in the members subjected to axial, bending and torsional loads.
- To apply the concepts of stresses and strain in solving problems related to springs, column and pressure vessels.
- To calculate the slope, deflection and buckling of loaded members.

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Unit I **10**

Stresses in Beams: Review of pure Bending. Direct and shear stresses in beams due to transverse and axial loads, composite beams.

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

Unit II **10**

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis(for symmetry about both axis and about one axis) for I-section and channel section.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method Fixed beams. Castigliano's Theorem.

Unit III **07**

Helical and Leaf Springs: deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Unit IV **07**

Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions, Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipments and machines.

Unit V **06**

Thin cylinders & spheres: Hoop and axial stresses and strain. Volumetric strain. Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders Stresses due to interference fits.

Text Books:

1. Strength of Materials by G.H. Ryder, Macmillan
2. Strength of Materials: Elementary Theory and Problems - Vol. I and Vol. II by Stephen Timoshenko, CBS Publishers
3. Strength of materials R. K. Rajput, S.Chand Publications

Reference Books:

1. Mechanics of Materials by Bear Johnston, McGraw Hill
2. Advanced Mechanics of Solids by L.S. Srinath, McGraw Hill
3.Mechanics of Materials by E P Popov, Pearson

CE- 302
BUILDING MATERIALS AND CONSTRUCTION

Course Outcomes (COs):

After completion of the course student will be able to:

- Explain various properties of building stones & bricks, their classification & testing.
- Elaborate the properties & uses of various materials like Gypsum & Lime.
- Explain various types of cements and their applications in construction & Various field and laboratory
- tests on cement.
- Describe the constituents of concrete, grades of concrete, & various testing involved.
- Analyze the importance of mineral and chemical admixtures, their properties & specifications for use in construction.
- Explain the classification & fundamental properties of timber along with seasoning & defects.
- Explain different types of lintel, arches, roofs, floors & explain their suitability.
- Understand the properties & usage of plastics, paints, glass, metals & insulating materials in construction.
- Explain various types of stairs, doors & windows with their relative advantages & disadvantages.
- Understand & analyze various Principles of building planning, by-laws and various components of Building.

L	T	P
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UNIT I **10**

Scope of Study of Building Materials: Building materials and their performance, economics of the building materials. **Stones:** Requirement of good building stones, characteristics of building stones and their testing. Common building stones. Method of preservation of stones. **Bricks:** Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles. **Gypsum:** properties of gypsum plaster, building products made of gypsum and their uses. **Lime:** Manufacture of limes, classification of limes, properties of limes. **Cement:** raw materials used, Process of manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of cement. **Cement Concrete:** Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Method of Curing of concrete. **Pozzolona:** Chemical composition and requirements for uses, Natural and Artificial flyash, Surkhi (burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction, **Timber:** Classification and identification of timber, fundamental Engineering Properties of timber, Defects in timber, factorsaffecting strength of timber, Methods of seasoning and preservation of timber. Wood based products. **Asphalt:** Bitumen and tar: Terminology, specifications and uses, Bituminous materials.

UNIT II **08**

Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction. **Paints, Varnishes and Distemper:** Common constituents, types and desirable properties, Cement paints. **Ferrous Metals:** Desirable characteristics of reinforcing steel. Principles of cold working. Reinforcing telemechanical & physical properties and chemical composition. Brief discussion on properties and uses of Aluminum and Lead. **Glass:** Ingredients, properties, types and use in construction. **Insulating Materials:** Thermal and sound insulating material, desirable properties and types.

UNIT III **08**

Buildings: Components of building, area considerations, Construction Principle and Methods for layout, Damp proofing, antitermite treatment in buildings, Vertical circulation: stair cases and their types, design and construction. Different types of floors, and flooring materials (Ground floor and upper floors). Bricks and stone masonary construction. Cavity wall & hollow block construction.

UNIT IV **07**

Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel and Chhajja, Principles of building Planning.

UNIT V **07**

Natural Ventilation, Water supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, distempering, colour washing, painting etc. Principles & Methods of building maintenance.

Text Books:

1. SK Duggal, "Building Materials" New Age International
2. PC Varghese, " Building Materials" PHI
3. Sushil Kumar, "Building Construction" Standard Publisher.
4. BC Punmia, "Building Construction" Laxmi Publication.

Reference Books:

5. Purushothama Raj, "Building Construction Materials & Techniques" Pearson Edu.
6. Rangwala, "Building Materials" Charotar Publishing House.
7. Domone, "Construction Materials" 4/e, CRC Press Taylor & Francis Group.
8. Adams, "Adams' Building Construction Adams" CRC Press Taylor & Francis Group.
9. Jha & Sinha, "Building Construction" Khanna Publisher
10. Sahu, "Building Materials and Cionstruction" Mc Grew Hill Education
11. Deodhar, "Civil Engineering Materials" Khanna Publisher
12. Mehta, "building Construction Principles, Materials & Systems" 2/e, Pearson Education Noida.
13. Sandeep Mantri, "Practical building Construction and its Management" Satya Publisher, New Delhi.

CE - 303
SURVEYING

Course Outcomes (COs):

After completion of the course student will be able to:

- The students are able to understand the use of different surveying instruments and their uses.
- Students are able to calculate compute the area and earthwork for different works by using surveying instruments.
- Students are able to do the surveying of different civil engineering projects.
- Students are able to estimate measurement errors and apply corrections along with calculation of angles, distance and levels.

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UNIT-1 **08**

Introduction, Classification of Survey, Principles of Surveying, Plans and Maps, Scale Accuracy and Errors

Horizontal Distance Measurement: Chain Surveying, Chains, Tapes, Accuracy of Chaining, Running Survey lines, Linear measurements with chains, Errors in chaining

UNIT-2 **08**

Compass Surveying: Bearing and Angles, Theory of Magnetic Compass , The Prismatic Compass, The Surveyor's Compass, Magnetic Declination, Local Attraction, Error in Compass Surveying

Theodolite Surveying: Classification of Theodolite, Temporary adjustments, Permanent adjustments, measurement of horizontal angles, measurement of vertical angles, Electronic theodolite

Traversing: Methods of Traversing, Plotting Traverse Survey, Checks, Closing Errors, Balancing Traverse, Adjustment of Bearings, Omitted measurements

UNIT-3 **08**

Levelling: Mehods of Levelling, Temporary adjustment of a level, Theory of direct leveling, Differential leveling, Balancing Back sight and Fore sight, Curvature and Refraction, Reciprocal Levelling, Cross Sectioning

Contouring: Contour Interval, Characteristics of Contours, Methods of Locating contours, Interpolation of contours, Contour gradient, Uses of Contour Maps, Trigonometric Levelling, Methods of Trigonometric Leveling.

UNIT-4 **08**

Plane Table Surveying: Description of Plane Table, Methods of Plane Table Surveying, Radiation, Traversing, Intersection, Resection, The three-point problem, Two point problem, Advantages and disadvantages of Plane Tabling

Tachaeometric Surveying: Methods of Tachaeometry, Fixed hair methods, Anallactic Lens, Subtense Method, Tangential Method, Range Finding

UNIT-5 **08**

Curves: Classification, Simple Circular Curves, Compound Curves, Reverse Curves, Transition Curves, Vertical Curves

Triangulation: Geodetic Surveying, Classification of Triangulation System, Reconnaissance, Signals and Towers, Base Line Measurements, Measurement of Horizontal Angles, Sattelite Station, Extension of Base

Text Books:

1. S K Duggal : Surveying Vol 1 & 2 , TMH
2. B C Punamia : Surveying & Leveling

ReferencesBooks:

1. R Subramanian : Surveying & Leveling , Oxford University Press
2. C Venkatramaih : Text Book of Surveying , University Press
3. H .Kanitkar : Surveying &Levelling

AS – 302/402
HUMAN VALUES AND ETHICS

Course Outcomes (COs):

After completion of the course student will be able to

- This course would help to assess ideas about ethics, self-exploration and happiness through reflective enquiry.
- It will aid in evaluating the prevailing problems in society due to differentiation and understanding the importance of human values in relationships.
- The course would lead to knowledge of the ideas of globalization and the world as a nation, for a transformative world order.
- It will help in analyzing ideas of leadership and creativity and using leadership qualities in day-to-day lives.
- It will augment an understanding of cross-cultural ethics and help students learn the art of resolving ethical dilemmas in business.

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UNIT 1 **08**

Course Introduction

1. Understanding: Why humans are ethical, why they are not;
2. Understanding the need, basic guidelines, content and process for Value Education;
3. Self Exploration–what is it? – It's content and process;
4. 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration;
5. Right understanding of Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority;
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario;
7. Method to fulfil the above human aspirations: understanding and living in **harmony** at various levels

UNIT 2 **08**

Understanding of Human Values and Ethics

1. Understanding the needs of Self ('I') and Body ('Me');
2. Understanding values in human-human relationship;
3. Meaning of Co-existence and Mutual Satisfaction;
4. Understanding Respect;
5. Understanding Comprehensive Human Goals;

UNIT 3 **08**

Effects of Holistic Harmony on Professional Ethics

1. World as a Nation;
2. Definitiveness of Ethical Human Conduct;
3. Basis for Humanistic Education and Humanistic Universal Order;
4. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order;

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,;
c) Ability to identify and develop appropriate technologies and management patterns for above production system;

5. Strategy for transition from the present state to Universal Human Order:
   a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers;
   b) At the level of society: as mutually enriching institutions and organizations;

UNIT 4 **08**

Effects of Holistic Personality for Success

1. Negotiation as a tool for success;
2. Leadership as an attribute of a successful Professional;
3. Managing Stress and Time;
4. Team Building--creating a harmonious environment with apathy to each other;
5. Understanding difference between evolution and revolution;

UNIT 5 **08**

Managing Relationship for Success

1. Understanding and valuing Cross-Cultural Ethics;
2. Managing Relationships (Networking), Personal Effectiveness and Self Leadership;
3. Theory of Constraints;
4. A Decision Making Model: Ethics as making decisions and choices;
5. Conflicts and Ethical Dilemmas;
6. Entrepreneurship and Ethics: A sense of business Ethics;
7. Pragmatic Behaviour of Business to its Colleagues/Competitors

Text Books:

1. Kazuo Ishiguro, 1989, *The Remains of the Day*, Faber and Faber
2. B. L. Bajpai, 2004, *Indian Ethos and Modern Management*. New Royal Book Co., Lucknow. Reprinted 2008;
3. Sussan George, 1976, *How the Other Half Dies*. Penguin Press, Reprint 1991;

Reference Books:

1. Amitabh Ghosh, 2008, *Sea of Poppies*. John Murray Publications.
2. R. K. Narayan, 1958, *The Guide*, Viking Press.
3. P. L. Dhar, R. R. Gour, 1990, *Science and Humanism*, Commonwealth Publishers;
4. R. R. Gaur, R. Sangal and G. P. Bagaria, 2010, *A Foundation Course in Human Values and Professional Ethics*, Excel Books.

Relevant movies and documentaries:

1. Story of Stuff (Documentary);
2. The Remains of the Day (Movie);
3. Pursuit of Happyness (Movie);
4. Fences (Movie);
5. Gifted (Movie)

AS – 303/ AS - 403
ENVIRONMENT AND ECOLOGY

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Get the information about environment, ecosystem and also about its functions like Food chain, Ecological pyramids etc.
- Get the complete information about EIA- Environmental Impact Assessment in which the student will get the knowledge about the projects and the process involved in getting the projects.
- Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources. Also get the knowledge about the analysis of polluted water.
- Gain the knowledge about different types of pollution and their treatment techniques like waste water treatment, solid waste management etc.,
- Get the complete information about the all legal aspects of environment protection.

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Unit I- Fundamentals of Environment & Ecology **08**

Definition, Scope & Importance and Need for public awareness.
Ecosystem- Definition, Energy flow in ecosystem, Ecological succession and Balanced ecosystem.
Effect of human activities on food, Shelter, Economic and social security.
Effect of human activities on environment - Agriculture, Housing, Industry, Mining and Transportation activities.
Basics of Environmental Impact, Assessment and Sustainable development.

Unit II- Natural Resources & Environmental Quality standard **09**

Water resources- Availability and quality aspects. Mineral resources, Material Cycle- Carbon, Nitrogen & Sulphur cycles, DO, BOD and COD.
Modern techniques used in analysis of Pollutants- Determination of disinfectants, Pesticides, Ambient Quality standards, Water quality parameters and standards, Turbidity, pH, Suspended solids and hardness,

Unit III- Environmental Pollution & Current Environmental issues **09**

Environmental Pollution-Definition, Causes, Effects and control measure of:

1. Air Pollution
2. Water Pollution
3. Soil pollution
4. Marine Pollution

Current environmental issues of importance: Population growth, Climate change & Global warming-effects, Urbanization, Cause of global warming, Acid rain. Ozone layer depletion- causes and effects on health, Control measures. Photochemical smog, Solid waste management, Waste water treatment.

Unit IV- Energy-Types , Sources and Uses **08**

Different types of energy, Conventional and nonconventional sources- Hydro-electric, Fossil fuel based, Nuclear, Solar, Biomass, Geothermal energy and Biogas. Hydrogen as alternative future source of energy.

Unit V- Environmental protection **06**

Role of Government, Legal aspects, Environment protection Act, Introduction to ISO 14000, Green building concept.

Text Book-

1. Environmental Studies- Dr. D. L. Manjunath, Pearson Education
2. Text book of Environment Science and Engineering- M. Anji Reddy- B S Publication
3. Elements of Environmental Science and Engineering- Dr. P. Meenakshi- Prentice-Hall of India Pvt Ltd, New Delhi, 2008.
4. Environment and Ecology- P.D. Sharma- Rastogi publication 2009.

Reference Books-

1. Principle of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India.
2. Environmental studies- R. Rajagopalan- Oxford Publication-2005.

AS - 401
COMPUTER ORIENTED NUMERICAL TECHNIQUES

Course Outcomes (COs):

After completion of the course student will be able to;

- Apply numerical methods to obtain the approximate solutions to the linear and non-linear transcendental and polynomial equations and find error.
- Identify numerical methods for various mathematical operations and tasks, such as interpolation formulae like forward, backward, and divided difference formulae.
- Apply the appropriate techniques for numerical differentiation and integration problems
- Design the numerical solution of initial value problems of the ordinary differential equations with implicit and explicit methods as appropriate
- Work numerically on the partial differential equations using different methods through of finite difference.

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Unit I **08**

Problem solving on computer, Algorithms and flow charts.
Introduction to numerical computing, approximations and errors in numerical computations, truncation and round off errors, propagation of errors.
Root finding: Bisection method, regula-falsi method, iteration method, Newton Raphson method, Secant method, systems of nonlinear equations. Rate of convergence of iterative methods.

Unit II **06**

Matrix algebra & solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU Decomposition, Jacobi method, Gauss Seidel method, SOR method, convergence of iterative methods. Tridiagonal systems and Thomas algorithm, Condition of a system and stability issues.

Unit III **10**

Interpolation and Extrapolation: Finite differences, Newton's forward and backward interpolation formula, Lagrange interpolation formula. Divided differences and Newton's formula.
Numerical differentiation. Numerical integration: Trapezoidal and Simpson's rules. Newton-Cotes integration formulas, Romberg integration, Gaussian quadrature.

Unit IV **08**

Numerical solution of O.D.E.: Taylor series method, Euler's method, Runge Kutta method.
Multistep method: Milne,s method, Adams method, accuracy, convergence criteria, stiffness.

Unit V **08**

Boundary Value problems: Finte difference method, solving eigenvalue problems, polynomial method and power method.
Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs.

Text Books :

1. Jain, Iyengar and Jain, Numerical Methods for Scientific and Engineering Computation (2003), New Age International, New Delhi.
2. Grewal B.S., Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.
3. E.Balagurusamy, Numerical Methods, Tata Mc Graw hill.

Reference Books :

1. Sastry, S.S. Introductory Methods of Numerical Analysis, 3rd ed. Prentice Hall of India, New Delhi (2002).
2. Schaum's Outlines: Numerical Analysis, 2nd ed. Tata Mc Graw Hill Publishing Co. Limited (1968).
3. Kandasamy, P. Thialagawathy, K. &Gumawathy, K. Numerical Method, S Chand & Company Ltd., New Delhi (1999)
4. Balaguruswanmy, E. Numerical Methods. Tata Mc Graw Hilll Publishing Co. Limited, New Delhi (2001)

CE – 401
Hydraulics and Hydraulic Machines

Course Outcomes (COs):

After completion of the course student will be able to;

- Differentiate between open channel flow and pipe flow.
- Apply velocity and pressure distribution, continuity equation, mass, energy and momentum conservation principles for solving different problemsrelated to channels.
- Calculate normal depth, critical depth, specific energy for given flow in channel.
- Understand the uses of pumps and turbines for conversion of energy.

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Unit – I **08**

Introduction: Difference between open channel flow and pipe flow, channel geometry, hydraulic parameters of various shapes of channels, types of open channel flow, velocity and pressure distribution, mass, energy and momentum conservation principles for prismatic and non-prismatic channels, continuity equation for steady and unsteady flow.

Energy-Depth Relations: Concept of specific energy, specific force, critical flow and its computation, flow in vertical and horizontal channel transitions.

Unit–II **08**

Uniform Flow: Characteristics of uniform flow, Manning's and Chezy's formula, normal depth, normal, critical and limit slopes, equivalent roughness coefficient, flow in compound sections, hydraulically efficient channel sections, flow in circular channels.

Unit – III **08**

Gradually Varied Flow: Dynamicequation of gradually varied flow and its limitations, classification and analysis of flow profiles, control sections, transitional depth.

Computation of GVF Profile: Integration of varied flow equation by analytical, graphical and advanced numerical methods, flow profiles in dividing and combining channels, role of end conditions.

Spatially Varied Flow: Differential SVF equations for increasing and decreasing discharge conditions.

Unit – IV **08**

Rapidly Varied Flow: Types of RVFs,hydraulic jump, types of jump, characteristics of jump in rectangular and non-rectangular channels on horizontal and sloping beds, length and location of jump, jump as an energy dissipator.

RVF Measurement: Flow in sharp crested, narrow crested and broad crested weirs, critical depth flumes, sluice gates, end depth in a free overfall.

Centrifugal Pumps: Difference between centrifugal and reciprocating pumps, classification of centrifugal pumps on the basis of various parameters, priming of a centrifugal pump,

fundamental equation of a centrifugal pump, types of heads and efficiencies, cavitation in pumps, characteristic curves.

Unit – V **08**

Turbines: Layout of a hydroelectric plant, classification of turbines on the basis of various parameters, important terms used, Surge Tanks.

Power produced by an impulse turbine and efficiencies.

Velocity triangle and work done for pelton wheel.

Reaction turbines classification and expression for work done.

Propeller and Kaplan turbines.

Performance of turbines, similarity laws and specific speed, characteristic curves,

Rapidly Varied Unsteady Flow: Celerity of wave, types of surges, analysis of positive and negative surges in a rectangular channel.

Text Books:

1. Subramanya,K, 'Flow through Open Channels', Tata McGraw Hill.
2. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N. 'Fluid Mechanics and Machinery', Oxford University Press.
3. RangaRaju, K.G., Flow through open channels, T.M.H.

Reference Books:

1. Srivastava, R , 'Flow through Open Channels' , Oxford University Press.
2. V.T. Chow: "Open-channel hydraulics." McGraw Hill .Publications
3. H. Chaudhury: "Open channel flow".
4. Henderson, "Open channel flow".

CE-402
ENGINEERING GEOLOGY

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand the role of geology in the design and construction process of underground openings in rock.
- Be able to apply geologic concepts and approaches on rock engineering projects.
- Be able to identify and classify rock using basic geologic classification systems.
- Be able to use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.

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UNIT – 1 **08**

Introduction, Importance of Geology in Civil Engineering.
Minerals: Their physical properties and detailed study of certain rock forming & common economic minerals.
Rocks: Their origin, structure, texture and classification & properties of igneous, sedimentary and metamorphic rocks and their suitability as Engineering Materials.
Stratification, Lamination and bedding.Outcrop-its relation to topography, dip and strike of bed, overlap, outlier and inlier, profile.
Engineering classification of Rocks: Deere & miller classification, Rock mass, Rock quality designation, Rock mass rating, Rock mass quality & applications in Civil engineering projects. Hock & Brown criterion

UNIT – 2 **10**

Rock deformation: Folds, Faults, joints, unconformity and their classification, causes and relation to Civil engineering. Behavior of rock masses & effects on outcrop.
Plate Tectonics & Continental drift.Earthquake, its causes, classification, Intensity & Magnitude. seismic zones of India, Geological consideration for construction of building and projects in seismic areas.

UNIT – 3 **07**

Landslides, its causes, classification and preventive measures.Settlement & subsidence.
Underground water, sources, Aquifers, Aquiclude, Artesian Wells, Underground water provinces of India and its role as geological hazard.
Building Stones, Engineering. properties of rocks, Alkali aggregate reaction, Grouting, Puzzolonic materials, Fly ash.

UNIT – 4 **08**

Geological investigations for site selection of Dams and reservoirs, tunnels, bridges and roads in hilly areas.
Principles of Geophysical explorations methods for subsurface Investigation.

UNIT – 5 **07**

Brief description of Physiographic & stratigraphic subdivision of India.Archaean group, Cuddapah system, Vindhyan system, Gondwana system, Deccantraps, Siwalik hills.

Text Books:

1. Prabin Singh: Engineering And General Geology, Katson Publishing House, Ludhiana
2. D.S. Arora: Geology for Engineers, Mohindra Capital Publishers, Chandigarh.
3. P. K. Mukerjee: A Text Book of Geology, The World Press pvt. Ltd., Calcutta.

Reference Books:

1. Krynine and Judd: Principles of Engineering Geology, McGraw Hill book Co., New York.
2. S. K. Garg: Physical & Engineering Geology, Khanna Pub., Delhi.
3. K V G K Gokhale: Text Book of Engineering Geology, B.S. Publication.
4. Blyth F.G.M.: A Geology for Engineers, Edward Arnold, Great Britain
5. F. G. Bell: Fundamentals of Engineering Geology, Butterwoths Pub., London.
6. Legget, R.F.: Geology and Engineering, McGraw Hill, New York
7. B.S. Sathya Narayanaswami, “Engineering Geology”, Dhanpat Rai & Co.

CE - 403
GEO-INFORMATICS

Course Outcomes (COs):

After completion of the course student will be able to;

- Analyse the principles and components of photogrammetric Survey & areal photogrammetry.
- Describe the concept & process of Remote Sensing, various elements involved & characteristics of spectral Curves.
- Elaborate various digital image processing techniques.
- Explain the concepts and fundamentals of GIS.
- Describe the use of remote sensing and GIS in different civil engineering applications.
- Elucidate various Global Navigation Satellite Systems & essentials of GPS & its components.

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UNIT-I **09**

Photogrammetric Survey, basic principles, elevation of a point, determination of focal length of lens, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, scale of a tilted photograph, tilt distortion, relief displacement of a tilted photograph, combined effects of tilt and relief, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope parallax, parallax in aerial stereoscopic views, parallax equations. Photogrammetry – analog, analytical and digital photogrammetry.

UNIT-II **08**

Remote Sensing, Introduction, concepts and physical basis of Remote Sensing, Electromagnetic spectrum, radiation laws, atmospheric effects, image characteristics. Remote sensing systems; sources of remote sensing information, spectral quantities spectral signatures and characteristics spectral reflectance curves for rocks, soil, vegetation and water. Introduction to Aerial and space borne platforms. Optical, thermal and microwave sensors and their resolution, salient features of some of operating Remote Sensing satellites.

UNIT-III **08**

Digital image processing: introduction, image rectification and restoration, image enhancement, image transformation, manipulation, image classification, fusion. Applications of remote sensing to civil engineering.

UNIT-IV **08**

GIS system: Definition terminology and data types, basic components of GIS software, data models, data acquisition, both raster based and vector based data input and data processing and management including topology, overlaying and integration and finally data product and report generation. GIS applications in civil engineering.

UNIT-V **07**

Global Navigation Satellite System (GNSS), GLONASS, GALILEO and GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications.

Text Books:

1. Sateesh Gopi, R Sath Kumar & N Madhu "Advance Surveying GIS & Remote Sensing" Pearson Education.
2. BC Punamia: Higher Surveying Laxmi Publication
3. B. Bhatta: Remote Sensing & GIS TMH.
4. G.S. Srivastava "An Introduction to Geo informatics" TMH.

References Books:

1. Kang Tshung Chang "Introduction of Geographic Information Systems" TMH.
2. Campbell, "Introduction to Remote Sensing" 3/e, CRC Press Taylor & Francis Group.
3. Chen, "Signal and Image Processing for Remote Sensing" CRC Press Taylor & Francis Group.
4. AM Chandra: Higher Surveying Narosa Pub.
5. TM Lillesand et al: Remote Sensing and Image Interpretation
6. R. Agor, " Advanced Surveying" Khanna Publishers.
7. M Anjireddy: Remote Sensing & GIS, BS Publications
8. Narayan Panigrahi "Geographical Information Science" Universities Press.
9. N.K. Agarwal: Essentials of GPS, Spatial Networks: Hyderabad
10. George Joseph " Fundamental of Remote Sensing" Universities Press.
11. Ahmed EI Rabbany, "Introduction to GPS the Global Positioning System" Artech House, Boston.
12. Chor Pang Lo, "Concepts & Techniques of Geographic Information Systems"2/e Pearson Education.

CE - 404
STRUCTURAL ANALYSIS – I

Course Outcomes (COs):

After completion of the course student will be able to:

- Ability to analyze statically determinate trusses, beams, and frames and obtain internal loading.
- Ability to analyze cable and arch structures.
- Ability to obtain the influence lines for statically determinate and indeterminate structures.
- Ability to determine deflections of beams and frames using classical methods.
- Ability to solve statically indeterminate structures using classical methods.
- Ability to solve statically indeterminate structures using matrix (stiffness) method.
- Ability to use modern structural analysis software.
- Familiarity with professional and ethical issues and the importance of lifelong learning in structural engineering.
- Familiarity with contemporary issues in structural engineering.

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UNIT-I **08**

Classification of Structures, Types of structural frameworks and Load transfer Mechanisms, stress resultants, degrees of freedom, Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of cables with concentrated and continuous loadings, Effect of Temperature upon length of cable.

UNIT-II **08**

Classification of Pin Jointed determinate trusses, Analysis of determinate plane trusses (compound and complex). Method of Substitution, Method of tension coefficient for analysis of plane trusses.

UNIT-III **08**

Strain Energy of deformable systems, Maxwell's reciprocal &Betti's theorem, Castigliano's theorems, Calculations of deflections: Strain Energy Method, Unit load method & for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method.

UNIT-IV **09**

Rolling loads and influence line diagrams for determinate beams and trusses, Absolute maximum bending moment and shear force. Muller-Breslau's principal & its applications for determinate structures.

UNIT-V **07**

Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch.

Text Books:

1. T S Thandavmorthy, "Analysis of Structures", Oxford University Press 5. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.

2. Reddy, CS, “Basic Structural Analysis”, Tata McGraw Hill.
3. Jain, OP and Jain, BK, “ Theory & Analysis of Structures”, Khanna Publishers
4. S Ramamurtham “Theory of Structure” Dhanpat Rai

References Books:

1. Hibbler, “Structural Analysis” , Pearson Education
2. Mau, “Introduction to Structural Analysis” CRC Press Taylor & Francis Group.
3. Ghali, “Structural Analysis: A Unified Classical and Matrix Approach” 5/e, CRC Press Taylor & Francis Group.
4. Temoshenko& Young “Theory of Structure” Tata McGraw Hill.
5. Vazirani&Ratwani et al, “Theory & Analysis of Structures”, Khanna Publishers
6. Coates, RC, Coutie, M.G. & Kong, F.K., “Structural Analysis”, English Language Book Society & Nelson, 1980
7. SP Gupta & Gupta “Theory of Structure Vol.1 &2” TMH
8. DS Prakash Rao “Structural Analysis: A Unified Approach” Universities Press
9. Devdas Menon Ädvance Structural Analysis”, Narosa
10. Wang, CK, “Intermediate Structural Analysis”, Tata McGraw Hill.
11. Hsieh, “Elementary Theory of Structures” 4/e Pearson Education, Noida.
12. Mckenzie, “ Examples in Structural Analysis” 2/e CRC Press Taylor & Francis Group.

CE - 501

DESIGN OF CONCRETE STRUCTURE– I

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand the properties and role of various constituent materials used in concrete making.
- Understand the properties of concrete and various design mix techniques for concrete.
- Apply the fundamental concepts, techniques in analysis and design of reinforced concrete elements i.e. beam & slab.
- Apply the design principles by undertaking simple design examples.
- Apply the various codal requirements related to RC members i.e. slab, beam and column.

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UNIT-1 **08**

Concrete Making materials, Properties of concrete and reinforcements , Testing of concrete, Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method.

UNIT-2 **08**

Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method.

UNIT-3 **08**

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, Design of beam in shear, Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments.

UNIT-4 **08**

Design of one way and two way solid slabs by Limit State Design Method, Serviceability Limit States, Control of deflection, cracking and vibrations.

UNIT-5 **08**

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, Requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts.

Note : All designs shall be conforming to IS : 456 – 2000.

Text Books:

1. Gambhir, M L ,"Fundamentals of Reinforced Concrete", Prentice Hall of India.
2. UnnikrishnaPillai, S. & D. Menon, " Reinforced Concrete Design", Tata Mc-Graw Hill Company Limited.
3. Park, R. and T. Pauley," Reinforced Concrete Structures", John Wiley & Sons.

References Books:

1. IS : 456 – 2000, " Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.
2. Jain, A.K., "Reinforced Concrete : Limit State Design", Nem Chand & Bros., Roorkee.
3. Jain, O. P. & Jai Krishna, " Plain and Reinforced Concrete", Vol. I & II, Nem Chand & Bros., Rookee.
4. Dayaratnam, P,"Reinforced Concrete Design", Oxford & IBH.

CE – 502
ENVIRONMENTAL ENGINEERING – I

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand key current environmental problems.
- Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
- Be able to analyse an industrial activity and identify the environmental problems.
- Be able to plan strategies to control, reduce and monitor pollution.
- Be able to select the most appropriate technique to purify and/or control the emission of pollutants.
- Be able to apply the basis of an Environmental Management System (EMS) to an industrial activity.
- Be conversant with basic environmental legislation.

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UNIT-1 **08**

Public Water supply: Hydrosphere, Hydrological cycle and Natural water. Beneficial uses of water, water demands, variations in demands; population forecasting; basic needs and factors affecting consumption; design period.

Sources of water: Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake systems.

UNIT-2 **08**

Quality and Examination of Water: Necessity for examination of impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures.

UNIT-3 **08**

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, general design guidelines for distribution systems, Hardy - Cross, Newton – Raphsonand equivalent pipe methods of pipe network analysis.

Water supply and plumbing systems in buildings and houses.

UNIT-4 **08**

Wastewater collection: Systems of sanitation and wastewater collection; choice of sewerage system and suitability to Indian conditions.

Estimation of wastewater flows and variations in wastewater flows. Storm water: Collection and estimation of storm water by different methods.

UNIT-5 **08**

Wastewater Transmission: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems.

Text Books:

1. Peavy, Howard S., Rowe, Donald R and Tchobanoglous, George,Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., NewDelhi.
2. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc-GrawHill.
3. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-GrawHill.

References Books:

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of UrbanDevelopment, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry ofUrban Development, Government of India, NewDelhi
3. Davis Mackenzie L., Cornwell, David A., "Introduction to EnvironmentalEngineering" McGraw Hill Education (India) Pvt. Ltd., NewDelhi.
4. A.K. Jain, Environmental Engineering, Khanna PublishingHouse
5. OP Gupta, Elements of Environmental Polluton Control, KhannaPublication
6. M. P. Poonia and SC Sharma: Environmental Engineering, Khanna publishinghouse
7. Keshav Kant, "Air Pollution Control Engineering", Khanna PublishingHouse

CE - 503
TRANSPORTATION ENGINEERING– I

Course Outcomes (COs):

After completion of the course student will be able to:

- Exhibit the knowledge of road development, explain various Road plans, Road types & patterns.
- Apply the knowledge of geometric design of road elements to provide solutions to various design problems.
- Undertake various Traffic studies and explain various traffic control elements like signs, signals, islands & intersections.
- Understand and use the concept of different methods in construction, inspection and maintenance of the pavement.
- Design the flexible & rigid pavements using suitable methods.
- Analyse various parking studies & understand the application & suitability of various parking facilities & terminals.

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UNIT – 1 **08**

Introduction: Role of Transportation, Modes of Transportation, History of road development, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Road types and pattern.
Geometric Design: Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves.

UNIT – 2 **08**

Traffic Engineering: Traffic characteristic, volume studies, speed studies, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection.

UNIT – 3 **08**

Design of Highway Pavement: Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC: 37-2001), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC : 58 – 2002).

UNIT – 4 **08**

Road Construction Methods: WBM, Surface dressing, Bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete road construction.

UNIT – 5 **08**

Traffic and Parking Studies: Traffic and Parking Problems, Ill effects of Parking, Design Standards for on Street Parking Facilities, Traffic Regulatory Measures for On Street Parking Facilities, Peripheral Parking Schemes, Truck Terminals, Long Distance Bus Terminals

Text Book:

1. Khanna S. K., Justo C.E.G, &Veeraragavan, A. "Highway Engineering", Nem Chand and Bros., Roorkee- 247667.
2. Khanna S. K., Justo C.E.G, &VeeraragavanA., "Highway Materials and PavementTesting", Nem Chand and Bros., Roorkee- 247667.
3. LR Kadiyali, Transportation Engineering, KhannaPublication.
4. Chakraborty Partha& Das Animesh., "Principles of Transportation Engineering", Prentice Hall (India), NewDelhi,

Reference Books:

1. L.R. Kadiyali, Transportation Engineering, Khanna PublishingHouse
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, NewDelhi
3. Kumar, R Srinivasa, "A Text book of Highway Engineering", Universities Press, Hyderabad.
4. Kumar, R Srinivasa, "Pavement Design", Universities Press,Hyderabad.
5. IRC : 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, NewDelhi
6. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (withCD)
7. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (FirstRevision)
8. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban)Highways
9. IRC:106-1990 Guidelines for Capacity of Urban Roads in PlainAreas
10. IRC:93-1985 Guidelines on Design and Installation of Road TrafficSignals.
11. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (FirstRevision)
12. IRC: SP: 68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements", Indian Roads Congress, NewDelhi.
13. IRC: 15-2002, "Standard Specifications and Code of Practice for construction of Concrete Roads" Indian Roads Congress, NewDelhi.
14. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, NewDelhi.

CE – 504
GEOTECHNICAL ENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand geotechnical field problems related to civil engineering.
- Identify soil type, provide its classification and particle size analysis of given soil.
- Calculate the stresses due to applied loads under the soil.
- Determine shear strength, unconfined compressive strength of soil available in site.
- Calculate bearing capacity of given soil.

L	T	P
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UNIT – 1 **08**

Preview of Geotechnical field problems in Civil Engineering, soil formation, transport and deposit, soil composition, basic definitions, clay minerals, index properties, particle size analysis and soil classification.

UNIT – 2 **08**

Soil-water systems, capillarity-flow, Darcy's law, permeability, field and lab tests, piping, quick sand condition, seepage, flow nets, flow through dams, filters. Soil compaction, water content – dry unit weight relationships, OMC, field compaction control, Proctor needle method.

UNIT – 3 **08**

Effective stress principle, stresses due to applied loads, Boussinesq and Westergaard equations. Compressibility and consolidation characteristics, rate of consolidation, Terzaghi's one dimensional theory of consolidation and its applications, over consolidation ratio, determination of coefficient of consolidation and secondary consolidation (creep), consolidation under construction loading.

UNIT – 4 **08**

Shear strength - direct & triaxial shear tests, Mohr – Coulomb strength criterion, drained, consolidated, undrained and unconsolidated tests, strength of loose and dense sands, normally consolidated and over consolidated soils, dilation, pore pressure, Skempton's coefficient. Earth pressure theories, Coulomb and Rankine approaches for c-φ soils, smooth and rough walls, inclined backfill.

UNIT – 5 **08**

Characterization of ground, site investigations, groundwater level, methods of drilling, sampling, in situ test, SPT, CPT, DCPT. Types of foundations – shallow / deep, isolated, combined, mat, etc., definitions, bearing capacity of shallow foundations (Terzaghi analysis), general, local and punching shear failures, corrections for size, shape, depth, water table, bearing capacity by consolidation method, insitu bearing capacity determination, Provisions of IS code of practice, selection of depth of footing, eccentrically loaded footings.

Text Books:

1. Narasinga Rao, B.N.D, "Soil Mechanics & Foundation Engineering", John Wiley & Sons, Wiley India Pvt. Ltd.
2. Khan I H, Textbook of Geotechnical Engineering, Prentice Hall India
3. Brij Mohan Das Geotechnical engineering CENGAGE Learning

4. Gulati, S.K, Geotechnical Engineering, Tata Mc. Graw Hill

References Books :

1. Murthy VNS, Geotechnical Engineering, Soil Mechanics and foundation engineering, Marcel Dekken Inc.
2. Rowe R.K, Geotechnical and Geotechnical Engineering Handbook, Kluwer Academic Publication London
3. Arora KR, Geotechnical Engineering: Soil Mechanics and foundation engineering, Standard Publisher Distributor
4. Venkataramaiah C, Geotechnical Engineering, New Age Pvt. Ltd.

CE - 505
STRUCTURAL ANALYSIS– II

Course Outcomes (COs):

After completion of the course student will be able to:

- To impart the principles of elastic structural analysis and behavior of indeterminate structures.
- To impart knowledge about various methods involved in the analysis of indeterminate structures.
- To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
- To enable the student get a feeling of how real-life structures behave
- To make the student familiar with latest computational techniques used for structural analysis.

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UNIT – 1

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint, Method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method. 8

UNIT – 2

Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged arches, Influence line diagrams for maximum bending moment, Shear force and thrust. 8

UNIT – 3

Suspension Bridges, Analysis of cables with concentrated and continuous loadings, Basics of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. 8

UNIT – 4

Basics of Force and Displacement Matrix methods for beams, frames and trusses. 8

UNIT – 5

Basics of Plastic Analysis, Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Frames. 8

Text Books :

1. H. C. Martin, Introduction to Matrix Methods of Structural Analysis, Mc-Graw Hill Book Publishing Company Ltd.
2. C. S. Reddy, Structural Analysis, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Gupta & Gupta, Theory of Structures, Vol 1 & 2, TMH
4. P. Dayaratnam, Analysis of Statically Indeterminate Structures, Affiliated East-West Press.

References Books :

1. A K Jain, Advanced Structural Analysis, Nem Chand & Bros., Roorkee
2. O. P. Jain & A. K. Jain, Theory and Analysis of Structures, Vol. I & II, Nem Chand Bros., Roorkee.
3. S. P. Timoshenko and D. Young, Theory of Structures, Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
4. Indterminate Structural Analysis by C. K. Wang. Mc-Graw Hill Book Publishing Company Ltd.
5. S SBhavikkati, Structural Analysis II, Vikash Publishing House.
6. B C Punamia and A K Jain, Theory of Structures, Laxmi Publication

CE - 601
ENVIRONMENTAL ENGINEERING – II

Course Outcomes (COs):

After completion of the course student will be able to:

- Ability to estimate sewage generation and design sewer system including Sewage pumping stations.
- Required understanding of the characteristics and composition of sewage, self purification of streams.
- Ability to perform basic design of the unit operations and processes that are Used in sewage treatment.

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UNIT-1 **08**

Pollutants of Water, their origin and effects; Oxygen demanding wastes, pathogens,3 nutrients, salts, thermal applications, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution.Effects of oxygen demanding wastes on surface waters. Wastewater quality and characteristics. Water borne diseases and their control. Objectives of treatment: Water and wastewater treatment, unit operations and processes and flow sheets.

UNIT-2 **08**

Sedimentation: Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of primary and secondary settling tanks; removal efficiency for discrete and flocculent settling. Coagulation: Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculators and clariflocculators.

UNIT-3 **08**

Filtration: Theory of filtration; Hydraulics of filtration; Carmen - Kozeny and other equations; slow sand, rapid sand and pressure filters, backwashing; brief introduction to other filters; design of filters. Disinfection: Requirements of an ideal disinfectant; kinetics of disinfection, various disinfectants, chlorination and practices of chlorination. Water softening and ion exchange: calculation of dose of chemicals. Adsorption.

UNIT-4 **08**

Wastewater Treatment: Preliminary, primary, secondary and tertiary treatment processes. Primary Treatment: Screens, grit chamber and their design, sedimentation and chemical treatment to be given. Secondary Treatment: Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters, R.B.C. Community and Low Cost Treatment Systems: aerated lagoons, waste stabilization ponds, oxidation ditches.

UNIT-5 **08**

Anaerobic digestion of sludge: Design of low and high rate anaerobic digesters and septic tanks. Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor. Disposal of wastewater on land and in water bodies. Introduction to Duckweed pond,

vermiculture and root zone technologies and other emerging technologies for wastewater treatment.

Text Books :

1. Peavy, Rowe and Tchobanoglous, Environmental Engineering, Tata Mc Graw Hill.
2. Metcalf and Eddy, Wastewater Engineering: Treatment & Reuse, Tata Mc Graw Hill.
3. Garg: Water Supply Engineering (Environmental Engg- I), Khanna Publishing House.
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engg.Vol.-II), Khanna Publishing House.

References Books :

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi.
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee, Water Supply and Sewerage, Mc Graw Hill.
4. Fair and Geyer, Water Supply and Wastewater Disposal, Jhon Wiley & Sons.
5. Ramalho, Introduction to Wastewater Treatment Processes, Academic Press.
6. Parker, Wastewater Systems Engineering Prentice Hall.

CE - 602
TRANSPORTATION ENGINEERING – II

Course Outcomes (COs):

After completion of the course student will be able to:

- Transportation Engineering-II contains basic engineering knowledge about the two other modes of transportation, Railway and Airways.
- Railway engineering involves the planning, design, construction, operation and maintenance of railway facilities used for the movement of people and goods, serving the social and economic needs of contemporary society and its successors.
- Airport engineering part involves the design and construction of various facilities of an airport which are necessary for its efficient working of the airways

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UNIT – 1

Indian railways: Development and organization of Indian Railways.Permanent way : Sub-grade, formation, embankment and cutting, track drainage.Rails : Rail gauges, types of rails, defects in rails, rail failure, creep of rail.Rail Fastenings : Fish plates, spikes, chairs, keys, bearing plates.Sleepers : Timber, steel, cast iron, concrete and prestressed concrete sleepers,manufacturing of concrete sleepers, sleeper density.

Ballast : Ballast materials, size of ballast, screeming of ballast, specification of ballast,tests on ballast. 10

UNIT – 2

Railway Track Geometry : Gradients, horizontal curves, super-elevation, safe speed oncurves, cant deficiency, negative super elevation, compensation for curvature ongradients, track resistance and tractive power.Points &Crossings : Elements of a simple turn-out, details of switch, details of crossings,

number& angle of crossings, design of turn-out. 8

UNIT – 3

Stations &Yards : Site selection for a railway station, layout of different types ofstations, classification of stations, types of railway yard, functions of marshalling yards.Signalling& interlocking : Classification of signals, method of train working, absoluteblock system, mechanical interlocking of a two line railway station. 7

UNIT – 4

Airport Engineering : Air craft characteristics affecting airport design; Runway operation; Runway pavement design,design of overlay; Runway lighting and marking heliport. 8

UNIT – 5

Water Transport - Harbors: Layout and port facilities; Inland waterways; Inland water operation. 7

Text Books :

1. S. P. Arora& S. C. Saxena, A Text Book of Railway Engineering, Dhanpat Rai Publications.
2. L R Kadiyali, Transport Engineering, Nem Chand & Bros.

3. N J Ashford, Airport Engineering : Planning, Design and Development of 21st Century Airports, Wiley.

Reference Books :

1. M. M. Aggrawal, Railway Engineering, Oxford Higher Education.
2. James H, Water Transport : Originand Early Evolution, Cambridge University Press.
3. Robert H, Planning and Design of Airports, Mc Graw Hill Education.

CE - 603
ADVANCED FOUNDATION ENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- Ability to evaluate Bearing capacity factors.
- Ability to evaluate the Pile group bearing capacity and settlement.
- Ability to understand Well foundation.
- Ability to understand dynamic loads on soil foundation system.

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Unit -1
Vertical pressures under surface loads, elastic solution, Bousisinesq and New Mark charts, Westergaard's equation and approximate solution. 8

Unit -2
Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and schmmertman's methods of settlement prediction in non cohesive soil. 8

Unit -3
Classification of piles, load carrying capacity of single pile in clay, silt and sand by dynamic and static methods, pile load test, pile group, negative skin friction andsettlement of pile group. 8

Unit – 4
Foundation on expansive soil, construction on expansive soil, alteration of soil condition, under-reamed piles. Elements of well foundation, shape, depth of scour, well sinking, tilt, shift and their prevention. 8

Unit -5
Stability of slopes, limit equilibrium method, method of slices, simplified Bishop method, Stability charts. Machine foundation: Classification, definitions, design principle in brief, Barken's method. 8

Text Books:
1. K. R. Arora – Soil Mechanics & Foundation Engineering, Standard Publisher.
2. Alam Singh – Modern Geotechnical Engineering, CBS Publisher.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics, New Age Int. Publisher.

Reference:
(a) J. E. bowles – Analysis and Design of Foundation, Mc Graw Hill.
(b) V. N. S. Murthy – Soil Mechanics and Foundation Engineering, CBS.
(c) B. M. Das – Foundation Engineering , CENGAGE Learning

CE - 604
DESIGN OF CONCRETE STRUCTURE– II

Course Outcomes (COs):

After completion of the course student will be able to:

- Design various sub-structure components like isolated footing, combined footing, retaining walls, along with relevant IS code requirements.
- Design various super-structure components like stairs, columns, continuous beams, along with relevant IS code requirements.
- Apply the concepts of structure design to special structural elements like curved beams, domes, water retaining structures, along with relevant IS code requirements.

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UNIT-1

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. (IS Code Method). 8

UNIT-2

Analysis and design of beam curved in plan. Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, and design of strap footing. 8

UNIT-3

Structural behaviour of retaining wall, stability of retaining wall against overturning andsliding, design of T-shaped retaining wall, Concept of Counter fort retaining wall. Loads, forces and I.R.C. bridge loadings anddesign of R.C. slab culvert. 10

UNIT-4

Design criteria, material specifications and permissible stresses for tanks, design conceptof circular and rectangular tanks situated on the ground / underground, design of overhead tanks. 8

UNIT-5

Advantages of prestressing, methods of prestressing, losses in prestress, analysis ofsimplepre-stressed rectangular and T-section. 6

Text Books :

1. Jain, A.K., "Reinforced Concrete : Limit State Design", Nem Chand & Bros., Roorkee.
2. Gambhir, M L ,"Fundamentals of Reinforced Concrete", Prentice Hall of India.
3. UnnikrishnaPillai, S. & D. Menon, " Reinforced Concrete Design", Tata Mc-Graw Hill Company Limited.

Reference Books :

1. IS : 456 – 2000, " Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.
2. Park, R. and T. Pauley," Reinforced Concrete Structures", John Wiley & Sons.
3. Dayaratnam, P,"Reinforced Concrete Design", Oxford & IBH.
4. Jain, O. P. & Jai Krishna, " Plain and Reinforced Concrete", Vol. I & II, Nem Chand & Bros., Rookee.

CE –6051
REMOTE SENSING AND GIS APPLICATION

Course Outcomes (COs):

After completion of the course student will be able to:

- Flood plain mapping for particular area.
- Identify the sources of energy for remote sensing and characteristics of electromagnetic radiation.
- Digitization, data Preprocessing, data reduction, and generalization.

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Unit I

Remote Sensing: Introduction, sources of energy for remote sensing, active and passivesources, electromagnetic radiation, and their characteristics, thermal emission, Interaction of EMR with atmosphere, spectral reflection curves. 8

Unit II

Multi concept of remote sensing, sensors and orbital characteristics, various sensing platforms for remote sensing, characteristics of various satellite, remote sensing data products and their uses.Data capture for simulation of land surface, geomorphology, landuse classification, flood plain mapping, application to snow cover studies, 8

Unit III

Geographic Information system: Introduction, concept and terminology, components ofGIS, Rastor and Vector formats, scanners and digitizers, methods of digitization, data Preprocessing, form conversion, data reduction, and generalization.Data bases and DBMS, Spatial databases, co-ordinate systems and geo-referencing. 8

Unit IV

Data merging, edge matching, registration and re-sampling, data manipulation and analysis representation of real-world problems, problem solving and spatial modeling, classification, aggregation, overlay, buffers anddigital elevation models. 8

Unit V

Applications in planning of utility lines, flood studies, ground water recharge, erosion modeling, case studies on use of GIS related to land use, water, environment and transportation.

Integrated use of remote sensing and GIS, introduction to arc view, arc info, map info and MODFLOW software. 8

Text Books :

1. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman., Remote Sensing and Image Interpretation. Wiley
2. B. Bhatta, Remote Sensing and GIS, Oxford University Press
3. Lillesand and Kiefer,Remote Sensing and Image Interpretation, John Wiley & Sons Ltd.
4. Ian Haywood, Dorlling, An Introduction to GIS, Kindersley Pvt. ltd

5. Satheesh, G., Sathikumar, R., and Madhu, N., Advanced Surveying,Pearsons Educations.

Reference books :

1. Curran, Paul J., Principles of Remote sensing Longman
2. Campbell, J.B., Introduction of Remote Sensing Taylor and Francis,
3. Sabins, F.F., Remote Sensing: Principles and Interpretations Worth Publishers
4. Reddy, M. Anji, Remote sensing and Geographic Information System BS Publications
5. Elachi, Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons Ltd.
6. Longley, Geographical Information System Vol. I and II,John Wiley & Sons Ltd.

CE –6052
INTEGRATED WASTE MANAGEMENT

Course Outcomes (COs):

After completion of the course student will be able to:

- Give the overview and beneficial reuse of Construction and Demolition (C&D) Waste.
- Understand Current Issues in Solid Waste Management.
- Identify the best methods for disposal of Municipal Solid Waste.

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Unit-1

Introduction: Solid Waste Management- Definition, concept of 4Rs (reduce, reuse, recycle and recover) of waste management, elements of a waste management system.

Current Issues in Solid Waste Management:Integrated waste management hierarchy,source reduction, recycling, waste-to-energy and land filling. Review of waste management under Swachh Bharat Mission and SmartCitiesProgram. 8

Unit-2

Municipal Solid Waste: Waste composition and quantities, collection, transportation, segregation,andprocessing. 8

Unit-3

Disposal of Municipal Solid Waste: Landfill, biochemical processes and composting, energy recovery from municipal solid waste. Municipal Solid Waste (MSW)Rules2016. 8

Unit-4

Construction and Demolition (C&D) Waste Management: Overview, components, C&D Waste Management Rules 2016, beneficial reuse of C & Dwastematerials. 8

Unit-5

Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges.Hazardous Wastes:Definition, classification, risk assessment, transportation of hazardous waste, current management practices. Environmental audit, containment, remedial alternatives. 8

Text Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGrawHill
2. Ramachandra T.V., Management of Municipal Solid Waste, 2009; by The Energy and Resource Institute,TERI
3. Sasikumar, K, Gopi Krishna, Sanoop, Solid Waste Management; 2009,PHI.

Reference Books:

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO),India
2. MSW Management Rules 2016, Govt. of India, available online at CPCBwebsite.
3. Construction and Demolition Waste Management Rules, 2016,MoEF&CC
4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
5. P Gupta, " Element of Solid waste hazardous management, Khanna Publishinghouse.

6. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, NewYork.
7. http://swachhbharatmission.gov.in/sbmcms/index.htm
8. http://swachhbharaturban.gov.in/

CE –6053
GEOSYNTHETICS AND REINFORCED SOILSTRUCTURES

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand the types, manufacture and testing of geosynthetics.
- Using geosynthetics in flexible payment, landfills and in erosion control.
- Sustainable infrastructure development.
- Design of reinforced soil retaining walls.
- Bearing capacity analysis of footings resting on reinforced foundation soils.

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UNIT 1

Introduction to Geosynthetics, types of geosynthetics, artificial and natural geosythetics and their applications, manufacture of geosynthetics, strength of reinforced soils, testing of geosynthetics. 8

UNIT-2

Drainage application of geo synthetics, filtration applications of geosynthetics, erosion control using geosynthetics, geosynthetics in flexible payment, introduction to geosynthetics in landfills, geosynthetics for constructionoflandfills. 8

UNIT-3

Sustainable infrastructure development, different types of soil retaining structures, design codes for reinforced soil retaining walls, construction aspects of geosynthetics reinforced soil retaining wall, testing requirements for reinforced soil retaining walls, geosynthetic reinforced soil embankments. 8

UNIT-4

Design of reinforced soil retaining walls – simple geometry, design of reinforced soil retaining walls – sloped backfill soil, soil embankments supported on geo cell mattresses, geo synthetic reinforced pile systems for high embankments. 8

UNIT-5

Reinforced soil for supporting shallow foundations, response of footings resting on reinforced foundation soils, bearing capacity analysis of footings resting on reinforced foundation soils, carbonfootprintanalysis. 8

Text Books :

1. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4th edition,1999.
2. Sanjay Kumar Shukla, Erol Guler “Advances in Reinforced SoilStructures,” Ppringer International Pub.

Reference Books :

1. Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 123, CIRIA, Thomas Telford. London, UK,1996.
2. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi,2004.
3. Hoe I. Ling, Guido Gottardi , Daniele Cazzuffi , Jie Han , Fumio Tatsuoka “Design and Practice of Geosynthetic-Reinforced SoilStructures”, DES Tech Publication, Inc. USA.

CE –6054
MODERNCONSTRUCTION MATERIALS

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand the properties and uses of modern building materials like bricks, concrete and polymers.
- Show the properties and uses of Conventional and modern water proofing materials, conventional and modern insulating materials.
- Select the appropriate building material for construction of economic structure.

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Unit – 1
Introduction, properties and uses of modern building materials: Fly ash bricks, soil - cement blocks, calcium silicate bricks, red mud jute fibre polymer composite (RFPC),glassreinforced gypsum. 8

Unit – 2
Introduction, properties and use of geosynthetics, bituminous material, fire resistant materials (chemicals ,paints ,tiles ,bricks, glass),metals, light - weight concrete, mass concrete and waste material based concrete.

8

Unit – 3
Introduction, properties and use of: Ferro cement &fibre reinforced concrete, different types of fibres, high density concrete, nuclear concrete, heat resisting & refractory concretes, pre fabricated systems. 8

Unit –4
Introduction, properties and use of: Polymers, fibre reinforced polymers, polymer concrete composites (PCCs), sulphur concrete and sulphur –infiltrated concrete.

8

Unit –5
Introduction, properties and use of: Conventional and modern water proofing materials, conventional and modern insulating materials(thermal, sound and electrical insulating materials).Concept of polymerfloorfinishes. 8

TextBook:

1) GhambhirM.L."Concrete Technology" Tata McGraw Hill education privateLimited.
2) A.R. Santhakumar, Concrete Technology, Oxford UniversityPress.
3) Building Materials, P.C. Varghese, Prentice-HallIndia.
4) Shetty, M. S., "Concrete Technology" S. ChandPublication.

ReferenceBook:

1) Krishnaraju .N., Advanced Concrete Technology, CBSPublished.
2) Materials Science and Engineering: An introduction, W.D. Callister, JohnWiley.
3) Nevile. A.M., Concrete Technology, Prentice Hall,Newyork.

4) Dr. U. K. Shrivastava, Building Materials Technology, Galgotia Publicationpvt.ltd.
5) Materials Science and Engineering, V. Raghavan, PrenticeHall.
6) Properties of Engineering Materials, R.A. Higgins, IndustrialPress.
7) Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J.Domone, 3rd ed., SponPress.
8) The Science and Technology of Civil Engineering Materials, J.F. Young, S.Mindess, R.J. Gray & A. Bentur, Prentice Hall.
9) Engineering Materials 1: An introduction to their properties & applications, M.F.Ashby and D.R.H. Jones, ButterworthHeinemann.

CE –6055
GEO-ENVIRONMENTALENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- To show the impact of ground contamination on geoenvironment, role of soil in geoenvironmental applications.
- Understand soil-water-contaminant interactions and its implications.
- Risk assessment of contaminated site, selection and planning ofremediationmethods

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UNIT-1

Fundamentals of Geoenvironmental Engineering : Scope of geoenvironmental engineering - multiphase behaviour of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of groundcontamination – impact of ground contamination on geoenvironment - case histories ongeoenvironmentalproblems. 8

UNIT-2

Soil-Water-Contaminant Interaction : Soil mineralogy characterization and its significance in determining soil behaviour – soil-water interaction and concepts of double layer, forces of interaction between soil particles, concepts of unsaturated soil, water flow in saturated and unsaturated zone, soil-water-contaminant interactions and its implications, factors effecting retention and transport of contaminants. 8

UNIT-3

Waste Containment System : 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 wastecontainment. 8

UNIT-4

Contaminant Site Remediation : Site characterization, risk assessment of contaminated site, remediation methods for soil and groundwater, selection and planning ofremediationmethods. 8

UNIT-5

Advanced Soil Characterization : Contaminant analysis, water content and permeability measurements, electrical and thermal property evaluation, use of GPR for site evaluation, introduction to geotechnical centrifuge modeling. 8

Text Books:

1. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York,2001.
2. Mitchell, J. K., "Fundamentals of Soil Behaviour" Wiley,2005.
3. Hillel D., "Introduction to Environmental Soil Physics" Academic Press, New York, 2003.

Reference Books:

1. O.P. Gupta, Elements of Environmental Chemistry, Khanna PublishingHouse
2. Alvarez-BenediJ. and Munoz-Carpena, R., "Soil-Water-Solute Process

Characterization: An Integrated Approach" CRC Press.
3. Berkowitz, B. Dror, I. and Yaron, B., "Contaminant Geochemistry" Springer..
4. Mohamed, A. M. O., "Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, NY.
5. O P Gupta, Elements of land and soil pollution, Khanna PublishingHouse

CE-701
DESIGN OF STEEL STRUCTURES

Course Outcomes (COs):

After completion of the course student will be able to:

- Consider various primary loads, load combinations for obtaining a worst design load.
- Plan the structural framing of industrial buildings and bridges from the given data/design constraints.
- Apply the concepts of structural design to obtain suitable member sizes/sections.
- Prepare and deliver rough sketches to the draftsman

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UNIT -1

Introduction to steel and steel structures: Advantages and Disadvantages of Steel as a Structural Material, Properties of Steel, Stress strain curve for Mild Steel and High Strength Steel Rolled steel section. Introduction to design: Design loads and load combinations, design philosophies. Introduction to Limit State Design: Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design. **08**

UNIT - 2

Design of Riveted, Bolted and Pinned Connections: Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Design of eccentric bolted connections. Simple Welded Connections: Types of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections. **08**

UNIT -3

Design of Tension Members: Introduction, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio (λ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate. **08**

UNIT-4

Design of Compression Members: Introduction, Effective Length, Slenderness Ratio , Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases. **08**

UNIT -5

Design of Beams: Introduction, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder , Introduction to Gantry Girder. **08**

NOTE: All designs are to be carried out as per IS: 800-2007

Text Books:

1 S. K. Duggal," Limit State Design of Steel Structures", Tata Mcgraw Hill.
2 S. S. Bhavikatti, "Design of steel structure by Limit state method as per IS';800-2007, Tata Mcgraw Hill.
3 N. Subramanian," Design of Steel Structures", Oxford University Press.
4 K S Sairam," Design of Steel Structures", Pearson Education.
5 S Ramamurtham," Design of Steel Structures", Dhanpat Rai Publishing Company.

Reference Books:

1 Robert Englekirk, "Steel Structures", John Wiley & Sons inc.
2 Lambert tall, "Structural Steel Design", Ronald Press Comp. New York.
3 Willam T Segui, "Design of Steel Structures", CENGAGE Learning.
4 D. MacLaughlin, "Structural Steel Design", CENGAGE Learning.

CE-702
ENGINEERING HYDROLOGY

Course Outcomes (COs):

After completion of the course student will be able to:

- Students understand the essential components and function of the hydrologic cycle including precipitation, evaporation/evapotranspiration, overland flow and surface storage, groundwater flow and storage, and channel flow, storm water runoff and water quality.
- Students can compute hydrologic mass balance in a closed basin.
- Students can develop unit hydrographs based on streamflow data, and conduct basic unit hydrograph analysis.
- Students can conduct frequency analysis on hydrologic data to determine return period or recurrence interval.
- Students can perform hydrologic and hydraulic routing using governing equations for hydraulic river routing.
- Students understand basic concepts of hydrologic simulation modeling to evaluate potentialimpacts of management decisions.
- Students can compute critical flow and critical depth in floodplain hydraulics.
- Students can compute groundwater drawdown based on water well withdrawal.
- Students can delineate watersheds and stream polylines from digital elevation data.

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UNIT – 1

Introduction: hydrologic cycle, water budget equation, world water balance, application in engineering. Precipitation: Forms of precipitation, weather systems for precipitation, measurement, raingauge network preparation of data, presentation of rainfall data, mean precipitation over an area, depth-area-duration relationships & maximum intensity- duration-frequency relationships, probable maximum precipitation (PMP). **08**

UNIT – 2

Abstraction from Precipitation: Evaporation and consumptive use – process and affecting factors, estimation and measurement techniques, Reservoir Evaporation and methods for its reduction, transpiration, Evapotranspiration - measurement and estimation; Actual Evapotranspiration (AET), Potential Evapotranspiration (PET), Initial Losses- Interception & Depression storage; Infiltration- process, capacities, Infiltration indices, measurement & estimation **08**

UNIT – 3

Runoff: Components, methods of estimation of runoff volume and peak runoff, runoff characteristics and types of streams, Rainfall-runoff relationship, empirical equations, Soil Conservation System (SCS-CN) method, flow duration curve, Flow-Mass curve, rating curve, runoff characteristics of stream, droughts: definition and its classification. **08**

UNIT – 4

Hydrographs: Classification of hydrographs, components of a flood hydrograph, Factors affecting flood hydrographs, base flow separation, effective rainfall, hyetograph, Direct Runoff Hydrograph,

Unit Hydrograph: Definition, application and limitations of unit hydrographs, derivation of unit hydrograph, method of superposition and S-curve, distribution graph, derivation of synthetic unit hydrograph, and introduction to instantaneous unit hydrographs, SCS dimensionless unit Hydrograph. **08**

UNIT – 5

Flood: Rational method, empirical formulae, unit hydrograph method, flood frequency studies, Gumbel's Method, Long-Pearson type-III distribution, design flood, risk/reliability and safety factor;

Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, hydraulic method of flood routing, Clark's method for IUH, Nash's conceptual model, flood forecasting & control **08**

Text Books:

1. K. Subramanya, "Engineering Hydrology", Mc Graw Hill Education.
2. Linsley R. K., Kohler M. A. and Paulhus J. L. H.,"Hydrology for Engineers", Mc Graw Hill Education.
3. Raghunath H. M., "Hydrology: Principles, Analysis, Design", New Age International Publishers.
4. Chow V. T., "Handbook of Applied Hydrology", Mc Graw Hill Education.

Reference Books:

1. Ojha,"Engineering Hydrology", Oxford University Press.
2. Viessman & Lewis, "Introduction to Hydrology", Pearson Publication.
3. Fetter, "Applied Hydrology", Pearson Publication.
4. Michael A. M., "Irrigation: Theory & Practice". S Chand Publication

CE-703
WATER RESOURCE AND ENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- Graduates of the program will be able to demonstrate in depth knowledge of the discipline and build capability to apply that knowledge to water resources issues.
- Program graduates will gain knowledge and skill in integrating water resources concepts across multiple disciplines.
- Graduates will have the ability to employ technical knowledge and leadership skills to water resources research and consultancy problems.
- Graduates of the WRE program will demonstrate the ability to carry out original and useful research in key areas of water resources engineering.
- Program graduates will be able to identify and analyse the impact of water resources development project and find a suitable solution from number of alternatives.
- Graduates of the program will develop skills to communicate both formal and informal values of water resources and water resources research with the public, learners, practitioners and all other community members.
- Program graduates will develop confidence in water resource system analysis and management with high ethical value towards social, environmental and economical issues.
- Graduates will develop enthusiasm and confidence to pursue lifelong learning for professional advancement.
- Program graduates will develop the spirit of working in team for common objectives.
- Graduates of the program will develop interest to pursue higher studies and teaching profession.

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UNIT – 1

Irrigation Techniques: Definition of Irrigation, Necessity of Irrigation in India, Advantages of Irrigation, Disadvantages and ill-Effects of Irrigation, Types of Irrigation, Techniques of water Distribution in the farms, Quality of Irrigation water.

Water requirements of crops: Crop period and Base period, duty and delta of a crop, relation between duty and delta, factors on which duty depends, importance of duty, crop seasons and Indian agriculture, Kharif-rabi ratio, Paleo irrigation, kor-watering, crash crops, crops rotation, optimum utilization of irrigation water, irrigation efficiencies, Consumptive use or evapo-transpiration, transpiration, transpiration ratio, transpiration measurement, potential and actual evapo-transpiration, effective rainfall, CIR, NIR, factors effecting consumptive use, estimation of consumptive use, soil moisture irrigation relationship, field capacity, readily available moisture, soil moisture-irrigation relationship, field capacity, readily available moisture, soil moisture deficiency, equivalent moisture, estimating depth and frequency of irrigation on the basis of soil moisture regime concept. **08**

UNIT – 2

Canal Irrigationsystem: alluvial and non-alluvial canals, alignment of canals, distribution system for canal irrigation, curves in channels, gross command area, culturable or cultivable

command area, intensity of irrigation, net and gross sown areas, net and grass irrigated areas, area to be irrigated, time factor, capacity factor, full supply coefficient, normal duty, computing the design capacity of an irrigation canal, losses of water in canals, canal regulation.

Sediment transport and design of irrigation channels: Importance of sediment transport, sediment load, bed formation, mechanics of sediment transport, Shield's entrainment method for design of non-scouring stable channels having protected side slopes in alluviums, design of stable channels in India, suspended load and its measurement, bed load and its measurement, cross section of an irrigation canal. **08**

UNIT – 3

Irrigation channels: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area

Statistics and channel dimensions, use of Garret's Diagrams in channel design, cross sections of an Irrigation channel, Computer programs for design of channels

Lining of Irrigation Canals: Advantages and types, factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining

Water Logging: Definition, effects, causes and anti-water logging measures, Drainage of water logged land, Types of drains open and closed, spacing of closed drains. **08**

UNIT – 4

Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion

River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge. **08**

UNIT – 5

Ground Water Hydrology: Zones of underground water, forms of subsurface water, Aquifers and their types, important terms, Determination of discharge through unconfined and confined aquifers with steady flow conditions.

Well hydraulics- Interference among wells, determination of aquifer constants, Well loss and specific capacity, efficiency of a well, recharge, estimation of recharge, Interference among wells, types of water wells, bored and open wells, specific yield of a well, Relative merits of well and canal irrigation, type of tube wells, well surrounding and well development, Suitable site selection for a tube well, Types of open wells, Methods of lifting water, Infiltration galleries**. 08**

Text Books:

1. S.K. Garg, "Irrigation Engineering. and Hydraulic Structures", Khanna Publishers.
2. S.K.Garg, "Hydrology and water resources Engineering", Khanna Publishers.
3. B.C. Punmia, "Irrigation and water Power engineering", Laxmi Publications.
4. K. Subramanya, "Engineering Hydrology", TMH.
5. K.R. Arora, "Irrigation Water Power and Water Resource Engineering".
6. Ralph A. Wurbs& Wesley P. James, "Water resource engineering", Pearson Publication.

Reference Books:

1. Larry W. Mays, "Water Resources Engineering", John Wiley India.
2. Wurbs and James, "Water resources Engineering", John Wiley India.
3. R. K. Linsley, "Water Resources Engineering", McGraw Hill.
4. G. L. Asawa, "Irrigation and Water Resources Engineering", New age International Publishers.

5. A.M. Michel, “Irrigation Theory and Practices”. S.Chand Publication
6. Houghalen, “Fundamental of Hydraulic Engineering System”, Pearson Publication.

CE-7041
RURAL DEVELOPMENT ENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- To impart practical based knowledge on agriculture and allied sectors
- To impart in-depth practical knowledge in rural development
- To provide hand hold exposure on agriculture -allied sectors like Diary, Apiculture, Fishery, Poultry science etc.
- To disseminate different rural technologies through various extension activities
- To identify and overcome the problems encountered in day-to-day life in agriculture and social sector
- To provide knowledge on commercial agricultural production practices

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UNIT-1

Rural Development Planning and Concept of Appropriate Technology: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development programmes/projects. **08**

UNIT- 2

Rural Housing: Low cost construction materials for housing; Architectural considerations for individual and group housing; Composite material: Ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction of: non-erodable mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rat-trap bond for walls, Panels for roof, Ferro-cement flooring/roofing units, Earthquake resistant measures for low cost houses. **08**

UNIT-3

Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment low cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, low cost waste disposal systems; septic tank ; Biogas technology; low cost community & individual Garbage disposal systems, Ferro-cement water storage tanks. **08**

UNIT-4

Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Fly ash and Cement Treated Course, Crusher-run-Macadam, Use of local materials. Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing for Rural Road. **08**

UNIT- 5

Low Cost Irrigation: Consideration of low cost irrigation techniques, drip& sprinkler irrigation systems, Watershed and catchments area development - problems and features of watershed management, watershed structures. **08**

Text Books:

1 M.N.Gangrade, N.K. Barwa, "Rural Development", NiraliPrakashan.
2 Rangwala, "Water supply and sanitary engineering",Charotar publication
3 P.Nair, "Rural Infrastructure", SBS Publication.
4 A.G.Madhov Rao, D.S.Ramachandra Murthy, "Appropriate Technologies for low cost Housing", Oxford and IBH Publishing Co. Pvt .Ltd.

Reference Books:

1 "Document on Rural Road Development in India" Volume1& 2, Central Road Research Institute, New Delhi.
2 CBRI, Roorkee, "Advances in Building Materials and Construction".
3 C. Satyanarayana Murthy, "Design of Minor Irrigation and Canal Structures", Wiley Eastern Ltd.

CE-7042
ENVIRONMENTAL IMPACT ASSESSMENT

COURSE OUTCOME

After completion of the course student will be able to

1. Appreciate the purpose and role of EIA in the decision-making process.
2. Understand strengths & limitations of environmental management.
3. Know procedures Understand screening & scoping processes Interpret options for evaluating environmental and social impacts.
4. Know formats of EIA Report (Environmental Impact Statement or Environmental Statement).
5. Understand the purpose of developing follow-up procedures, and options for designing these procedures.

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UNIT - 1

History of EIA, Evolution Environmental Laws in World & India, Development of EIA in India, Environmental Clearance Procedure in India, Basic Concept of EIA: Introduction, EIA Procedure, Objective of EIA, Significances Systematic Approach for Using EIA: Introduction, Identification of Study Area, Classification of Environmental Parameters, Terms of References, Preparation of EIA Report, Scoping in EIA, Baseline Studies in EIA, Environmental Monitoring & Management Planning, Draft and Final EIA, Impact Analysis, Final EIA Report. **08**

UNIT - 2

Criteria for The Selection of EIA Methodology, EIA Methods: Ad-hoc Methods, Checklists Methods, Matrices Methods, Networks Methods, and Overlays Methods, Environmental Index Using Factor Analysis, Cost/Benefit Analysis, Predictive or Simulation Methods, Predictive Models for Impact Assessment. **08**

UNIT – 3

Environmental Impact Statement (EIS): Introduction, Basic Concepts behind EIS, Various Stages in EIS Production, Typical EIS Outline, Rapid EIA: Introduction, Procedure, Advantages and Limitation. **08**

UNIT – 4

Prediction and assessment of impacts on the air environment: Introduction, a generalized approach for assessment of air pollution impact, Prediction and Assessment of Impacts on Surface Water Environment: Introduction, Project Which Create Impact Concerns for the

Surface-Water Environment, Systematic Methods for Evaluation of Impacts of Various Developmental Activities on Surface Water Environment. **08**

UNIT – 5

Risk Assessment: Introduction, Environmental Risk Assessment, Risk Assessment & Treatment of Uncertainty, Key Steps in Performing an Environmental Risk Assessment (ERA), Advantages and Limitation of Risk Assessment. **08**

Text Books:

1 Larry W. Canter, "Environmental Impact Assessment, second edition", McGraw-Hill International editions.
2 Lauren David P., "Environmental Impact AssessmentWillyInterscience", New Jersey.
3 Lalit N. Patnaik, "Environmental Impacts of Industrial & Mining activities",Ashish Public house.

Reference Books:

1. Trivedi R. K., Sinha M. P., "Impact of Mining on Environment", Ashish Publication House.
2. Cooper, John R., Randle, Keith,"Radioactive releases in the environment: Impact and Assessment", John Wiley Sons.

CE-7043
AIR & NOISE POLLUTION CONTROL

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand all properties of air, causes of its pollution, methods of representation of air pollution.
- Define the effect of air and noise pollution on human health, plants and animals.
- Understand principles, types, operations of each individual pollution control device.

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UNIT - 1
Composition of dry ambient air, properties of air, Definition of air pollution, Classification of air pollutants, Units for classification of air pollutants, History of air pollution- global and national, Scope of problem-general, urban, rural and specific. **08**

UNIT - 2
Sources of air pollution: Natural and man-made, Major pollutants from different sources in Indian cities, Emission factors, Effect of air pollution on human health, plants, animals, properties and visibility. **08**

UNIT – 3
Meteorological aspects of air pollution, lapse rate, stability conditions, wind velocity profile, maximum mixing depth, topographic effects and plume patterns. Plume dispersion, Gaussian model for predicting concentration downwind from a single source, line source, area source. **08**

UNIT – 4
Control devices: Principles, types, operations of each individual device i.e. Settling Chambers, Baghouse filter, Electrostatic Precipitator, Government of India's air pollution Acts and laws, Indian standards - emission and air quality standards, IS for various ambient air standards for various industries. **08**

UNIT – 5
Noise: Basic concept, measurement, various control methods. Noise standards **08**

Text Books:

1 Henry C .Perkins, “Air pollution” , McGraw Hill Publications.
2 P.L. Magill, “Air Pollution Handbook”, McGraw Hill Publ. New York.
3 A Parker, “Industrial Air Pollution Handbook”, Tata McGraw Hill Publications.
4 Wang, Lawrence K., Pereira, Norman C, Yung-Tse, “Advanced Air and Noise Pollution”, Springer.
5 Wark and Warner,“Air Pollution its origin and Control”. Pearson
6 A.T. Rossano, “Air Pollution Control Guidebook for Management”. Tata McGraw Hill Publications.

Reference Books:

1 Government of India's publication of laws related to air pollution. Central Pollution control
2 Board's (CPCB) publication of standards IS relevant to air pollution monitoring definitions,standards etc.
3 B.G. Liptak(ed.) “Environmental Engineers” Handbook vol. II ‘Air pollution’ Chilton book co. USA.

CE-7044
EARTHQUAKE RESISTANT DESIGN

Course Outcomes (COs):

After completion of the course student will be able to:

- To provide a coherent development to the students for the courses in sector of earthquake engineering.
- To present the foundations of many basic engineering concepts related earthquake Engineering.
- To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

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UNIT-1
Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes. **08**

UNIT-2
Response of Structure to Earthquake motion, Modelling of structures, Dynamics of single degree of freedom system. **08**

UNIT-3
Dynamics of multi degree of freedom system, Idealization of structure, seismic response **08**

UNIT-4
Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Introduction to earthquake resistant brick and masonry buildings. **08**

UNIT-5
Reinforced Concrete framed buildings, Code provisions, Introduction to machine foundation & its design, Degrees of freedom of a block foundation. **08**

Text Books:

1 S.K. Duggal, "Earthquake Resistant Design of structures", Oxford Higher Education.
2 Pankaj Agarwal, Manish Shrikhandi, "Earthquake Resistant Design of structures", Prentice-Hall of India Private Limited.
3 James M. Kelly, "Earthquake Resistant design with Rubber", Springer-Verlag.
4 J.M. Biggs, "Introduction to Structural Dynamics". McGraw Hill Publication
5 Jai Krishna and A.R. Chandrasekaran, "Elements of Earthquake Engineering". South Asian Publisher
6 IS: 1983 - 1984 Criterion for Earthquake Resistant Design.

Reference Books:

1 Mario Paz., "Structural Dynamics - Theory & computation".Springer
2 Anil K. Chopra., "Dynamics of Structures Theory and Applications to Earthquake Engineering".Pearson
3 Agarwal and Srikhande, "Earthquake Resistant Design of structures". PHI publication

CE-7045
TUNNEL ENGINEERING

Course Outcomes (COs):

After completion of the course student will be able to:

- Identify main characteristics of different ground behaviour.
- Identify and plan tunnel excavation method from technical, production, and sustainability point of view.
- Design tunnel reinforcement based on empirical, analytical and numerical assessment depending on complexity and acquire a holistic perspective on the design process.
- Analyse water ingress to tunnels and identify possible water related problems for excavation, as well as plan and implement suitable tunnel draining and/or grouting methods.
- Analyse cost and time for ordinary tunnels based on risks and construction management principles.

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UNIT -1
Historical development, tunnel terminology, tunnel cross section and alignment **08**

UNIT -2
Site investigations, Geotechnical Considerations of tunnelling, stages in tunnel construction **08**

UNIT -3
Construction & Excavation methods, Tunnelling in Rock tunnels. **08**

UNIT -4
Soft ground tunnels, hauling of muck, Micro tunnelling techniques, Tunnel support design. **08**

UNIT- 5
Ventilation of tunnels, Lighting of tunnels, Drainage system for tunnels, Environmental and aesthetic considerations, safety aspects, general safety measures, economy of tunnels **08**

Text Books:

1 B.C.Punamia, "handbook of tunnel Engineering II Basics and additional Services For Design and Construction", Wiley Ernst & Sohn.
2 Gary B. Hemphill, "Practical Tunnel Construction", Wiley John Ernst & Sohn INC.
3 Z T Bieniawski,"Rock Mechanics Design in Mining &Tunneling".
4 J O Bickel & T R Kuesel, "Tunnel Engineering Handbook". CBS Publisher

Reference Books:

1 R. Srinivasan, "Harbour & Dock & Tunnel", Charotar publication.
2 S.C. Saxena, "Tunnel Engineering".Dhanpat Rai Publication

AS–701
ENGINEERING ECONOMICS

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand key economic analytical principles for decision-making among alternative courses of action in engineering
- Learn about the nature of economics and demand analysis.
- Understand about concept of supply, cost analysis and demand forecasting.
- Learn about market structure.
- Learn about nature and characteristics of Indian economy
- Using analytical techniques including benefit-cost ratio and breakeven analysis, solve economic problems involving comparison and selection of alternatives.

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Unit-1

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of economics, relation between science, engineering, technology and economics; Meaning of demand, determinants of demand, shifts in demand, law of demand, price elasticity of demand &types, income elasticity, cross price elasticity, determinants of elasticity and uses and importance of elasticity. **08**

Unit-2

Concept of Supply: Law of supply, factors affecting supply, and elasticity of supply. Demand forecasting: introduction, meaning and forecasting, methods or techniques of demand forecasting, criteria for good demand forecasting and demand forecasting for a new product. **08**

Unit-3

Cost Analysis: Introduction, types of costs, cost-output relationship: cost function, cost-output relationships in the short run, and cost-output relationships in the long run; Short run and long run, break- even analysis; Production functions: laws of variable proportions, law of returns and economies of scale: internal and external. **08**

Unit-4

Market Structure: Market structure perfect competition, imperfect competition – monopolistic, oligopoly and duopoly sorbent features of price determination and various market conditions. **08**

Unit-5

Nature and characteristics of Indian economy: Concepts of LPG, elementary concepts of national income, inflation and business cycles ,concept of N.I and measurement, meaning of inflation, types and causes and phases of business cycle investment decisions for boosting economy(national income and per capital income). **08**

Text Books:

1. Premvir Kapoor, "Sociology and Economics for Engineers", Khanna Publishing.
2. D. Salvatore, “Principles of Microeconomics”, Oxford University Press.
3. A. Koutsoyiannis, “Modern Microeconomic”, Macmillan Education Ltd.

Reference Books:

1. D. N. Dwivedi, “Principles of Microeconomics”, Pearson Education.
2. F. A. Cowell, “Microeconomic Principles and Analysis”, Oxford University Press.
3. J. L. Riggs, “Engineering Economics”, McGraw Hills.

AS–702
INDUSTRIAL MANAGEMENT

Course Outcomes (COs):

After completion of the course student will be able to:

- To understand the basic concept of Industrial management and its types and ownership.
- To know the functions of management with the help of scientific theory and human resource management.
- Able to know the objective and measurement in work study and use the different model of inventory control.
- To design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
- Able to analyse the project management scheme in project network analysis

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Unit-1

Introduction: Concept and scope of industrial management. **Productivity:** definition, measurement, productivity index, types of production system and industrial ownership. **08**

Unit-2

Functions of Management: Taylor's scientific management theory, Fayol's principles of management, social responsibilities of management, introduction to human resources management: nature of HRM, functions and importance of HRM. **08**

Unit-3

Work Study: Introduction, definition, objectives, steps in work study; **Method study:** Definition, objectives, steps of method study; **Work measurement:** Purpose, types of study: Stop watch methods steps: Allowances, standard time calculations, work sampling, production planning and control inventory control: inventory, cost, models of inventory control: EOQ, ABC, VED. **08**

Unit-4

Quality Control: Statistical quality control, control charts for variables and attributes, acceptance sampling: single sampling- double sampling plans and introduction to TQM. **08**

Unit-5

Project Management: Project network analysis, CPM, PERT and project crashing and resource leveling. **08**

Text Books:

1. Gideon Halevi, "Industrial Management- Control and Profit: A Technical Approach" Springer.
2. A.P. Verma and N. Mohan "A Textbook of Industrial Management" S.K. Kataria& Sons.
3. S. K. Sharma, Savita Sharma "Industrial Engineering and Organization Management", Kataria and Sons.

Reference Books:

1. S.C. Sharma & T.R. Banga, ”Engineering Management” (Industrial Engineering & Management), Khanna Book Publishing Co.
2. P. Khanna, ”Industrial Engineering and Management”, Dhanpatrai publications Ltd.
3. Paneer Selvam, “Production & Operation Management”, PHI.

CE-801
CONSTRUCTION TECHNOLOGY & MANAGEMENT

Course Outcomes (COs):

After completion of the course student will be able to:

- Students shall be able to Plan Bar Chart, CPM chart, PERT chart material requirement schedule.
- Manpower schedule, Machinery Schedule.
- Student shall be able to carry out manpower resources leveling and smoothing.
- Overview of Construction Management and Present Status of Construction Industry.
- Student shall be prepare Project management reporting documents.
- Student shall be able to frame a labour law for their project site.

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UNIT-1
Project cycle, organizing, planning, scheduling, monitoring, updating and management, work break down structure, Bar charts, milestone charts, network techniques, fundamentals of network, network rules and errors, Fulkerson's rule, types of networks viz A-O-A & A-O-N**. 08**

UNIT-2
Introduction to network techniques, types, comparison of PERT and CPM, central limit theory, critical path, slack& its type, network analysis by PERT, activity times, float& its type, network analysis by CPM, Updating and resource allocation. **08**

UNIT-3
Cost model analysis, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope, Time Value of money, Cash flow diagram, economic comparison, Present Worth method, Annual Equivalent Method, Rate of Return Method, break even cost analysis. **08**

UNIT- 4
Depreciation, Book value, Salvage Value, Scrap Value, methods of depreciation calculation, Construction Equipments: various excavation equipments, compaction equipments, hoisting equipments, Owning Cost, Operational cost. **08**

UNIT- 5
Agreement, contract, essential requirements of a valid contract, various types of contracts and their relative advantages and disadvantages, tender, process of tendering, security deposit, mobilisation advance, BOQ, PPP, BOT, EPC, EIA, DLP. **08**

Text Books:

1 Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2 Srinath, L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3 Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004

Reference Books:

1 Ojha, “Construction Management”.
2 Srivastava, U.K., “Construction Planning and Management”, Galgotia Publications Pvt. Ltd., New Delhi.
3 Sarkar, “Construction Technology”, Oxford.
4 S V Deodhar and SC Sharma, "Construction Engineering and Management, Khanna Publishing house.

CE-8021
URBAN TRANSPORTATION SYSTEM

Course Outcomes (COs):

After completion of the course student will be able to:

- To cover concepts of Transportation planning, various modes, transit systems and their suitability.
- To give idea of modeling in planning, to develop the methodology of traveldemand modeling for Urban Transportation Systems.
- To provide knowledge of Land use planning and transportation interaction.

L	T	P
3	1	0

UNIT-1
Introduction to transportation planning, the planning concept, goals, objective and importance of transportation planning, nature of traffic problems in cities, Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments **08**

UNIT- 2
Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Types of transport systems, evolution of transport modes, transport problems and mobility issues. Public Transport: Intermediate Public Transport (IPT) Rapid and mass transport system like MRTS & bus rapid transit, Transport Planning Process, Problem Definition, Solution Generation. **08**

UNIT- 3
Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment. **08**

UNIT- 4
Studying travel behaviour, Analysing urban travel markets, Traffic and transportation surveys and studies, traffic and travel characteristics, urban transport planning process – stages, study area, zoning, database. **08**

UNIT-5
Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, Benefit Cost method. Transport system management: Long term and short term planning. **08**

Text Books:

1 Hutchinson, B.G., "Principal of Urban Transport System planning", McGraw Hill Book Company, New York.
2 Vukan R. Vuchic, "Urban Transit, Operations, Planning and Economics", John Wiley & Sons, Ltd.
3 Khanna S. K., Justo C.E.G, &Veeraragavan, A. "Highway Engineering", Nem Chand and Bros., Roorkee- 247 667.
4 Kadiyali L. R., & Lal, N.B. "Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)", Khanna Publications, Delhi – 110 006

Reference Books:

1 William W. Hay., "An Introduction to Transportation Engineering".Krieger Publication
2 E.K.Mortak., "Introduction to Transportation Engineering planning".
3 J.W.Dickey.," Metropolitan Transportation planning".CRC Press
4 L.R. Kadiyali, "Traffic Engineering".Khanna Publication
5 Hutchinson, B.G.(1974), "Principles of Urban Transport Systems Planning", Mc Graw Hill Book Company, New York.
6 John W.Dickey.(1975), "Metropolitan Transportation Planning", Mc Graw Hill Book Company, New York.

CE-8022
DESIGN OF HYDRAULIC STRUCTURES

Course Outcomes (COs):

After completion of the course student will be able to:

- Integrate the hydraulics and water resources background by involving the students in water structures design applications.
- Introduce the students to professional practice and design codes.
- Encourage class discussions for formulating and solving multi-variable hydraulic design problems in an open-ended solution space.
- To develop understanding of the basic principles and concepts of analysis and design of hydraulic structures.

L	T	P
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UNIT – 1

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification, Introduction to design principle of falls, Design of Sarda type and straight glacis tall.

Principle & Design of distributary head regulator and cross regulator, canal escape, Bed bars. **08**

UNIT – 2

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types, Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. **08**

UNIT – 3

Flood routing: Types, methods of reservoir routing, channel routing by Muskingham Method. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. Dams: classification and selection criteria.Earth Dams: Classification, causes of failure Phreatic line, and its determination Introduction to stability analysis. **08**

UNIT – 4

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks. **08**

UNIT – 5

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential specially in reference to India, classification of power plants, important terms, types of turbines and their suitability, Power House layout and important structures of a powerhouse. **08**

Text Books:

1. S. K. Garg, “Irrigation Engineering. And Hydraulic Structures”, Khanna Publishers.
2. Larry W Mays, “Water Resources Engineering”, John Wiley India.
3. Wurbs and James, “Water resources Engineering”, John Wiley India.

Reference Books:

1. R.K. Linsley, “Water Resources Engineering“, McGraw Hill.
2. G L Asawa, “Irrigation and Water Resources Engineering”, New age International Publishers.
3. B. C. Punimia&Pande B.B. Lal, “Irrigation and Water Power Engineering”.Laxmi Publication

CE-8023

GROUND IMPROVEMENT TECHNIQUES

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand the concepts behind various ground improvement techniques.
- Identify appropriate techniques for various ground conditions.
- Predict the behaviour of ground after improvement

L	T	P
3	1	0

UNIT -1

Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-fly ash mixes. **08**

UNIT -2

In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibro-flotation techniques, Ground Suitability for Vibro-flotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement. **08**

UNIT -3

In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method. **08**

UNIT – 4

Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test. **08**

UNIT -5

Underpinning of foundations: importance and situations for underpinning, methodology, typical examples. Geotextiles: types, functions, specifications, precautionin transportation & storage. **08**

Text Books:

1 Purshotham Raj , "Ground Improvement", Laxmi Publication Pvt. Ltd.
2 S. K. Garg, "Soil Mechanics & Foundation Engineering". Khanna Publication
3 A. K. Samadhiya, " Ground Improvement Techniques".
4 Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd.

Reference Books:

1 J. N. Mandal, " Geosynthetics World".New Age International Private Limited
2 Bergado et. al., "Soft Ground Improvement".America Society of Civil Engineers
3 Koerner, R. M., "Designing with Geosynthetics". Xlibris Publication

CE-8024
CONCRETE TECHNOLOGY

Course Outcomes (COs):

After completion of the course student will be able to:

- To define and understand concepts related Concrete technology which involves types and property of concrete and different adhesive materials and its vital use for safe, economic development for the buildings.
- To present the foundations of many basic Engineering tools and concepts related to Concrete technology and Civil Engineering.
- To give an experience in the implementation of Engineering concepts which are applied in field of Civil Engineering.

L	T	P
3	1	0

UNIT -1

Concrete Materials-I -Cement: introduction, manufacturing, composition of cement, clinker composition, hydration of cement, testing of cement properties, types of cement (OPC & non OPC both), quality of mixing water for use in concrete. **08**

UNIT -2

Concrete Materials-II -Aggregates: introduction, classification, characteristics, deleterious substances in aggregates, Alkali-aggregate reaction, grading of aggregate, sieve analysis, fineness modulus, bulking of sand, testing of aggregates. **08**

UNIT -3

Concrete Materials-III -Chemical Admixtures: introduction, functions of chemical admixtures, study of accelerators, retarders, air-entrainers, plasticizers& their properties.
Mineral supplementary Additives: introduction,study of supplementary cementing materials& their properties like fly ash, GGBS (ground granulated blast furnace slag), silica fume. **08**

UNIT -4

Properties of fresh & hardened concrete: workability, factors affecting workability, measurement of workability, segregation, bleeding,rheology by modified slump, measurement of strength of concrete, Mix design(IS 10262), production&curing of concrete, acceptance of concrete**. 08**

UNIT -5

Non Destructive Testing of Concrete: surface hardness method, ultrasonic pulse velocity method. Special concretes & concreting techniques: hot weather concreting, cold weather concreting, ready mix concrete, light weight concrete, ferrocement, fibre reinforced concrete, shotcrete**. 08**

Text Books:

1 Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, 2004.
2 Shetty, M.S,"Concrete Technology, Theory and Practice", S. Chand and Company Ltd, 2008.
3 Santhakumar, A.R , "Concrete Technology", Oxford University Press, New Delhi, 2007.

Reference Books:

1 IS 10262:2009 “Guidelines for concrete mix design proportioning”, Bureau of Indian Standards, New Delhi, 2000.
2 IS 456:2000 “Plain& Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.
3 Neville, A.M. and Brooks, J.J.,"CONCRETE TECHNOLOGY", ELBS.
4 Gupta B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
5 Newman, K."CONCRETE SYSTEMS in COMPOSITE MATERIALS" Elsevier Publishing Company. 1966.
6 P. K.Mehta& Paulo J. M. Monteiro, "Concrete: microstructure, properties and materials", The Mc Graw Hill Companies.
7 Jayant D. Bapat (2013), “Mineral admixtures in cement & concrete”, Taylor and Francis group.
8 M.C. Nataraja and Lelin Das, “Concrete mix proportioning as per IS 10262:2009”.

AS–801
ENGINEERING ECONOMICS

Course Outcomes (COs):

After completion of the course student will be able to:

- Understand key economic analytical principles for decision-making among alternative courses of action in engineering
- Learn about the nature of economics and demand analysis.
- Understand about concept of supply, cost analysis and demand forecasting.
- Learn about market structure.
- Learn about nature and characteristics of Indian economy
- Using analytical techniques including benefit-cost ratio and breakeven analysis, solve economic problems involving comparison and selection of alternatives.

L	T	P
3	0	0

Unit-1

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of economics, relation between science, engineering, technology and economics; Meaning of demand, determinants of demand, shifts in demand, law of demand, price elasticity of demand &types, income elasticity, cross price elasticity, determinants of elasticity and uses and importance of elasticity. **08**

Unit-2

Concept of Supply: Law of supply, factors affecting supply, and elasticity of supply. Demand forecasting: introduction, meaning and forecasting, methods or techniques of demand forecasting, criteria for good demand forecasting and demand forecasting for a new product. **08**

Unit-3

Cost Analysis: Introduction, types of costs, cost-output relationship: cost function, cost-output relationships in the short run, and cost-output relationships in the long run; Short run and long run, break- even analysis; Production functions: laws of variable proportions, law of returns and economies of scale: internal and external. **08**

Unit-4

Market Structure: Market structure perfect competition, imperfect competition – monopolistic, oligopoly and duopoly sorbent features of price determination and various market conditions. **08**

Unit-5

Nature and characteristics of Indian economy: Concepts of LPG, elementary concepts of national income, inflation and business cycles ,concept of N.I and measurement, meaning of inflation, types and causes and phases of business cycle investment decisions for boosting economy(national income and per capital income). **08**

Text Books:

1. Premvir Kapoor, "Sociology and Economics for Engineers", Khanna Publishing.
2. D. Salvatore, “Principles of Microeconomics”, Oxford University Press.
3. A. Koutsoyiannis, “Modern Microeconomic”, Macmillan Education Ltd.

Reference Books:

1. D. N. Dwivedi, “Principles of Microeconomics”, Pearson Education.
2. F. A. Cowell, “Microeconomic Principles and Analysis”, Oxford University Press.
3. J. L. Riggs, “Engineering Economics”, McGraw Hills.

AS–802
INDUSTRIAL MANAGEMENT

Course Outcomes (COs):

After completion of the course student will be able to:

- To understand the basic concept of Industrial management and its types and ownership.
- To know the functions of management with the help of scientific theory and human resource management.
- Able to know the objective and measurement in work study and use the different model of inventory control.
- To design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
- Able to analyse the project management scheme in project network analysis

L	T	P
3	0	0

Unit-1
Introduction: Concept and scope of industrial management. **Productivity:** definition, measurement, productivity index, types of production system and industrial ownership. **08**

Unit-2
Functions of Management: Taylor's scientific management theory, Fayol's principles of management, social responsibilities of management, introduction to human resources management: nature of HRM, functions and importance of HRM. **08**

Unit-3
Work Study: Introduction, definition, objectives, steps in work study; **Method study:** Definition, objectives, steps of method study; **Work measurement:** Purpose, types of study: Stop watch methods steps: Allowances, standard time calculations, work sampling, production planning and control inventory control: inventory, cost, models of inventory control: EOQ, ABC, VED. **08**

Unit-4
Quality Control: Statistical quality control, control charts for variables and attributes, acceptance sampling: single sampling- double sampling plans and introduction to TQM. **08**

Unit-5
Project Management: Project network analysis, CPM, PERT and project crashing and resource leveling. **08**

Text Books:

1. Gideon Halevi, "Industrial Management- Control and Profit: A Technical Approach" Springer.
2. A.P. Verma and N. Mohan "A Textbook of Industrial Management" S.K. Kataria& Sons.

3. S. K. Sharma, Savita Sharma “Industrial Engineering and Organization Management”, Kataria and Sons.

Reference Books:

1. S.C. Sharma & T.R. Banga, ”Engineering Management” (Industrial Engineering & Management), Khanna Book Publishing Co.
2. P. Khanna, ”Industrial Engineering and Management”, Dhanpatrai publications Ltd.
3. Paneer Selvam, “Production & Operation Management”, PHI.

APPENDIX

List of Open Electives

Note: Students may opt any one subject from the following list of open electives with restriction in some subjects as mentioned-

S.No.	Subject Code	Subject Name	Subject Offered by Department of	Remark
1.	OE-8011	Fuzzy logic and Neural Network	Computer Science &Engg.	--
2.	OE -8012	Mobile Application development	Computer Science &Engg.	--
3.	OE -8013	Automation & Robotics	Computer Science &Engg.	--
4.	OE -8014	Mobile Computing	Computer Science &Engg.	--
5.	OE -8015	Internet-of-Things	Computer Science &Engg.	--
6.	OE -8016	Cyber Law and Ethics	Computer Science &Engg.	--
7.	OE -8017	Data Analytics	Electrical Engg.	--
8.	OE -8018	Non-Conventional Energy Resources	Electrical Engg.	--
9.	OE -8019	Applied Operations Research	MechanicalEngg.	Not to be opted by students of MechanicalEngg.
10.	OE -8020	Six Sigma Methods & Application	MechanicalEngg.	--
11.	OE -8021	Mechatronics	MechanicalEngg.	--
12.	OE -8022	Biomedical Electronics	Electronics & Comm.Engg.	Not to be opted by students of Electronics & Comm.Engg.
13.	OE -8023	Embedded System	Electronics & Comm.Engg.	Not to be opted by students of Electronics & Comm.Engg.
14.	OE -8024	Advances in Polymer Science Technology	Applied Science& Humanities	--
15.	OE -8025	Mathematical Modeling and Simulation	Applied Science& Humanities	--
16.	OE -8026	Nanoscience and Quantum Computing	Applied Science& Humanities	--
17.	OE -8027	Entrepreneurship Development	Applied Science& Humanities	--
18.	OE -8028	Critical And Logical Thinking	Applied Science& Humanities	--
19.	OE -8029	Town Planning	CivilEngg.	--

20.	OE -8030	Disaster Management	CivilEngg.	--
21.	OE -8031	Environmental Pollution & Management	CivilEngg.	--

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OE -8011
FUZZY LOGIC AND NEURAL NETWORK

L	T	P
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Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Understand basic knowledge of fuzzy sets and fuzzy logic.
- Apply basic fuzzy inference and approximate reasoning.
- Understand principles of neural networks.
- Apply basic fuzzy system modelling methods.

Unit-1 **08**

Introduction to Neural Networks: Introduction, humans and computers, organization of the brain, biological neuron, biological and artificial neuron models, Hodgkin-Huxley neuron model, integrate-and-fire neuron model, spiking neuron model, characteristics of ANN, Mcculloch-Pitts model, historical developments, and potential applications of ANN.

Unit-2 **08**

Essentials of Artificial Neural Networks: Artificial neuron model, operations of artificial neuron, types of neuron activation function, ANN architectures, classification taxonomy of ANN –connectivity, neural dynamics (activation and synaptic), learning strategy (supervised, unsupervised, reinforcement), learning rules, and types of application.

Unit-3 **08**

Single Layer Feed Forward Neural Networks: Introduction, **Perceptron models:** discrete, continuous and multi-category; **Training algorithms:** discrete and continuous perceptron networks, perceptron convergence theorem, limitations of the perceptron model, and applications.

Unit-4 **08**

Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, and membership functions.

Unit-5 **08**

Fuzzy Logic System Components: Fuzzification, membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, and defuzzification methods.

Text Books:

1. Rajasekharan and Rai., "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication.
2. Bart Kosko, "Neural Networks and Fuzzy Logic System", PHI Publications.
3. S.N.Sivanandam, S.Sumathi, S.N.Deepa, "Introduction to Neural Networks using MATLAB 6.0", TMH.

Reference Books:

1. James A Freeman and Davis Skapura, “Neural Networks”, Pearson Education.
2. Simon Hakins, “Neural Networks”, Pearson Education.
3. C.Eliasmith and CH.Anderson, ”Neural Engineering”, PHI.

OE-8012
Mobile Application Development

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Ability to apply general programming knowledge in the field of developing mobile applications.
- Understanding of the specific requirements, possibilities and challenges when developing for a mobile context.
- Understanding of the interactions between user interface and underlying application infrastructure
- Understand the Android Software development.

Unit-1 **08**

Introduction: What is android, android versions and its feature to set the various android devices on the market, the android market application store, android development environment - system requirements, android SDK, installing java, and ADT bundle - eclipse integrated development environment (IDE), creating android virtual devices (AVDs), android architecture overview and creating an example. **Android Application:** The android software stack, the linux kernel and android runtime - Dalvik virtual machine

Unit-2 **08**

Android Software Development Platform: Understanding java SE and the Dalvik virtual machine, the directory structure of an android project, common default resources folders, the values folder, leveraging android XML, screen sizes. **Launching your application:** The android manifest.xml file, creating your first android application, android framework overview and android application components.

Unit-3 **10**

Understanding Android Views: View groups and layouts, designing for different android devices, views and view groups, android layout managers, the view hierarchy, designing an android user interface using the graphical layout tool. Graphical user interface screen with views, displaying text with text view, retrieving data from users, using buttons, check boxes and audio groups. Getting dates and times from users, using indicators to display data to users, adjusting progress with seek bar and working with menus using views.

Unit-4 **07**

Displaying Pictures: Gallery, image switcher, grid view, and image view, views to display images, creating animation files, content providers, and databases, saving and loading files, SQLite databases and android database design.

Unit-5 **07**

Intents and Intent Filters: Intent overview, implicit intents, creating the implicit intent example project, explicit intents, creating the explicit intent example application, intents with activities and intents with broadcast receivers. A basic overview of android threads and thread handlers.

Text Books:

1. S. Sydhani Begum, “Mobile App Development”, Notion press.
2. Pradeep Kothari, “Android Application Development”, Dream Tech press.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, ”Android Programming”, Big Nerd Ranch.

Reference Books:

1. Jonathan McCallister, “Mobile Apps”, Create Space Independent Publishing platform.
2. Dan Hermes , “Xamarin Mobile Application Development”, Apress.
3. Dawn Griffiths, ”Head First Android Development”, O’Reilly.

OE-8013
AUTOMATION AND ROBOTICS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Explain the fundamentals of robotics and its components
- Illustrate the Kinematics and Dynamics of robotics
- Explain sensors and instrumentation in robotics.

Unit-1 **08**

Introduction to Robotics: Types and components of a robot, classification of robots, closed-loop and open-loop control systems. Kinematics systems: Definition of mechanisms and manipulators, social issues and safety.

Unit-2 **09**

Robot Kinematics and Dynamics: Kinematic Modelling: Translation and rotation representation, co-ordinate transformation, DH parameters, Jacobian, singularity and statics, dynamic modelling, Equations of motion: Euler-Lagrange formulation.

Unit-3 **09**

Sensors and Vision System: Sensor: Contact and proximity, position, velocity, force and tactile etc., Introduction to Cameras: Camera calibration, geometry of image formation, Euclidean/similarity/affine/projective transformations and vision applications in robotics.

Unit-4 **08**

Robot Control: Basics of control: Transfer functions, control laws: P, PD, PID, non-linear and advanced controls, robot actuation systems: actuators: electric, hydraulic and pneumatic. Transmission: Gears, timing belts and bearings and parameters for selection of actuators.

Unit-5 **06**

Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components and programming for robot applications

Text Books:

1. Mittal R.K., NagrathI.J., “Robotics and Control”, Tata McGraw Hill.
2. Mukherjee S., “Robotics and Automation”, Khanna Publishing House, Delhi.
3. Craig, J.J., “Introduction to Robotics: Mechanics and Control”, Pearson, New Delhi,

Reference Books:

1. Saha, S.K., “Introduction to Robotics”, McGraw-Hill Higher Education”, NewDelhi.
2. Ghosal, A., “Robotics”, Oxford, New Delhi.
3. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi.

OE-8014
MOBILE COMPUTING

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Understand the Ad-hoc Network Routing Protocols.

Unit -1: **08**
Introduction: Challenges in mobile computing, coping with uncertainties, resource poorness and bandwidth, etc. cellular architecture, co-channel interference, frequency reuse and capacity increase by cell splitting. **Evolution of mobile system**: CDMA, FDMA, TDMA, and GSM.

Unit -2: **08**
Mobility Management: Cellular architecture, co-channel interference. **Mobility:** handoff, types of handoffs, location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes, Mobile IP and cellular IP.

Unit -3: **09**
Publishing & Accessing Data in Air: Pull and push based data delivery models, data dissemination by broadcast, broadcast disks, directory service in air and energy efficient indexing scheme for push based data delivery. **File System Support for Mobility**: Distributed file sharing for mobility support, CODA and other storage manager for mobility support.

Unit -4: **08**
Ad-hoc Network Routing Protocols: Ad-hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad-hoc on-demand routing, location aided routing and zonal routing algorithm.

Unit -5: **07**
Mobile Transaction and Commerce: Models for mobile transaction, Kangaroo and Joey transactions and team transaction, recovery model for mobile transactions, electronic payment and protocols for mobile commerce.

Text Books:

1. J. schiller , “Mobile Communication”, Addison Wesley.
2. Charlsperkins, “Ad-hoc Networks”, Addison Wesley.
3. Charlsperkins, “Mobile IP”, Addison Wesley.

Reference Books:

1. Willam Stallings, “Wireless Communications and Networking “, Pearson Education.
2. Sandeep Ks Gupta, “Fundamentals of Mobile & Pervasive Computing”, Frank Adelstein.
3. A. Mehrotra, “GSM System Engineering” Artech House.

OE- 8015
INTERNET OF THINGS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Understand the application areas of IOT.
- Understand building blocks of Internet of Things and characteristics.
- Understand about radio frequency identification technology.

Unit-1 **08**

Introduction: Internet of thing, history of IoT, about IoT, overview and motivations, examples of applications, internet of things definitions and frameworks: IoT definitions, IoT architecture, general observations, ITU-T views, working definition, IoT frameworks and basic nodal capabilities.

Unit-2 **08**

Fundamentals of IoT Mechanisms and Key Technologies: Identification of IoT objects and services, structural aspects of the IoT, environment characteristics, traffic characteristics, scalability, interoperability, security and privacy, open architecture, key IoT technologies, device intelligence, communication capabilities, mobility support, device power, sensor technology, RFID technology and satellite technology.

Unit-3 **08**

Radio Frequency Identification Technology: RFID introduction, principle of RFID, components of an RFID system, Issues EPC global architecture framework- EPCIS & ONS, design issues, technological challenges, security challenges, IP for IoT, and web of things. **Wireless Sensor Networks:** History and context, WSN architecture, the node, connecting nodes, networking nodes, securing communication WSN specific IoT applications, challenges- security, QoS, configuration, various integration approaches, data link layer protocols, routing protocols and infrastructure establishment.

Unit-4 **08**

Resource Management in the Internet of Things: Clustering, software agents, clustering principles in an internet of things, architecture, design guidelines, and software agents for object representation, data synchronization, identity portrayal, identity management, various identity management models- local, network, federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, identity and trust.

Unit-5 **08**

Internet of Things Privacy, Security and Governance: Vulnerabilities of IoT, security requirements, threat analysis, use cases and misuse cases, IoT security tomography and layered attacker model, identity establishment, access control, message integrity, non-repudiation, availability and security model for IoT.

Text Books:

1. A. Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press.
2. Matt Richardson, S. Wallace, “Getting Started with Raspberry Pi”, O'Reilly (SPD).
3. Olivier Hersent, D. Boswarthick, O.Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Willy Publications.

Reference Books:

1. D. Uckelmann, M. Harrison, Michahelles, Florian , “Architecting the Internet of Things”, Springer.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press.
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis ,Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier.

OE-8016
CYBER LAW AND ETHICS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- locate and apply case law and common law to current legal dilemmas in the technology field.
- Understand about internet security threats.

Unit-1 **08**

Fundamentals of Cyber Law: Jurisprudence of cyber law, object and scope of the IT Act2000, introduction to Indian cyber law, uncitral model law, ISP guideline. Intellectual property issues and cyber space, Indian perspective, overview of intellectual property related legislation in India, patent, copy right, trademark law, law related to semiconductor layout and design.

Unit-2 **08**

E-commerce Security: Security threats to e-commerce, virtual organization, business transactions on web, e-governance and EDI, concepts in electronic payment systems, e-cash, credit/debit cards, e-agreement, legal recognition of electronic and digital records, e-commerce issues of privacy, wireless computing-security challenges in mobile devices. **Digital Signatures** -Technical issues, legal issues, electronic records, digital contracts, and requirements of digital signature system.

Unit-3 **08**

Security Policies: Development of policies, www policies, email security policies, policy review process-corporate policies-sample security policies, publishing and notification requirement of the policies, **Evolving technology security:** mobile, cloud, outsourcing and SCM.

Unit-4 **09**

Internet Security Threats: Information systems and its importance, role of security in internet and web services, classification of threats and attacks, security challenges, security implication for organizations, security services-authentication, confidentiality, integrity, availability and other terms in information security, Introduction to cryptography, firewalls, basic concepts of network security, perimeters of network protection & network attack, need of intrusion monitoring and detection, hacking, cracking, sneaking, viruses, trojan horse, malicious code & logic bombs, Introduction to biometric security, its challenges, and finger prints.

Unit-5 **07**

Investigation and Ethics: Cyber-crime, cyber jurisdiction, cyber-crime and evidence act, treatment of different countries of cyber-crime, ethical issues in data and software privacy, plagiarism, pornography, tampering computer documents, data privacy and protection, domain name system, software piracy, issues in ethical hacking. **Cyber-crime forensic:** Case study in cyber-crime.

Text Books:

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analyzing Computer Security", Pearson Education India.
2. Harish Chander, "Cyber Law and IT Protection", PHI Publication, New Delhi.
3. Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House.

Reference Books:

1. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
2. Anshul Kaushik, "Cyber Security", Khanna Publishing House.
3. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House, Delhi.

OE-8017
DATA ANALYTICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify appropriate data mining algorithms to solve real world problems.
- Compare and evaluate different data mining techniques like classification, prediction, clusteringand association rule mining.
- Describe complex data types with respect to spatial and web mining.

UNIT-I **10**

Introduction: Sources, modes of availability, inaccuracies and uses of data; Data Objects and Attributes; Descriptive Statistics: Visualization, Data Similarity and Dissimilarity, Pre-processing of Data: Cleaning for Missing and Noisy Data; Data Reduction: Discrete Wavelet Transform, Principal Component Analysis, Partial Least Square Method, Attribute Subset Selection, Data Transformation and Discretization.

UNIT-II **08**

Inferential Statistics: Probability density functions; Inferential statistics through hypothesis tests. **Business Analytics:** Predictive Analysis (Regression and Correlation, Logistic Regression, In-Sample and Out-of-Sample Predictions), Prescriptive Analytics (Optimization and Simulation with Multiple Objectives);

UNIT-III **08**

Mining Frequent Patterns: Concepts of support and confidence; Frequent Item sets Mining Methods; Pattern Evaluation. Classification: Decision Trees – Attribute Selection Measures and Tree Pruning; Bayesian and Rule-based Classification; Model Evaluation and Selection; Cross-Validation; Classification Accuracy; Bayesian Belief Networks; Classification by Back-propagation and Support Vector Machine.

UNIT-IV **06**

Clustering: Partitioning Methods – k-means Hierarchical Methods and Hierarchical Clustering using Feature Trees; Probabilistic Hierarchical Clustering; Introduction to Density, Grid and Fuzzy and Probabilistic Model-based Clustering Methods; and Evaluation of Clustering Methods.

UNIT-V08

Machine Learning: Introduction and Concepts: Ridge Regression; Lasso Regression; and *k*-Nearest Neighbours, Regression and Classification;

Supervised Learning with Regression and Classification Techniques: Bias-Variance Dichotomy, Linear and Quadratic Discriminant Analysis, Classification and Regression Trees; Ensemble Methods: Random Forest, Neural Networks, Deep Learning.

Text Books:

1. G. Shmueli, N. R. Patel, and P. C. Bruce, "Data Mining for Business Intelligence", John Wiley & Sons, New York.
2. V. Kumar, and P.N. T. M. Steinbach, "Introduction to Data Mining", Pearson.

Reference Books:

1. J. Han, M. Kamber and J. Pei, "Data Mining: Concepts and Techniques, Morgan Kaufmann.
2. G. James, D. Witten, T. Hastie, and R. Tibshirani, "An Introduction to Statistical learning with Applications in R", Springer, New York.
3. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer.

OE-8018
NON-CONVENTIONAL ENERGY RESOURCES

L T P
3 1 0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify renewable energy sources and their utilization.
- Understand basic concepts of solar radiation and analyze solar thermal systems for itsutilization.
- Understand working of solar cells and its modern manufacturing technologies.
- Understand concepts of Fuel cells and their applications.
- Compare energy utilization from wind energy, geothermal energy, biomass, biogas andhydrogen.

UNIT-I **09**

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits; Solar Energy: Solar Radiation and its measurement, modes of utilization of solar energy; Solar Photovoltaic Technology: Theory of solar cells. Solar cell materials, voltage developed by solar cell, Solar cell performance, solar PV power plant.

UNIT-II **06**

Solar Thermal Energy: Flat plate collectors: materials used, applications and performance; Focusing type collectors: materials used, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling systems, limitations.

UNIT-III **10**

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations; Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations; Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV **07**

Thermo-electric and Thermionic conversions: Principle of working, performance and limitations; Wind Energy: Wind power, site selection criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of energy conversion systems.

UNIT-V **08**

Bio-mass: Availability of bio-mass and its conversion theory; Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations; Wave energy and Tidal energy: Working principle, performance, limitations; waste recycling plants; Grid integration of RES.

Text Books:

1. M. V. R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional", BS Publications.
2. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
3. C.S. Solanki, "Renewable Energy Technologies: A Practical Guide for Beginners" PHI Learning.
4. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers.
5. R. D. Begamudre, "Energy Conversion Systems", New Age International Publishers.

Reference Books:

1. Peter Auer, "Advances in Energy Systems and Technology", Vol. 1 & II Edited by Academic Press.
2. Godfrey Boyle, "Renewable Energy Power for A Sustainable Future", Oxford University Press.

OE-8019
APPLIED OPERATIONS RESEARCH

L T P
3 1 0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To be able to understand the application of OR and frame a LP Problem with solution–graphical and through solver add in excel (software).
- To be able to build and solve Transportation and Assignment problems using appropriate method.
- To be able to design and solve simple models of CPM and queuing to improve decision
- making and develop critical thinking and objective analysis of decision problems.
- To be able to solve simple problems of replacement and implement practical cases of decision making under different business environments.
- Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

UNIT-I **10**

Introduction: Definition and scope of OR, Techniques and tools, model formulation, general methods for solution, Classification of Optimization problems, Optimization techniques.

Linear Optimization Models: Complex and revised Simplex algorithms, Degeneracy and duality, Post-optimum and Sensitivity analysis, Assignment, transportation and transhipment models, Travelling salesmanproblem, Integer and parametric programming.

UNIT-II **08**

Game Problems: Minimax criterion and optimal strategy, two persons zero sum game, Games by Simplex dominance rules.

UNIT-III **07**

Waiting Line Problems: Classification of queuing problems, M/M/1 & M/M/1/N queuing systems, Steady state analysis of M/M/m queues, Discrete and continuous time Markov models, Chapman-Kolmogorov equation, Birth & death processes in manufacturing, Open and Closed queuing networks.

UNIT-IV **07**

Inventory Management: ABC analysis, deterministic and Probabilistic models.

UNIT-V **08**

Dynamic Programming: Characteristics of dynamic programming problems, Bellman's principle of optimality, Problems with finite number of stages.

Stochastic Programming: Basic concepts of Probability theory, Stochastic linear programming.

Text Books:

1. L.Saaty, Elements of Queuing Theory,DoverPubns, New Ed edition
2. HadleyAddison&Wesley, Nonlinear and Dynamic Programming, Pearson Education(US)
3. Ackoff&Sasieni, Fundamentals of Operations Research,Wiley& Sons Inc.

References Books:

1. Wagner, Principles of OR with Applications to ManagerialDecisions, Prentice Hall
2. Taha, OperationsResearch, Pearson Education India
3. R PanneerselvamPrentice, OperationsResearch, Hall ofIndia
4. A P VermaS.K, OperationsResearch, Kataria&Sons
5. Hillier and Lieberman, Introduction to Operations Research, Prentice Hall

OE-8020
SIX SIGMA METHODS & APPLICATION

L	T	P
3	1	0

Course outcomes (COs)

- Ability to understand the concepts, implementation and objectives of sixsigma.
- Ability to use a structural approach to process improvement.
- Ability to develop a skill to predict, prevent and control defects in a process.
- Ability to achieve quality improvement through process improvement.
- Understand the tools of process discovery.

UNIT I **08**

Quality Perception; Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement. Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis. Probability Distribution: Normal, Binomial, Poisson Distribution.

UNIT II **08**

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S,Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score,Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

UNIT III **08**

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

UNIT IV **08**

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

UNIT V **08**

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to software for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

Text Books:

1. Hillier and Lieberman,Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower PublishingCo.
2. Greg Brue, Six Sigma for managers, McGraw-Hill
3. Pete Pande, What is Six Sigma, McGraw-Hill

References Books:

1. Peter S. Pande, The Six Sigma Way, McGraw-Hill education
2. Peter S. Pande, The Six Sigma way, McGraw-Hill
3. Adam Vardy, Lean Six Sigma, Create space Independent Publishing Platform
4. Thomas Pyzdek and Paul Keller, Six Sigma,McGraw-Hill

OE-8021
MECHATRONICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify key elements of mechatronics and its representation by block diagram.
- Understand the concept of sensors and use of interfacing systems.
- Understand the concept and applications of different actuators.
- Illustrate various applications of mechatronic systems.
- Develop PLC ladder programming and implementation in real life problem.

UNIT-I **08**

Introduction: Introduction to mechatronics, systems, measurement systems, control systems, microprocessor based controllers, The mechatronics approach, Problems.

Review of Transducers: Sensors and transducers, performance terminology, Displacement position and proximity, velocity& motion, Force, Fluid pressure, Liquid flow, liquid level, Temperature, Light sensors, Selection of sensors, Inputting data by switches.

UNIT-II **09**

Signal Conditioning: Signal conditioning, The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing, Pulse - modulation, Problems.

Data Presentation Systems: Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition systems, Measurement systems, Measurement systems, Testing and calibration.

UNIT-III **09**

Pneumatic and Hydraulic Systems: Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure-control valves, Cylinders, Process control valves, rotary actuators, Problems.

Mechanical Actuation Systems: Mechanical systems, Types of motion, Kinematics chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection problems.

UNIT-IV **07**

Electrical Actuation Systems: Electrical systems, Mechanical Switches, Solid-state switches, Solenoids, DC motors, AC motors, Stepper motors.

UNIT-V **07**

Basic System Models: Mathematical models, mechanical system building blocks, Electrical system building blocks, Thermal system building blocks.

Text Books:

1. W. Bolton, Mechatronics,. Addison Wesley Longman, Pub, 1999 (Delhi)
2. K.P Ramachandra, Mechatronics, Wiley Publication.
3. Dr. Rajesh Purohit, Industrial Engineering robotics and Mechatronics, Made Easy Publication

References Books:

1. William Bolton, Mechatronics, Pearson Education.
2. M.D.Singh and J.G Joshi, Mehatronics, PHI Publication
3. Richard A.Kolk, Mechatronics System design. Cengage Learning, Inc
4. AppuKuttan K.K, Introduction To Mechatronics, Oxford University Press

OE-8022
BIOMEDICAL ELECTRONICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To have a basic understanding of medical terminology, relevant for biomedical instrumentation.
- To understand and describe the physical and medical principles used as a basis for biomedical instrumentation.
- Understand the elements of risk for different instrumentation methods and basic electrical safety.
- Understand the position of biomedical instrumentation in modern hospital care.

Unit I **08**

Introduction: The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man–Instrumentation system, Components, Physiological system of the body, Problem encountered in measuring a living system.

Transducers: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications.

Unit II **08**

Sources of Bioelectric potentials: Resting & Action potentials, propagation of active potential, The Bioelectric potentials-ECG, EEG, EMG, and Invoked responses.

Electrodes: Electrode theory, Biopotential Electrodes–Microelectrodes Body surface electrodes, Needle Electrodes, Biochemical Transducers, Reference electrodes, PH electrodes, Blood Gas electrodes.

Unit III **08**

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes & leads, ECG recorders - Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Care & Monitoring - Elements of Intensive Care monitoring, patient monitoring displays, Diagnosis, Calibration & Repairability of patient monitoring equipment, pacemakers & Defibrillators.

Unit IV **08**

Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics - Spiro meter, Respiratory Therapy equipments: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

Diagnostic Techniques: Ultrasonic Diagnosis Echocardiography, Echo Encephalography, Ophthalmic scans, X-Ray & Radio-isotope Instrumentation, Computerized Axial Tomography Scanners.

Unit V **08**

Introduction to Bio-Medical Signals:

Classification, Acquisition and Difficulties during Acquisition, Electroencephalography, Electromyography, & electro-retinography, Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.

Bio Telemetry: The components of Biotelemetry system Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Physiological Effects of Electric Current Safety of Medical Electronic Equipments, Shock hazards from Electrical equipment and prevention against them.

Text Books:

1. Leslie Cromwell, Fred J. Welbell and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice Hall (India).

Reference Books:

1. R. S. Khandpur, "Biomedical Instrumentation", Tata McGraw-Hill.
2. Willis J. Tompkins, "Biomedical DSP: C Language Examples and Laboratory Experiments
   for the IBM PC", Prentice Hall (India).
3. D. C. Reddy, "Biomedical Signal Processing", McGraw-Hill

OE-8023
EMBEDDED SYSTEMS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Gain knowledge of embedded systems.
- Understand the concept, classification, characteristics, quality attributes and applications of Embedded Systems.
- Understand the architecture of embedded system and basics of real-time operating system.
- Write simple programs based on 8051 μC.
- Design simple applications using 8051 μC kit.

Unit I **08**

Introduction to Embedded system, Embedded System Project Management, ESD and Codesign issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Unit II **08**

8051 Microcontroller: Microprocessor V/s Micro-controller, 8051 Microcontroller: General architecture; Memory organization; I/O pins, ports & circuits; Counters and Timers; Serial data input/output; Interrupts. 8051 Instructions: Addressing Modes, Instruction set: Data Move Operations, Logical Operations, Arithmetic Operations, Jump and Call Subroutine, Advanced Instructions. 8051 Interfacing and Applications: Interfacing External Memory, Keyboard and Display Devices: LED, 7-segment LED display, LCD.

Unit III **08**

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Unit IV **08**

Brief general architecture of AVR, PIC and ARM microcontrollers, JTAG: Concept and Boundary Scan Architecture. Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

Unit V **08**

Advanced Processor: (only architectures) 80386, 80486 and ARM (References)

RTOS: Tasks, states, Data, Semaphores and shared data, Operating system, services, Message queues, Mailboxes.

Communication basics: Microprocessor Interfacing, I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel Protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Keyboard, Latch Interconnection, PPI.

Text Books:

1. K. V. Shibu, “Introduction to Embedded Systems”, McGraw Hill.
2. E. Mazadi, “The 8051 Microcontroller And Embedded Systems Using Assembly And C”, Pearson Education India, 2007

Reference Books:

1. Kenneth Hintz and Daniel Tabak, “Microcontrollers (Architecture, Implementation and Programming)”, TMH 2005.
2. Raj Kamal, “Embedded Systems”, TMH, 2006.
3. K. Ayala, “The 8051 Microcontroller”, 3rd Ed., Thomson Delmar Learning, 2007.
4. Frank Vahid and Tony Givargis, “Embedded System Design”, John Wiley.

OE-8024
ADVANCES IN POLYMER SCIENCE TECHNOLOGY

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Get knowledge of calculation of molecular weight of polymers.
- Get know about rate of different polymerization reactions
- Get know about morphology and deformation causes in polymers.
- Get know the use of composites and conducting in technology
- Get knowledge about various processing techniques of polymers like plastic, fibres and elastomers.

UNIT 1: **08**

Characteristics and Analysis of Polymers

Basic concept of Polymer Science, Measurement of molecular weight and size, Polymer degradation, Analysis and testing of polymers.

UNIT 2: **0**8

Mechanism and Kinetics of Polymerisation

Free radical, Cationic,Anionic, Coordination polymerization and their kinetics. Step Growth polymerization and their kinetics, Ring opening polymerization.

UNIT 3: **08**

Structure and Properties of Polymers

Morphology in crystalline polymers, Calculation of crystallinity, Polymer structure and physical properties, Deformation, flow and melt characteristics, Rheology and mechanical properties of polymers.

UNIT 4: **0**8

Composites, Conducting Polymers

Definition, types of composites, preparation methods, testing of composites, Applications of composites in technology. Conducting polymers- Definition, Synthesis and application in technology.

UNIT 5: **0**8

Processing of Polymers- Plastics, Fibers and Elastomers

Plastics-extrusion, injection molding, blow molding, compression and transfer molding; Spinning of fibers. Elastomers: Utility of Vulcanization and Reinforcement in Engineering.

Text Books:

- F.W. Billmeyer, "Text Book of Polymer Science", 3rdEdn., Wiley Inter Science.
- V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, “Polymer Science” 3rd Edition, New Age International Publishers.

Reference Books:

- F. Rodriguez, "Principles of polymer systems",4thEdn., Taylor and Francis, Washington.
- Fried, J.R., “Polymer Science and Technology”, Prentice Hall, Inc.

OE-8025
Mathematical Modeling and Simulation

L	T	P
3	1	0

Course Outcome (COs):

After completion of the course student will be able to:

- Define, describe and apply basic concepts related to modeling and simulation.
- Importance of simulation, how to simulate real world problems.
- Simulation of real world problems like water reservoir, autopilot, servo system.
- Develop mathematical model for real world problems.
- Model and simulate mechanical and electrical systems using the computer tools Simulink.

UNIT I **08**

Introduction to Modeling and Simulation: System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study. Introduction to Simulation, appropriate and not appropriate, advantages and disadvantage, application areas, history of simulation software, MATLAB as a Simulation tool.

UNIT II **08**

System simulation, why& when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

UNIT III **08**

Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

Unit IV **08**

System dynamics,exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams.

Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

UNIT V **08**

Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration.Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

Text Books:

1. Geoftrey Gordon, " System Simulation", PHI
2. Narsingh Deo, "System Simulation with digital computer"PHI

Reference Books

1.Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education

2. V P Singh, "System Modeling and simulation", New Age International.
3. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis", TMH

OE-8026
Nanoscience and Quantum Computing

L	T	P
3	1	0

Course Outcome:

After completion of the course student will be able to:

- To apply engineering and physics concepts to the nano-scale and non-continuum domain. Identify and compare state-of-the-art nanofabrication methods and perform a critical analysis of the research literature. Design processing conditions to engineer functional nanomaterials.
- To explain the fundamental science and quantum mechanics behind nanoelectronics. Explain the concepts of a quantum well, quantum transport and tunnelling effects. Differentiate between microelectronics and nanoelectronics and to understand basic and advanced concepts of nanoelectronic devices, sensors
- Understand the general concepts of photon trapping and plasmons in nanooptics, nano-photonics etc and to explain the basic functions, properties and different methods of Nanoholes and photons, solar energy, solar cells, optically used nanomaterials, Photoniccrystals.
- To impart knowledge on *Nanomaterials* for *biomedical* applications such as Proteins and applications, Drug delivery systems and to explain fabrication of nanoporous and nanofluidic devices and itsapplications.
- To provide a brief idea about quantum information and quantum Computing, Superposition, Measurement and working principle of quantum computers.

UNIT - I: Nanomaterials and Nano-structures **08**

Brief review of nanomaterials: Fullerenes, Nanotubes, Nanowires, Quantum Dots, Dendrites, Synthesis- Top Down, Bottom Up, Plasma arcing, Chemical vapour Deposition, sol-gel methods, Characterization using Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy, X ray methods, Fluorescence, Properties of nanomaterials.

UNIT –II:Nanoelectronics **08**

Introduction – micro, and nano fabrication: Optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy, Quantum electronic devices: High electron mobility transistors, Quantum interference Transistor, Single electron Transistor, MEMS, NEMS

UNIT - III: NanotechnologyinOptics **08**

Properties of light – interaction of light and nanomaterials: Photon trapping and Plasmons, Dielectric Constant and Polarisation, Refractive index, Nanoholes and photons, solar energy, solar cells, optically used nanomaterials, Photoniccrystals

UNIT – IV: NanotechnologyinBiomedicine **08**

Self assembled monolayers, Bio molecular motors: Function of Motor Proteins and applications, Drug delivery systems, Nanofluidics: Fluids at micro andNanometer scale, fabrication of nanoporous and nanofluidic devices and itsapplications.

UNIT – V: Quantum Computers **08**

Brief idea about quantum information and quantum Computing: Superposition, Measurement, Unitary evolution, qubits-single and multiple qubits, quantum memory, Elementary gates-quantum teleportation, working principle of quantum computers.

TextBooks:

1. Nanotechnology- Basic Science and Emerging Technologies, Mick Wilson, KamaliKannangara Geoff Smith, Michelle Simmons and Burkhard Raguse, I Edition – Overseas Press,2005
2. Introduction to Nanoscale Science & Technology, Ed. By Massimilano DiVentra – I Edition, Kluwer Academic - 2004
3. Nanotechnology, Gregory Timp – I Edition, Springer International –2005

Reference Books:

1. Nanotechnology, Michael Kohler – I Edition, Wiley VCH –2004
2. Nano-Engineering in Science & Technology, Michael Rieth – I Edition, World Scientific –2004
3. Nano, The NwextRevoliution, Mohan SundaraRajan – I Edition, National Book Trust – 2004
4. Nanotechnology, Gregory Timp-I Edition, Springer International - 2005

OE-8027
ENTREPRENEURSHIP DEVELOPMENT

L	T	P
3	1	0

Course Outcome (COs):

After completion of the course student will be able to:

- Define, describe and apply basic concepts related to entrepreneurship.
- Understand the systematic process to analyze and evaluate project, prepare project report.
- Prepare balance sheet, financial report.
- Interpret their own business plan.
- Consider the legal and financial conditions for starting a business venture.

UNIT-I **08**

Entrepreneurship- definition. growth of small scale industries in developingcountries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types.Government policy for small scale industry; stages in starting a small scale industry.

UNIT-II **08**

Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

UNIT-III **08**

Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT-IV **08**

Project Planning and control: The financial functions cost of capital approach inproject planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication.

UNIT-V **08**

Laws concerning entrepreneur viz, partnership laws, business ownership, salesand income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

Text Books:

1.Khana.S.S., "Entrepreneurial Development" S.Chand &Co.Ltd.,Ram Nagar,New Delhi,2013.
2. Donald F Kuratko, "Entrepreneurship-Theory, Process and Practice",9th Edition, Cengage Learning 2014.

Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India

OE-8028
CRITICAL AND LOGICAL THINKING

L	T	P
3	1	0

Course Outcome (COs):
After completion of the course student will be able to:

- Analyzing, reasoning, evaluating, decision-making and problem-solving attributes to play a vital role in organizational growth.
- Understand and comprehend the complexity of the professional domain and implement Interpersonal Skills.
- Negotiate with the odds and provide best opinions to the higher officials.
- Logical leadership with critical bent to produce positive results in unfavorable situations.

Unit I: Fundamentals of Critical Thinking **08**

Introduction to Critical Thinking, Recognizing Arguments, Key Concepts – Thinking Reflection and Creativity; Rhetorical Language; Principles of Interpretations; Process of Elimination; The Parts of an Argument – Claims and Propositions, Evidence, Reasoning; Argument and Critical thought; Communicating Arguments; Co-orientational, Cultural and Ethical View of Arguments

Unit II: Critical Thinking and Logical Communication **07**

Language and Critical Thinking; Citing and listing references – How to refer appropriately to the work of others; Putting your thinking into words; Writing about reflection - How to structure and report your thoughts; Editing and presenting your assignment – How to review your own work and follow academic conventions; Preparing for employment – How to transfer your thinking skills to a career.

Unit III: Logical Concepts and Philosophy of Science **08**

Truth and Validity; Hypothesis; Methods of Experimental Enquiry; Logic: Inductive and Deductive;Syllogism and Fallacies; Aristotle's conception of Virtue and Well-being; Kant's conception of Good Will, Duty and Categorical Imperative; Joseph Butler's Theory of Conscience and Self Love; J. S. Mill's Utiliterianism, Freedom and Responsibility, Chankya'sArthsashtra

Unit IV: Select School of Thought and Criticism **08**

Structuralism (Ferdinand de Saussure), Post Structuralism, Deconstruction (Jacques Derrida), Reader Response Theory (Roland Barthes), Gender Studies, Cultural Studies (Raymond Williams).

Unit V: Select School of Thought and Criticism **08**

1) ***Hind Swaraj***by Mahatma Gandhi

2) ***Tradition and Individual Talent*** by T.S. Eliot
3) ***"***Phenomenal Woman"*** by *Maya* Angelou
4) **Heart of Darkness by Joseph Conrad**

Note: (*) denotes texts for detailed study.

Text Books:

1 Rangarajan, L.N. *Kautilya The Arthashashtra*. Penguin Classics, New Delhi, 2000.
2 Gandhi, M. K. *Hindi Swaraj*. Delhi Open Books, New Delhi, 2019.
3 Eliot, T. S. *Tradition and the Individual Talent*, The Sacred Wood, New York, 1921.
4 Conrad, Joseph. *Heart of Darkness*. Signet Classic Publishers, New York, 1997.
5 Angelou, Maya. *Phenomenal Woman: Four Poems Celebrating Women*. New York: Random House, 1994.
6 *Critical Thinking: A Student's Introduction* by Gregory Bassham and William Irwin and Henry Nardone and James Wallace, McGraw-Hill, Noida, 2019.
7 *How to Improve your Critical Thinking & Reflective Skills* by Jonathan Weyers, Pearson Education, New York, 2011.

Reference Books:

1 *Critical Thinking* by Brooke Noel Moore and Richard Parker, McGraw-Hill, Noida, 2019.
2 *Critical Thinking and Communication* by Edward S Inch, Pearson Education, New York, 2011.
3 *A glossary of literary terms* by M H Abrams& Geoffrey Galt Harpham, Cengage Learning, San Francisco, 1957.
4 *English Literary Criticism and Theory* by M.S. Nagarajan, Orient BlackSwan, Hyderabad, 2006.
5 *The Penguin Dictionary of Philosophy* by Thomas Mautner, Penguin Reference, New Delhi, 1997.
6 *Western Philosophy: An Anthology* by John Cottingham, Wiley-Blackwell, New Jersey, 1996.

CE-8029
TOWN PLANNING

L T P
3 1 0

Course Outcome (COs):
After completion of the course student will be able to

- To understand the concept of balanced town by ensuring that new and existing facilities are complimentary to each other.
- To provide sustainable buildings by considering the environmental, social and economic conditions.
- To provide diversity of accommodation.
- To provide leisure and cultural facilities for the town.
- To create awareness about the traffic management within the town.

UNIT-1 **08**

Introduction to Town Planning: Definitions of town planning, form of planning, Elements and planning principal of city plan, Shapes of plan in accordance to road networks.

UNIT-2 **08**

Planning Concepts and Evolution: Planning concepts related to City beautiful movement (Chicago, Chandigarh), Urban Utopia (Broadacre), Garden city (Letchworth), Radburn Theory (Radburn) and Neighbourhood planning.

UNIT-3 **08**

Planning Process & Standards: Understanding of planning process, Relevance of standards in planning as per URDPFI guidelines prepared by TCPO.

UNIT-4 **08**

Roads and traffic studies: Awareness of concepts related to various traffic problems in India, Understanding of PCU, Traffic volume, Road capacities, Road types; their sections and intersections, Traffic calming as per IRC guidelines.

UNIT-5 **08**

Modern Transportation systems: New concepts in mass and rapid transportation systems e.g. BRT, LRT and Metro rail. **Modern approach in Planning:** Introduction, Benefits and Planning components of Green City (e.g. Vancouver), Compact City (e.g. Sky city, China) and Smart City (e.g. Malta)

Text Books:

1 John Ratcliffe, "An Introduction to Town and Country Planning", Hutchinson 1981.
2 Arthur B. Gallion and Simon Eisner, "The Urban Pattern – City planning and Design", Van Nostrand Reinhold company.
3 Rangwala, "Town Planning", Charotar publishing house.
4 G.K.Hiraskar, "Town Planning".

Reference Books:

1 Rame Gowda, " Urban and Regional planning".
2 S.K. Khanna, C.E.G. Jhusto, "Highway Engineering", Nemchand& Bros. Roorkee 1997.
3 N.V.Modak, V.N. Ambedkar, "Town and country planning and Housing", orient longman, 1971.
4 URDPFI Guidelines for Planning by TCPO.
5 IRC Guidelines.

CE-8030

DISASTER MANAGEMENT

L	T	P
3	1	0

Course Outcome (COs):
After completion of the course student will be able to

- Capacity to integrate knowledge and to analyse, evaluate and manage the different publichealth aspects of disaster events at a local and global levels, even when limited information is available.
- Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
- Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
- Capacity to manage the Public Health aspects of the disasters.
- Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.
- Capacity to design and perform research on the different aspects of the emergencies anddisaster events while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.
- Capacity to analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society andpeople's responsibility for how it is used.

UNIT-1 **08**

Introduction: Reasons, classifications-natural, based on violence, deterioration of environment and health and failures of industrial society; disaster risk, elements of risk Goals of disaster management, Assessment of disasters magnitude**.**

UNIT-2 **08**

Natural disasters: Earthquake, floods, cyclone, landslide, volcano, Tsunami, drought.

UNIT-3 **08**

Man-made disasters: Reasons, types, assessment methodologies, mitigation; community-based participation; government intervention.

UNIT-4 **08**

Phases / Elements of disaster management: Mitigation, Preparedness, response, recovery, Structural and non-structural measures for flood disasters, earthquake, cyclone, landslides

UNIT-5 **08**

Community based disaster preparedness, new paradigm for risk reduction, Government of India‘s initiatives, International bodies, Case studies of recent major disasters in India and Abroad.

Text Books:

1 R.B. Singh (Ed.), “Disaster management”, Rawat publications, New Delhi.

2 “National Disaster Response Plan”, A Document prepared by Department of Agriculture and Cooperation.

Reference Books:

1. Concept of Trigger Mechanism, Govt. Of India, Ministry of Home Affairs, February 2001, Publication.
2. Water and Climate related Disasters, Govt. of India, Ministry of Home affairs, Publication.

CE-8031
ENVIRONMENTAL POLLUTION AND MANAGEMENT

L	T	P
3	1	0

Course Outcome (COs):
After completion of the course student will be able to

- Understand the relation, impact and dependency of human being on environment.
- Identify the sources of different types of pollutants, methods of reduction of these pollutants.
- Identify sources and effects of air, water and land pollution.
- Demonstrate the use of different uses and effectiveness of government policies related toreduction of pollution.

UNIT-1 **08**

Impact of man on environment, Consequence of population growth, Energy problem, Pollution of air, water & land, Global environmental issues

UNIT-2 **08**

Water pollution: Sources and classification of water pollutants, wastewater treatment, control strategies, Eutrophication of lakes, self purification capacity of streams,
Thermal pollution: Sources, effects and control measures.

UNIT-3 **08**

Air pollution: Sources and effects, meteorological aspects, control methods and equipments, Land pollution: Types of land pollution, solid waste management-generation, storage, collection, transport, processing and disposal
Noise pollution: Sources, effects, preventive and control measures.

UNIT-4 **08**

EIA: Planning and management of environmental impact studies;
Impact evaluation methodologies: baseline studies, screening, scooping, checklist, overlays, Environmental Impact Assessment of water resources and environmental projects, Case study of power plant.
EA: Meaning, audit items, audit procedure, safety audit.

UNIT-5 **08**

Contemporary issues: Emission trading, discharge permits, international resource sharing issues, climate change, international environmental treaties and protocol, Environmental legislation: Introduction to various legislations related to water, air, biodiversity, ozone depletion etc at National and International level; Institutions for governance.

Text Books:

1 C. Manoharachary and P. Jayarama Reddy, “Principles of environmental studies (Ecology, economics, management and law)”, B.S. Publications.
2 P.V. Rao, “Text of Environmental Engineering”, Prentice Hall Pvt ltd., Delhi.

Reference Books:

1 Y. Ananayulu and C.A. Sastry, “Environmental impact assessment methodologies”, B.S. Publications, Hyderabad.