

BIRLA VISHVAKARMA MAHAVIDYALAYA
(ENGINEERING COLLEGE)
(AN AUTONOMOUS INSTITUTION)
VALLABH VIDYANAGAR – 388120, GUJARAT
AFFILIATED TO GUJARAT TECHNOLOGICAL UNIVERSITY



ACADEMIC REGULATIONS
AND
COURSES OF STUDY
FOR
FOUR YEAR DEGREE PROGRAMME LEADING TO
BACHELOR OF TECHNOLOGY (B.TECH.)
IN
CIVIL ENGINEERING
IMPLEMENTED FROM THE BATCH ADMITTED IN ACADEMIC
YEAR 2018-19

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Institute Vision

“Produce globally employable innovative engineers with core values.”

Institute Mission

- Re-engineer curricula to meet global employment requirement
- Promote innovative practices at all levels.
- Imbibe core values
- Reform policies, systems and processes at all levels.
- Develop faculty and staff members to meet the challenges

Core Values

Quality, Creativity, Team Work, Lifelong Learning, Pro-activeness,
Cost Consciousness, Sharing, Transparency

**B.TECH. CIVIL PROGRAMME OFFERED BY
DEPARTMENT OF CIVIL ENGINEERING**

Programme Vision

Produce globally employable innovative Civil Engineers with core values

Programme Mission

- Re-engineer curricula of Civil engineering to meet global employment requirements.
- Promote innovative practices in Civil and Structural Engineering Department.
- Imbibe_core values in Civil engineering endeavors undertaken.
- Reform policies, systems and processes at all levels in Civil Engineering education and research.
- Develop faculty and staff members to meet challenges.

Programme Outcomes (POs)

Engineering Graduates will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.
2. Identify, formulate, review research literature, and analyse complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, cultural and societal & environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. Apply appropriate techniques, resources, modern engineering and IT tools including prediction and modelling to civil engineering activities with an understanding of their limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health & safety, legal & cultural issues and the consequent responsibilities relevant to the professional civil engineering practice.
7. Understand the impact of the professional civil engineering solutions in societal and environmental contexts, demonstrate the knowledge of the same and need for sustainable development.
8. Apply ethical principles & commit to professional ethics and responsibilities & norms of the civil engineering practice.
9. Function effectiveness an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on civil 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.
11. Demonstrate knowledge and understanding of the civil engineering and management principles and apply those to one's own work, as a member and leader in a team, to manage civil engineering projects in multidisciplinary environments
12. Recognize the need for, have the preparation and ability to engage in independent and life-long learning in the broadest context of civil engineering technological changes.

Programme Specific Outcomes (PSOs) for (BE) Civil/ Structural Engineering Programme

1. Design civil engineering structures using relevant codes of practice, materials, techniques and software.
2. Follow human values and ethics with team spirit in every civil engineering project undertaken.
3. Adapt state-of-the-art practices and materials in the field of civil engineering.

Academic Regulations (Major) – UG.18

FOR UNDER GRADUATE PROGRAMMES (FULL TIME)

UG.18.1 ADMISSION

UG.18.1.1 A candidate seeking admission to the four year degree programme for Bachelor of Technology must have eligibility as per the Gujarat Government/ Admission Committee for Professional Courses (ACPC) / Gujarat Technological University (GTU)/ Charutar Vidya Mandal (CVM) rules.

UG.18.1.2 Admission granted to an applicant is to be considered provisional until all the fees are paid and all the prescribed documents are in order. BVM Engineering College **DISCLAIMS ALL RESPONSIBILITIES**, if any, of the documents required as per ACPC/ GTU norms, which are not submitted or found unacceptable by it. The institute will not accept any responsibility for students who do not submit the expected examination / registration / enrollment forms in time.

UG.18.2 PROGRAMMES OF STUDY

UG.18.2.1 A student shall undergo the prescribed courses as given in the programme of studies to obtain his/her degree in major in which he/she is admitted. These courses for various programmes are listed in Annexure – I.

UG.18.2.2 A student shall undergo the courses as prescribed by the respective Board of Studies from time to time to obtain minor engineering degree in the respective programme(s). For awarding minor degree, regulations are annexed here as Annexure – III.

UG.18.3 COURSE LEVELS

UG.18.3.1 At the commencement of each semester a student shall register for the set of courses offered during the semester. For the registration process, refer UG.18.9.

UG.18.3.2 All courses offered are divided into four levels: Level 1 to Level 4. The levels correspond to successive years of study of a typical B. Tech. student, i.e. a regular student will complete his/her Level-1 courses during his/her first year, Level-2 courses during his/her second year, and so on.

UG.18.4 COURSE CATEGORIES

Courses taken by a student to complete his/her degree programme are divided into Humanities and Social Science, Basic Science, Engineering Science, Mandatory Courses, Professional Core Courses, Programme Elective Courses, Open Elective Courses, Project Work, Seminar and Internship.

UG.18.4.1 COMPULSORY COURSES

Each programme of studies contains a certain number of compulsory courses, they are categorized as Programme core courses, seminar and project work / dissertation.

UG.18.4.2 PROGRAMME ELECTIVE COURSES

Each programme of studies contains a certain number of programme elective courses. Programme elective courses will be offered under each discipline at corresponding level from which a student may choose course(s).

UG.18.4.3 OPEN ELECTIVE COURSES

Open elective courses are courses offered by a discipline for students other than the corresponding discipline.

UG.18.4.4 MANDATORY NON CREDIT COURSES

Each programme of studies contains a certain number of mandatory non-credit courses decided by respective Board of Studies.

UG.18.5 DEFINATION OF STATUS OF COURSE

UG.18.5.1 REGULAR COURSES

Each programme of studies contains a certain number of courses (including elective courses and mandatory non-credit courses) to be studied in respective semester decided by respective Board of Studies.

UG.18.5.2 BACKLOG COURSES

The courses in which student has not obtained letter grade DD or above / PP at first attempt (Refer UG.18.13).

UG.18.6 PRE-REQUISITES

UG.18.6.1 A student shall not be allowed to enroll for any course at Level-4 unless he/she has completed all his/her course requirements at Level-1 with acceptable grades (Refer UG.18.13).

UG.18.7 COURSE CREDITS

UG.18.7.1 Each course offered has **L-T-P** structure, where “**L**” means number of theory lecture hours per week, **T** means number of tutorial hours per week and “**P**” means number of practical hours per week.

UG.18.7.2 Total course credits for a course are obtained by adding credits of theory lectures, tutorials and practical together. e.g. 1 hr. Lecture = 1 credit, 1 hr. Tutorial = 1 credit & 1 hr. Practical = 0.5 credit.

UG.18.8 FACULTY COUNSELOR

UG.18.8.1 Each student is assigned to a Faculty Counselor who will advise and counsel him/her regarding the selection of courses to be registered in a given semester as well as monitor his/ her holistic growth.

UG.18.8.2 Each student must obtain approval for “Backlog” courses (Refer UG.18.5.2) from the Faculty Counselor.

UG.18.9 REGISTRATION

UG.18.9.1 To earn course credits in a semester a student must register for the courses at the commencement of the semester.

UG.18.9.2 At the commencement of each semester the **first working day** is designated as the Registration Day. A student must complete his/her registration formalities on that day as per the procedure laid down by the institute.

UG.18.9.3 A further period of 12 working days is designated as late registration period. During this period a student shall require to pay late registration fees, as decided by the institute from time to time to complete his/her registration. Late registration will only be permitted on genuine reasons, (Refer UG.18.12.3) subject to the approval of the Principal.

- UG.18.9.4 Student shall not be permitted to attend classes without registration.
- UG.18.9.5 The registration must be completed by the student in person.
- UG.18.9.6 A student who has completed all the requirements for his/her B. Tech. degree (Refer UG.18.19) will not be allowed to register in any further courses.
- UG.18.9.7 All registrations in every semester must be duly approved by the Principal.
- UG.18.9.8 Student should obtain approval from Faculty Counsellor to register any Backlog course(s) within 10 days of declaration of results of the previous semester or first 10 days of the commencement of semester, whichever is later.
- UG.18.9.9 Total number of credits for Backlog courses should not be more than 24.

UG.18.10 WITHDRAWAL

- UG.18.10.1 Student may withdraw all the courses registered in a semester before four weeks of commencement of End Semester examination. Further, on genuine reasons (Refer UG.18.12.3) a student can withdraw at any time during the entire semester. In such cases NO FEES will be refunded.

UG.18.11 ASSESSMENT OF STUDENT PERFORMANCE IN A COURSE

- UG.18.11.1 The performance of a student in a course will be evaluated based on (i) continuous assessment of theory and tutorial/practical work and (ii) end-semester theory and tutorial / practical examinations.
- UG.18.11.2 The end- semester theory examination in a course has a weightage of 60 % of total theory marks. Out of the remaining 40 % of theory marks, 30 % of marks will be evaluated based on mid semester examination and remaining 10 % based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.
- UG.18.11.3 The end-semester tutorial/practical examination in a course has a weightage of 40 percent of total tutorial/practical marks and continuous assessment of the same carries the remaining 60 % of total tutorial/practical marks. Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, end-semester practical examination and attendance.

Continuous assessment (tutorial/practical) scheme is given below:

Term work	30 % (Equal weightage for every practical. At least 10 practical/tutorial need to be performed or mini project)
Quiz/Assignment/ Viva/ active learning component	30 %
Total	60 %

The respective Board of Studies shall decide the list of the courses in which end semester practical evaluation is feasible. In such courses evaluation shall be based on practical as well as viva for 40 % marks of end semester tutorial/practical. If practical performance is not feasible then 40 % of marks as end semester tutorial/practical evaluation will be based only on viva.

UG.18.11.4 The overall performance of a student in a course is assessed on the principle of “single head of passing”, i.e., there will be a single grade for a course based upon the aggregate of marks obtained by the student in theory and tutorial/practical components in continuous assessment as well as end semester examination. However, a student must score minimum 35% marks in end semester theory and tutorial/practical examination to make himself/ herself gradable.

UG.18.12 EXAMINATIONS

UG.18.12.1 The end-semester examination for all courses offered in an academic year will be conducted by the institute for awarding 60 % of marks out of the total theory marks.

UG.18.12.2 No student shall be allowed to appear in the end semester examination unless he/she has attended 100% of theory and tutorial/practical classes of each course and will be awarded letter grade FA (Refer UG.18.13) in all the courses he/she has registered in the corresponding semester, except backlog courses.

However, a maximum 25 % relaxation in attendance is permissible with prior intimation, along with required documents, from concerned authorities. The relaxation includes medical, co-curricular and extra-curricular activities, genuine social engagements etc.

UG.18.12.3 The institute will conduct two continuous assessment of theory (mid semester examination) in a semester for each course for the evaluation of 30 % of total theory marks. The average marks of two mid semester examinations shall be considered as the final marks for mid semester examination.

A student who remains absent in any of the two mid semester examination for whatsoever reason(s) shall be awarded with zero marks in the respective mid semester examination.

However, if a student remains absent due to any of the following genuine reasons, for such students a special examination may be conducted by the department and marks obtained in the special examination will be considered as marks of the mid semester examination in which he/she has remained absent. Such student should obtain prior approval from the Principal.

- a) A student is critically ill or injured and certified by Civil Surgeon.
- b) Death of direct blood relation relative.
- c) A student representing Gujarat state in national level events and/or India in International events organized by official boards.

UG.18.12.4 The institute will conduct only one continuous assessment of theory (mid semester examination) for all courses of the semester in the following cases.

- a) First Semester of B. Tech. programme.
- b) Third semester of B. Tech. programme for the students who are admitted in the second year of B. Tech. Diploma to Degree students.
- c) Corresponding semester of the year of transfer for transferred students or international students, if the admission of such students is five weeks later than commencement of academic calendar.

UG.18.12.5 No student shall be allowed to appear in the end semester examination of a course unless he/she has scored at least 35% marks in mid semester examination and will be considered in “NOT PERMITTED TO APPEAR (NPTA)” status for the respective course and letter grade “NA” will be awarded (Refer UG.18.13).

The NPTA student(s) shall appear in mid semester remedial examination of the next semester.

UG.18.12.6 The End Semester tutorial/practical examination shall be rearranged for a student who is not able to appear in the regular schedule due to genuine reason(s) (Refer UG.18.12.3). Such student should obtain prior approval from the Principal.

However, such rearrangement should be confined within the Academic Calendar of the respective semester.

UG.18.13 LETTER GRADES

UG.18.13.1 The overall performance of a student in credit courses is represented by a letter grade from AA to FP, FA, NA and WD with the following meaning and equivalent grade points:

LETTER GRADE	EQUIVALENT GRADE POINTS	REMARK
AA	10	Outstanding
AB	9	Excellent
BB	8	Very Good
BC	7	Good
CC	6	Average
CD	5	Satisfactory
DD	4	Pass
FP	0	Failure due to Performance
FA	0	Failure due to Attendance
NA	0	Not Permitted To Appear
WD	0	Withdrawal

For non-credit courses the evaluation will be PASS or FAIL and for that the letter grade will be awarded PP or FP, respectively.

UG.18.13.2 A credit course is said to be completed successfully, only if a letter grade DD or better (in grade points) is obtained in that course.

UG.18.13.3 A non-credit course is said to be completed successfully only if a letter grade PP is obtained in that course.

UG.18.13.4 The scheme of awarding letter grades and the letter grades awarded in each course are subjected to scrutiny and approval by the Academic Council.

UG.18.14 FAILURE IN A COURSE

UG.18.14.1 A student earns **zero** credit for a course when he/she gets letter grade FP, NA, FA or WD in that credit course.

UG.18.14.2 If letter grade FA is obtained in an elective course, the student may change the elective.

UG.18.14.3 A student with letter grade FA/WD in courses should re-register the courses subsequently whenever offered.

UG.18.14.4 A student with letter grade FP should appear, at the earliest, in the end semester theory as well as practical/ viva exam and should obtain a letter grade DD or better (in grade points) in credit courses and PP in non-credit courses.

UG.18.14.5 A student having more than six Backlog courses (Refer UG.18.6.2) will not be allowed to move to the next level.

UG.18.15 SEMESTER PERFORMANCE INDEX (SPI)

UG.18.15.1 The performance of a student in a semester is expressed in terms of the semester Performance Index (SPI).

UG.18.15.2 The semester Performance Index is the weighted average of course grade points obtained by the student in the regular courses (Refer UG.18.6.1) registered in the semester. The weights assigned to course grade points are the credits carried by the respective courses.

That is,

$$SPI = \frac{\sum_{i=1}^n g_i c_i}{\sum_{i=1}^n c_i}$$

where, g_i is the equivalent grade point of i^{th} course,

c_i is the credit of the course

n is total number of regular courses registered by the student in a semester

UG.18.16 CUMULATIVE PERFORMANCE INDEX (CPI)

UG.18.16.1 The cumulative performance of student is expressed in terms of the Cumulative Performance Index (CPI). This index is defined as the weighted average of course grade points obtained by the student for all courses taken since his/her entry to the programme. The weights are defined in same way as in UG.18.15.2.

UG.18.16.2 If a student repeats a course, only the grade points obtained in the latest attempt is counted towards the Cumulative Performance Index (CPI).

UG.18.17 ADMISSION BY TRANSFER

UG.18.17.1 Any student aspiring for admission by transfer in any B.Tech. programme is not eligible for the same after 5th Semester of the respective B.Tech. programme.

UG.18.17.2 For a student admitted by transfer to any B.Tech. programme after completing part of his/her degree requirements elsewhere or under the previous academic regulations of BVM, he/she will be allowed to continue in subsequent level after completing all the requirements of previous levels of the respective institute or previous academic regulation. He/She will be exempted from all courses upto the completed levels. For these courses “EXEMPTED” status will be shown in the Transcript.

UG.18.17.3 The remaining requirements must be completed by the student as per UG.18.18.

UG.18.17.4 The CPI of such a student will be calculated only on the basis of the courses taken after transfer.

UG.18.18 REQUIREMENTS FOR THE AWARD OF B. Tech. DEGREE

UG.18.18.1 To be eligible for the award of the degree of Bachelor of Technology a student must earn total credits as prescribed by respective Board of Studies.

UG.18.18.2 The total credits requirements for the degree of B. Tech. must be completed in not more than 16 semesters from the date of admission. However, for a student admitted by transfer or Diploma to Degree (D2D) the maximum permissible duration shall be 100 % more than the period prescribed for completion of the programme at the time of admission.

UG.18.19 AWARD OF CLASS

UG.18.19.1 The class awarded to a student with his B. Tech. degree is decided by his final CPI as per the following table:

FIRST CLASS WITH DISTINCTION- CPI not less than 7.10

FIRST CLASS - CPI less than 7.10 but not less than 6.50

SECOND CLASS - CPI less than 6.50 but not less than 5.50

PASS CLASS - CPI less than 5.50

A candidate who passes in all courses and all heads of passing in the examination shall be given a gracing of the required CPI for getting second class/first class/first class with distinction, subject to a maximum of CPI 0.10, in concurrence with rules and guidelines of AICTE/ GTU.

UG.18.20 TRANSCRIPT

UG.18.20.1 The Transcript will be issued to the student as and when required and will contain a consolidated record of all the courses undergone by him/her, grades obtained and CPI upto the date of issue of transcript.

UG.18.20.2 Only last letter grade obtained in a course by the student upto the date of issue of transcript will be shown in the Transcript.

UG.18.21 EXAMINERS

UG.18.21.1 The respective board of studies shall appoint at least two examiners for end semester theory as well as practical/viva examination. For each end semester theory examination, there shall be two paper setters. One paper setter out of the two shall be from outside the institute (external examiner). The end semester practical examination of each subject shall be conducted by an internal (Examiner from the institute) and an external examiner. For 4th level courses, each end semester theory examination evaluation shall be made by an internal and an external examiner. One of the internal examiner/s shall be appointed as convener who shall co-ordinate the examination procedure for end semester examinations of the respective subject.

UG.18.21.2 In the end semester practical examination maximum upto 60 students can be examined per day per examiner for first, second and third level courses and upto 45 students can be examined per day per examiner for fourth level courses.

UG.18.21.3 In the end semester practical examinations of Projects maximum upto 12 groups can be examined per day per examiner.

In the end semester practical examinations of Seminars maximum upto 20 groups can be examined per day per examiner

UG.18.22 REVIEW OF ESE THEORY ANSWER BOOKS

UG.18.22.1 A student shall apply for review of end semester theory answer book(s) within 7 working days after declaration of semester results. The student will have to pay the fees for the same as decided from time to time.

The answer book(s) of the student(s) who has applied for the review will be shown to him/her.

If student is satisfied with the assessment then he/she shall sign the answer book with a remark "Seen and Satisfied".

If student is not satisfied with the assessment, then the respective Board of Studies shall appoint two examiners (Convener of original exam and a new examiner) for the review of the end semester examination (theory) both sections. Both examiners shall jointly review both the sections and marks awarded in the previous assessment shall be kept open.

The marks obtained by the candidate after the review shall be considered for grading, only if, the change in mark is more than or equal to 10% of total mark of End Semester (Theory) Examination.

If change in grade is found after review, the review fees shall be refunded.

UG.18.23 GRADING

UG.18.23.1 The office of Controller of Examinations shall prepare the histogram of each course for the purpose of grading after the completion of assessment of the course.

UG.18.23.2 The convener of the respective course shall grade the students based on the histogram provided by the Controller of Examinations.

UG.18.24 GRADE REVIEW

UG.18.24.1 The Academic Council shall appoint a Grade Review Committee for each semester. The Grade Review Committee shall comprise of following members:

- (a) Principal
- (b) All Board of Studies Chairman
- (c) University Nominee
- (d) Dean, Academics
- (e) Associate Dean, Academics
- (f) Controller of the Examinations
- (g) Joint Controller of Examinations
- (h) Member Secretary, Academic Council
- (i) Officer-in-Charge of Credit System

UG.18.24.2 The Grade Review Committee shall meet immediately after results of all courses are completed and review the grades awarded by the convener of respective course. The revision of the grade suggested by the Grade Review committee shall be considered as final grade and binding.

UG.18.24.3 The Grade Review Committee can grace upto 10 % of total marks of theory examination in marks of end semester theory exam to make a student gradable. However grace marks shall not be counted in the aggregate marks obtained by the student for the grade.

**ANNEXURE – I: Programme of studies leading to the degree of the Bachelor of Technology
(Civil Engineering)**

Semester 1

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	BS111: ADVANCED CALCULUS	3	1	0	4	4
2	ES103: BASIC ELECTRICAL ENGINEERING	3	0	2	5	4
3	ES110: BASIC MECHANICAL ENGINEERING	3	0	2	5	4
4	ES111: WORKSHOP	0	0	4	4	2
5	HS112: ENVIRONMENTAL SCIENCE	2	0	0	2	0
Total		11	1	8	20	14

*For Students admitted in AY 2018-19, **BS101: ADVANCED CALCULUS** (LTP:3,2,0)

§For Students admitted in AY 2018-19, **HS102: ENVIRONMENTAL SCIENCE**
(LTP:2,2,0)

Semester 2

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	BS112: LINEAR ALGEBRA AND FOURIER SERIES	3	1	0	4	4
2	BS103: PHYSICS	3	0	2	5	4
3	ES106: PROGRAMMING FOR ENGINEERS	1	0	4	5	3
4	ES109: ENGINEERING GRAPHICS AND DESIGN	2	0	4	6	4
5	ES115: BASIC CIVIL ENGINEERING	3	0	2	5	4
6	HS101: ENGLISH	2	0	2	4	3
Total		14	1	14	29	22

#For Students admitted in AY 2018-19, **BS102: LINEAR ALGEBRA AND FOURIER SERIES** (LTP:3,2,0)

Semester 3

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	2BS02: DIFFERENTIAL EQUATIONS AND STATISTICS	3	1	0	4	4
2	2SE01: CONSTRUCTION MATERIAL AND CONCRETE TECHNOLOGY	3	0	2	5	4
3	2ES01: MECHANICS OF SOLIDS	3	0	2	5	4
4	2CE01: FLUID MECHANICS	3	0	2	5	4
5	2HS01: PROFESSIONAL SOFT SKILLS	1	0	2	2	2
6	2CE02: ENGINEERING SURVEYING	3	0	2	5	4
Total		16	1	10	26	22

Semester 4

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	2BS03: NUMERICAL METHODS IN CIVIL ENGINEERING	1	0	2	3	2
2	2CE03: HYDRAULIC ENGINEERING	3	0	2	5	4
3	2SE02: GEOTECHNICAL ENGINEERING	2	0	1	3	2.5
4	2SE03: STRUCTURAL ANALYSIS - I	2	0	1	3	2.5
5	2CE04: ENGINEERING GEOLOGY	3	0	1	4	3.5
6	2CE05: CONSTRUCTION TECHNOLOGY	3	0	0	3	3
Total		14	0	7	21	17.5
CEIS1: INTERNSHIP-I (Two Weeks)		-	-	-	-	0

Non-Credit Mandatory course

Semester 5

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	Open Elective - I	3	0	0	3	3
2	3SE01: ADVANCED GEOTECHNICAL ENGINEERING	3	0	1	4	3.5
3	3SE02: STRUCTURAL ANALYSIS - II	3	1	0	4	4
4	3CE01: WATER AND WASTE WATER ENGINEERING	3	0	2	5	4
5	3CE02: HIGHWAY AND TRAFFIC ENGINEERING	3	0	2	5	4
6	3SE03: DESIGN OF STEEL STRUCTURES	3	1	0	4	4
Total		18	2	5	25	22.5

Open Elective - I

1	3CP81: FUNDAMENTALS OF COMPUTER NETWORKS AND SECURITY	3	0	0	3	3
2	3CP82: FUNDAMENTALS OF OPERATING SYSTEMS	3	0	0	3	3
3	3IT81: CYBER SECURITY	3	0	0	3	3
4	3IT82: INTERNET TECHNOLOGY	3	0	0	3	3
5	3IT83: SOFTWARE PROJECT MANAGEMENT	3	0	0	3	3
6	3IT84: ENTERPRISE RESOURCE PLANNING	3	0	0	3	3
7	3EE81: ENERGY AUDIT & CONSERVATION	3	0	0	3	3
8	3EE83: INSTALLATION AND COMMISSIONING OF ELECTRICAL EQUIPMENT	3	0	0	3	3
9	3EL81: ELECTRONICS COMMUNICATION SYSTEM	3	0	0	3	3
10	3EC81: INTRODUCTION TO CELLULAR COMMUNICATION	3	0	0	3	3
11	3EC82: APPLIED ELECTRONICS	3	0	0	3	3
12	3ME81: INDUSTRIAL ENGINEERING AND QUALITY ASSURANCE	3	0	0	3	3
13	3ME82: PROJECT MANAGEMENT	3	0	0	3	3
14	3PE81: PRINCIPLES OF SUPPLY CHAIN MANGEMENT	3	0	0	3	3
15	3PE82: INDUSTRIAL INTERNET OF THINGS	3	0	0	3	3

Semester 6

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	Open Elective - II	3	0	2	5	4
2	3CE03: BUILDING PLANNING, COSTING AND VALUATION	3	0	2	5	4
3	3HS01: ETHICS AND CONSTITUTION OF INDIA#	2	0	0	2	0
4	3CE04: RAILWAY AND BRIDGE ENGINEERING	2	1	0	3	3
5	3SE04: DESIGN OF RC STRUCTURES	3	1	0	4	4
6	3CE05: HYDROLOGY AND WATER RESOURCES ENGINEERING	3	1	0	4	4
Total		16	3	4	23	19
CEIS2: INTERNSHIP-II#		-	-	-	-	0
# Non-Credit Mandatory course						

Open Elective - II

1	3CP85: OBJECT ORIENTED CONCEPTS AND PROGRAMMING	3	0	2	5	4
2	3CP84: INFORMATION TECHNOLOGY ESSENTIALS	3	0	2	5	4
3	3CP83: PROGRAMMING WITH PYTHON	3	0	2	5	4
4	3IT85: WEB APPLICATION AND DEVELOPMENT	3	0	2	5	4
5	3IT86: JAVA PROGRAMING	3	0	2	5	4
6	3IT87: OBJECT ORIENTED PROGRAMMING WITH C++	3	0	2	5	4
7	3IT88: MOBILE APPLICATION DEVELOPMENT	3	0	2	5	4
8	3EE82: RENEWABLE ENERGY TECHNOLOGIES	3	0	2	5	4
9	3EE84: INDUSTRIAL AUTOMATION	3	0	2	5	4
10	3EL82: BASICS OF EMBEDDED AND IOT SYSTEMS	3	0	2	5	4
11	3EL83: SENSORS TECHNOLOGY	3	0	2	5	4
12	3EC83: EMBEDDED SYSTEMS AND IOT	3	0	2	5	4
13	3ME83: RENEWABLE ENERGY SOURCES	3	0	2	5	4
14	3ME84: ENERGY CONSERVATION AND MANAGEMENT	3	0	2	5	4
15	3PE83: MANAGING PROJECT	3	0	2	5	4

16	3PE84: ADDITIVE MANUFACTURING	3	0	2	5	4
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Semester 7

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	4SE01: EARTHQUAKE ENGINEERING	2	0	2	4	3
2	4CE01: PROJECT MANAGEMENT AND EQUIPMENT	3	1	0	4	4
3	4CE02: CONSTRUCTION SAFETY AND QUALITY MANAGEMENT	2	0	0	2	2
4	Program Elective - I	3	0	2	5	4
5	Program Elective – II	3	1	0	4	4
6	4CE31: PROJECT - I	0	6	0	6	6
Total		13	8	4	25	23

Program Elective - I

1	4SE51: GROUND IMPROVEMENT TECHNIQUES	3	0	2	5	4
2	4CE42: AIR POLLUTION AND CONTROL	3	0	2	5	4
3	4CE43: GEOMATICS ENGINEERING	3	0	2	5	4
4	4CE44: HYDRAULIC MACHINES	3	0	2	5	4

Program Elective - II

1	4SE41: ADVANCED DESIGN OF STEEL STRUCTURES	3	1	0	4	4
2	4SE42: ADVANCED STRUCTURAL ANALYSIS	3	1	0	4	4
3	4CE45: IRRIGATION AND HYDRAULIC STRUCTURES	3	1	0	4	4
4	4CE46: URBAN TRANSPORTATION SYSTEM	3	1	0	4	4

Semester 8

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	Program Elective – III	2	0	2	4	3
2	Program Elective – IV	1	0	4	5	3
3	Program Elective – V	3	0	0	3	3
4	Program Elective - VI	3	0	0	3	3
5	Program Elective - VII	0	0	4	4	2
6	4CE32: PROJECT - II	0	6	0	6	6
OR						
	4CE33: INDUSTRIAL PROJECT	0	6	0	6	6

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		Total	9	6	10	25	20
Total Credits Distribution		111	23	60	194	160	
Program Elective - III							
1	4SE43: ADVANCED DESIGN OF CONCRETE STRUCTURES	2	0	2	4	3	
2	4SE44: COMPUTER AIDED STRUCTURAL ANALYSIS	2	0	2	4	3	
	4CE47: GREEN BUILDING MATERIALS AND TECHNIQUES	2	0	2	4	3	
3	4CE48: PAVEMENT ANALYSIS AND DESIGN	2	0	2	4	3	
Program Elective - IV							
1	4SE45: STRUCTURAL DESIGN PRACTICES	1	0	4	5	3	
2	4CE49: DIGITAL LAND SURVEY PROJECT	1	0	4	5	3	
3	4CE50: TRAFFIC ENGINEERING AND FIELD STUDIES	1	0	4	5	3	
4	4CE51: BUILDING CONSTRUCTION PROJECT	1	0	4	5	3	
Program Elective - V							
1	4SE46: DESIGN OF SPECIAL STRUCTURES	3	0	0	3	3	
2	4SE47: REPAIR AND REHABILITATION OF STRUCTURES	3	0	0	3	3	
3	4CE52: BUILDING SERVICES AND TREATMENTS	3	0	0	3	3	
4	4CE53: SOLID WASTE MANAGEMENT	3	0	0	3	3	
Program Elective - VI							
1	4SE48: PRESTRESSED CONCRETE	3	0	0	3	3	
2	4SE49: FOUNDATION ENGINEERING	3	0	0	3	3	
3	4CE54: IRRIGATION WATER MANAGEMENT	3	0	0	3	3	
4	4CE55: DOCK, HARBOUR & AIRPORT ENGINEERING	3	0	0	3	3	
Program Elective - VII							
1	4SE50: SOFTWARE TRAINING IN STRUCTURAL ENGINEERING	0	0	4	4	2	
2	4CE56: SOFTWARE TRAINING IN CIVIL ENGINEERING	0	0	4	4	2	

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L=Lecture Hrs./wk; T=Tutorial Hrs./wk; P=Practical Hrs./wk; H=Total Contact Hrs./wk; C=Credits of Course

ANNEXURE –II: Syllabi for the courses offered in programme of studies leading to the degree of Bachelor of Technology (Civil Engineering)

BS101: ADVANCED CALCULUS
CREDITS = 5 (LTP: 3,2,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Tutorial / Practical Marks		
			ESE	CE	ESE	CE		
3	2	0	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	08
2	Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Differentiation of Hyperbolic and Inverse Hyperbolic functions, Successive differentiation, standard forms, Leibnitz's theorem and applications, power series, expansion of functions, Indeterminate forms and L'Hospital's rule; Maxima and minima.	08
3	Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.	10
4	Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.	10
5	Sequence and Their Convergence, Convergence and Divergence of Infinite Series, Geometric Series, P-Test, A Necessary Condition for Convergence, Comparison Test, Ratio Test.	06
Total		42

List of References:

1. Weir, M.D. et al., Thomas' *Calculus (11th Edition)*, Pearson Education, 2008.
2. Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
3. Sastry S. S., "*Engineering Mathematics – Vol. I and II*", Prentice Hall of India.
4. Stuart J., "*Calculus*", Cengage Learning, India Pvt. Ltd. (2008).

BS111: ADVANCED CALCULUS
CREDITS - 4 (LTP:3,1,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	1	0	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	08
2	Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Differentiation of Hyperbolic and Inverse Hyperbolic functions, Successive differentiation, standard forms, Leibnitz's theorem and applications, power series, expansion of functions, Indeterminate forms and L'Hospital's rule; Maxima and minima.	08
3	Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.	10
4	Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.	10
5	Sequence and Their Convergence, Convergence and Divergence of Infinite Series, Geometric Series, P-Test, A Necessary Condition for Convergence, Comparison Test, Ratio Test.	06
Total		42

List of References:

1. Weir, M.D. et al., *Thomas' Calculus (11th Edition)*, Pearson Education, 2008.
2. Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
3. Sastry S. S., "*Engineering Mathematics – Vol. I and II*", Prentice Hall of India.
4. Stuart J., "*Calculus*", Cengage Learning, India Pvt. Ltd. (2008).

ES103: BASIC ELECTRICAL ENGINEERING
CREDITS = 4 (LTP:3,0,1)

Course Objectives:

Electricity is the basic requirement for all citizens of a Country. It is also very important for all sectors of Industry, Engineering and Infrastructure. In view of this, it is desirable for all discipline engineering graduates to know the fundamental concepts of electrical engineering. This subject deals with fundamental circuit analysis and solution methods, introduction to electrical machines, power converters and basics of domestic electrical installations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits C	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	70	30	30	20	150

Course Contents:

Unit No	Topics	Teaching Hours
1	DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8
2	AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	8
3	Transformers Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	6
4	Electrical Machines Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	8
5	Power Converters: DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	6

Unit No	Topics	Teaching Hours
6	Electrical Installations Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6
Total		42

List of References:

1. D.P. Kothari and I. J. Nagrath, “*Basic Electrical Engineering*”, Tata McGraw Hill,2010.
2. D.C. Kulshreshtha, “*Basic Electrical Engineering*”, McGrawHill,2009.
3. Ritu Sahdev, *Basic Electrical Engineering*, (ISBN: 9789386173492), Khanna Book Publishing Co.
4. B. L. Theraja, “*A Textbook of Electrical Technology*” - Volume I and II, S. Chand Publishers, 2012
5. L.S. Bobrow, “*Fundamentals of Electrical Engineering*”, Oxford University Press,2011.
6. E. Hughes, “*Electrical and Electronics Technology*”, Pearson,2010.
7. V.D. Toro, “*Electrical Engineering Fundamentals*”, Prentice Hall India, 1989.

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve non-linearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding – slip-ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters –PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switch-gear.

ES110: BASIC MECHANICAL ENGINEERING
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

To Study the fundamentals of mechanical systems and appreciate significance of mechanical engineering in different fields of engineering.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Prime movers and its types, Concept of Force, Torque, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth law and First law	4
2	Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydro, Solar, Wind, and Bio-fuels, Environmental issues like Global warming and Ozone depletion	3
3	Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between c_p and c_v , Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Polytropic process	5
4	Properties of Steam: Steam formation, Types of steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of steam tables, steam calorimeters	6
5	Heat Engines: Heat engine cycle and Heat engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles	5
6	Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories	-
7	Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies	4
8	Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming	3
9	Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistaging	3

Unit No.	Topics	Teaching Hours
10	Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, Vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners	4
11	Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)	-
12	Transmission of Motion and Power: Shaft and axle, Different arrangement and applications of Belt drive; Chain drive; Friction drive and Gear drive	-
13	Engineering Materials: Types, properties and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer	4
Total		42

Note: Topic No. 6, 11 and 12 of the above syllabus are to be covered in Practical Hours.

List of References:

1. N M Bhatt and J R Mehta, *Elements of Mechanical Engineering*, Mahajan Publishing House
2. Pravin Kumar, *Basic Mechanical Engineering*, Pearson Education
3. G.S. Sawhney, *Fundamental of Mechanical Engineering*, PHI Publication New Delhi
4. Sadhu Singh, *Elements of Mechanical Engineering* S. Chand Publication
5. B.K. Agrawal, *Introduction to Engineering Materials* McGraw Hill Publication, New Delhi

ES111: WORKSHOP
CREDITS - 2 (LTP:0,0,2)

Course Objectives:

Introduce the concepts of basic manufacturing processes and demonstrate the conversion of raw material into a finished product.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
0	0	4	2	-	-	60	40	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to workshop and safety aspect: Orientation of the workshop, Introduction to safety aspects to be observed in workshop or industries.	2

Unit No.	Topics	Teaching Hours
2	Machine Shop: Introduction and demonstration of various machine tools such as Lathe, Drilling, Shaping, Slotting, Planning, Milling, Grinding.	20
3	Manufacturing Shops: Carpentry, Fitting, Smithy & Tin Smithy, Welding, Brazing, Soldering, Gas cutting, Casting, Plastic moulding & Glass cutting.	34
Total		56

List of References:

- Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “*Elements of Workshop Technology*”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- Kalpakjian S. And Steven S. Schmid, “*Manufacturing Engineering and Technology*”, 4th edition, Pearson Education India Edition, 2002.
- Gowri P. Hariharan and A. Suresh Babu, “*Manufacturing Technology – I*” Pearson Education, 2008.
- Roy A. Lindberg, “*Processes and Materials of Manufacture*”, 4th edition, Prentice Hall India, 1998.
- Rao P.N., “*Manufacturing Technology*”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

HS102: ENVIRONMENTAL SCIENCE
CREDITS - 0 (LTP:2,2,0)

Rationale:

To inculcate the environmental values translating into pro-conservation actions Honorable Supreme Court of India has made it 'mandatory' to introduce a basic course on environment at the undergraduate level.

Course Objectives:

- Develop awareness about various environmental pollution effects and control measures.
- Create awareness about environmental ethics.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
2	2	0	0	35	15	30	20	100

Course Content:

Unit No.	Topics	Teaching Hours
1	INTRODUCTION TO ENVIRONMENT Definition, principles and scope of Environmental Science. Impacts of technology on Environment, Environmental Degradation, Importance for different engineering disciplines	02
2	ENVIRONMENTAL POLLUTION Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of water pollutants, Effects of water pollutants Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO ₂ , NO _x , Auto exhaust, Effects of common air pollutants Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects Solid Waste: Generation and management Bio-medical Waste: Generation and management E-waste: Generation and management	12
3	GLOBAL ENVIRONMENTAL ISSUES Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change	07
4.	SOCIAL ISSUES AND ENVIRONMENT Role of an individual in prevention of environmental pollution. Environmental ethics: Issues and possible solution. Wasteland reclamation, consumerisms and waste products.	05
5	CONCEPT OF 4R's Principles, Application of 4R's :Reduce, Reuse, Recycle, Recovery	02
Total		28

HS112: ENVIRONMENTAL SCIENCE
CREDITS - 0 (LTP: 2,0,0)

Rationale:

To inculcate the environmental values translating into pro-conservation actions Honorable Supreme Court of India has made it 'mandatory' to introduce a basic course on environment at the undergraduate level.

Course Objectives:

1. Develop awareness about various environmental pollution effects and control measures.
2. Create awareness about environmental ethics.

Teaching and Assessment Scheme

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
2	0	0	0	30	20	00	00	50

Course Content:

Unit No.	Topics	Teaching Hours
1	INTRODUCTION TO ENVIRONMENT Definition, principles and scope of Environmental Science. Impacts of technology on Environment, Environmental Degradation, Importance for different engineering disciplines	02
2	ENVIRONMENTAL POLLUTION Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of water pollutants, Effects of water pollutants Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO ₂ , NO _x , Auto exhaust, Effects of common air pollutants Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects Solid Waste: Generation and management Bio-medical Waste: Generation and management E-waste: Generation and management	12
3	GLOBAL ENVIRONMENTAL ISSUES Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change	07
4.	SOCIAL ISSUES AND ENVIRONMENT Role of an individual in prevention of environmental pollution. Environmental ethics: Issues and possible solution. Wasteland reclamation, consumerisms and waste products.	05
5	CONCEPT OF 4R's Principles, Application of 4R's :Reduce, Reuse, Recycle, Recovery	02
Total		28

BS102: LINEAR ALGEBRA AND FOURIER SERIES
CREDITS = 5 (LTP : 3,2,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Tutorial / Practical Marks		
			ESE	CE	ESE	CE		
3	2	0	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Matrices: addition and multiplication by scalar, matrix multiplication; Linear systems of equations (homogeneous and nonhomogeneous), rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	10
2	Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.	12
3	Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10
4	Periodic function, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Parseval's theorem.	10
Total		42

List of References:

- Howard A. and Chris R., "*Elementary Linear Algebra*", John Wiley & Sons, 2005.
- Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
- Bali N. P. and Goyal M., "*Engineering Mathematics*", Laxmi Publication (Latest Edition).

BS112: LINEAR ALGEBRA AND FOURIER SERIES
CREDITS - 4 (LTP:3,1,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Matrices: addition and multiplication by scalar, matrix multiplication; Linear systems of equations (homogeneous and nonhomogeneous), rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	10
2	Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.	12
3	Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10
4	Periodic function, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Parseval's theorem.	10
Total		42

List of References:

- Howard A. and Chris R., "*Elementary Linear Algebra*", John Wiley & Sons, 2005.
- Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
- Bali N. P. and Goyal M., "*Engineering Mathematics*", Laxmi Publication (Latest Edition).

BS103: PHYSICS
Credits 4 (LTP: 3,0,1)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	70	30	30	20	150

Course Contents:

Unit No	Topics	Teaching Hours
1.	Properties of Matter Concept of Load, Stress and Strain , Hook's Law, Stress-Strain Diagram, Ductility, Brittleness and Plasticity ,Elastic behavior of solids ,Working stress and factor of safety ,Factors affecting elasticity ,Types of Elasticity Twisting couple on a cylinder or wire-shaft, Torsional Pendulum, Cantilever-Depression of Cantilever, Young's modulus by Cantilever ,I-shape Griders, Viscosity and comparison of viscosities	8
2.	Waves, Motion and Acoustics Simple Harmonic motion, Free, forced, resonance, damped and undamped vibration , Damped harmonic motion , Force vibration and amplitude resonance, Velocity resonance and energy intake , Wave motion, transverse and longitudinal vibration , Sound absorption and reverberation, Sabine's formula and usage (excluding derivation) Acoustic of building	10
3.	Ultrasonic and Non destructive testing (NDT) Ultrasonic waves, Properties of ultrasound, Production of ultrasonic waves, Piezoelectric and magnetostriction method, Detection of ultrasound, Application of ultrasound, Introduction of NDT ,Advantages of NDT,NDT through ultrasound	8
4.	Optics Introduction, Huygen's Principle, Superposition of waves and interference of light by wavefront splitting and amplitude splitting, Young's Double slit experiment, Newton's ring, Michelson's Interferometer, Farunhofer diffraction from a single slit and a circular aperture, Rayleigh criterion for limit of resolution and its application to vision, Diffraction grating and their resolving power.	8
5.	Lasers Properties of Laser, Einstein's theory of matter radiation : A and B coefficients, Amplification of light by population inversion, Different types of lasers, gas lasers (He-Ne) solid-state lasers(ruby), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, Applications of lasers in science, engineering and medicine.	8
Total		42

List of References:

1. Dattu R Joshi, *Engineering Physics*, McGraw hill Publications
2. Shatendra Sharma & Jyotsan Sharma, *Engineering Physics* Pearson Publication

3. Barry J Goodno, James M. Gere, *Mechanics of Materials*, SI Edition, 9th Edition, Published: 2018 Print ISBN: 9781337093354
4. A Ghatak, *Optics*, McGraw Hill Education

Suggested Practical List

1. Introduction to Lab
2. Error Analysis in Physical Measurements
3. Optical Fiber for measurement of Numerical Aperture and Acceptance Angle
4. Least Square Fitting.
5. Diffraction and interference experiments (from ordinary light or laser pointers); measurement of speed of light on a table top modulation; minimum deviation from a prism.
6. Measurement of the Distance using Ultrasonic Sensors.
7. Study of Object Detection using Ultrasonic Sensors.
8. Melde's Experiment Transverse and Longitudinal Modes
9. To determine the frequency of given laser source.
10. Frequency of AC Supply-Sonometer method
11. Wavelength of Light -Diffraction Grating Using LASER
12. Acoustic grating method set up for measurement of velocity of ultrasonic waves in liquid
13. Melde's experiment Resonator
14. Study of Damped Simple Harmonic Motion
15. Newton's rings, Determination of using sodium light.
16. Calibration of Spectrometer & determination of unknown wavelength
17. Dispersive curve of a prism
18. Study of Fabry-Perot Etalon
19. Study of Lloyd's Mirror
20. Study of Double Refraction in Calcite Prism

ES106: PROGRAMMING FOR ENGINEERS
CREDITS - 3 (LTP: 1,0,2)

Course Objectives:

To enhance logical thinking and to impart basic programming skills.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
1	0	4	3	35	15	60	40	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Programming Introduction to the idea of algorithm; Introduction to Programming (Flow chart/pseudocode); Computing Software: System Software, Languages, Tools;	2

Unit No.	Topics	Teaching Hours
2	Vectors and Matrices Creations of Vectors and Matrices, Mathematical Operations with Vectors and Matrices: Addition, Multiplication, Determinants, Matrix Inverse; Data Input/Output: Entering a Scalar, String, Vector and Matrix; Input/Output Data files	3
3	Program Flow Control Logical Operators, Writing and evaluation of conditionals and consequent branching, Iteration and loops.	4
4	Basic Algorithm Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs	5
5	Functions Functions (including using built in libraries), Function File, Sub function, Anonymous Function, Inline Function, Passing Array to function	Laboratory
6	Plotting and Graphics 2D Plotting: Annotations and Enhancements, Interactive Plotting, Animation; 3D Plotting: Lines, Surfaces;	Laboratory
Total		14

List of References:

1. Edward B. Magrab and at. al., *An Engineer's Guide to Matlab*, Prentice Hall
2. Brian D. Hahn and Daniel T. Valentine, *Essential MATLAB for Engineers and Scientists*, Third Edition, ELSEVIER
3. E. Balaguruswamy, *Programming in ANSI C*, Tata McGraw-Hill

ES109: ENGINEERING GRAPHICS AND DESIGN
CREDITS - 4 (LTP : 2,0,2)

Course Objectives:

To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
2	0	4	4	35	15	60	40	150

Details of Assessment Instruments under CE Practical Component:

Sketch book: 10 marks, Sheet: 10 marks

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Engineering Graphics: Drawing instruments and accessories, BIS – SP 46.	2 (Lab Hours)
2	Use of plane scales, Diagonal Scales.	2
3	Orthographic Projections: Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view	4
4	Engineering Curves: Classification and application of Engineering Curves, Construction of Conics, Cycloidal Curves, Involute and Spirals along with normal and tangent to each curve	4
5	Projections of Points and Lines: Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes	4
6	Projections of Planes: Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane	4
7	Projections of Solids, Section of Solids and Development of Surfaces: Classification of solids. Projections of solids (Cylinder, Cone, Pyramid and Prism) along with frustum with its inclination to one reference plane and with two reference planes, Section of such solids and the true shape of the section, Development of surfaces	7
8	Isometric Projections and Isometric View or Drawing: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing of objects	3
9	Computer Aided Drawing: Design concepts, Introduction to AutoCAD, Basic commands for 2D drawing like: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dimension style, etc. Industrial Drawing symbols, Program specific commands and tools.	6 (Lab Teaching)
Total		28

List of References:

1. N.D.Bhatt, “*Engineering Drawing*”, 53rd Edition, 2014, Charotar Publishing house Pvt. Ltd. Anand, and Gujarat.
2. P.J.Shah, “*A Text Book of Engineering Graphics*” S.Chand & Company Ltd. New Delhi.
3. P.S.Gill, “*A Text Book of Engineering Drawing*, S.K.Kataria & Sons, Delhi.
4. B. Agrawal and C M Agrawal, “*Engineering Drawing*”, Tata McGraw Hill, New Delhi.

ES115: BASIC CIVIL ENGINEERING
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

1. Impart knowledge of surveying & Construction.
2. Develop basic concepts of building construction.
3. Appraise about the modes of transportation.
4. Develop basic concepts of water harvesting

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	70	30	30		20

Course Contents:

Unit. No.	Topics	Teaching Hours
1	INTRODUCTION TO CIVIL ENGINEERING Introduction, Branches and Scope of civil engineering, Role of Civil Engineer, Units of measurement, Unit conversion (Length, Area, Volume).	02
2	CIVIL ENGINEERING MATERIALS Introduction of civil engineering materials and classification. Properties, uses and list of tests of materials: Brick, Cement, Aggregate, Mortar, Concrete, Timber and Metal.	06
3	BUILDING PLANNING AND CONSTRUCTION Concept of building plan and building drawing, Principles of planning and architecture, Preparation and study of one room building planning and drawing. Concept of main stack holders: client, contractor and consultant. Building Construction: Types of building, Components of building & its functions, types of loads on building, load bearing and framed structure, Introduction to electrical layout, water supply, plumbing and sanitation. Concept of HVAC, Nominal dimensions for rooms, doors, windows, ventilators and various levels of constructions in a building.	12
4	SURVEYING AND LEVELLING Introduction, Fundamental principles, Classification. Linear measurement: Instruments used, Chaining on plane ground, Offset, Ranging. Angular measurement: Compass-Instrument used Meridian, Bearing, and Local attraction. Leveling: Instrument used, Terminology, Types of leveling, and Methods of leveling, Introduction to contour, Modern tools: Plannimeter. Introduction to Theodolite, Total Station, Introduction to GPS, GIS & RS	10
5	WATER RESOURCES ENGINEERING AND TRANSPORTATION SYSTEM Hydrologic Cycle, Sources of water, Introduction to Hydraulic Structures, Classification of canals, Water Conservation. Introduction to modes of transportation: Roadway and Railways. Cross section of roadway and functions of each component, cross section of railway track and functions of each component.	8

Unit No.	Topics	Teaching Hours
6	ADVANCEMENTS IN CIVIL ENGINEERING: Green building, Energy efficient building, Smart city and its features, Mass Transportation systems-BRTS, Metro, Features of Earthquake resistant structures, Rain water harvesting systems.	4
Total		42

List of References:

1. Dr. B. C. Punmia, Ashok kumar Jain, Arunkumar Jain, *Surveying, Vol. I*, 16th Edition. Publisher: Laxmi Publication Delhi.2005.
2. Duggal S. K., *Surveying Vol. I*, Tata McGraw Hill Publication, New Delhi.
3. Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain, “*Building Construction*”, 5th Edition, Laxmi Publication. Delhi.-ISBN-81-7008-053-3
4. S. K. Duggal, “*Building Materials*”, New Age International Publishers, 2008 ISBN (13) : 978-81-224-2975-6
5. Dr. R. K. Jain and Dr. P. P. Lodha, “*Elements of Civil Engineering*, 1st edition, McGraw Hill Education, India Pvt.Ltd.2014.
6. F.S.Umrigar and J.H.Patel, “*Basic Civil Engineering*”, 2nd Edition, Atul Prakashan, Ahmedabad, 2004.
7. Relevant IS codes and National Building Code.

HS101: ENGLISH
CREDITS = 3 (LTP : 2,0,1)

Course Objectives:

To acquaint BE students with the basics of English. The curriculum intends to familiarize students with LSRW Skills and provides exposure and practice in all four aspects to equip them with the useful language competencies and confidence to communicate well. The course accentuates good drilling in practicum in order to enable students to learn, perform and enhance their accuracy and skills in English language to excel in their field of specialization.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
2	0	2	3	35	15	30	20	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Vocabulary Building The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations. General English words and their technical equivalent words	4

Unit No.	Topics	Teaching Hours
2	Basic Writing Skills Sentence Structures. Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence and Cohesion, Organizing principles of paragraphs in documents, Techniques for writing precisely	6
3	Identifying Common Errors in Writing Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés, Collocations	6
4	Nature and Style of sensible Writing Types of writing- descriptive, narrative, argumentative, Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion	4
5	Writing Practices Paragraph Writing: Topic sentence, supportive sentences and conclusion, Précis Writing, Essay Writing	4
6	Language Skills (This unit involves interactive practice sessions In Language Lab) Listening Comprehension, Reading Comprehension, Writing Skills (Permission letter, Invitation letter, Acknowledgement letter, Reporting complaint/grievance), Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues Communication at Workplace, Interviews, Formal Presentations, Public Speeches: Talking about self (Professional Setting, social setting), Introduction of Speakers, Vote of thanks	6
Total		30

Language Lab Activities

Sr. No.	Language Laboratory Activities	Duration	Nature of Activities
1.	Listening Comprehension	1	Individual Task
2.	Reading aloud stories - developing dialogues - deciding roles and enactment and performance analysis	2	Group work
3.	Dialogue Writing (Cue cards)	1	(Team Work- Teacher Guided)
4.	Reading Comprehension	2	Individual Tasks & Group Tasks (Digital Language Lab)
5.	Note Taking and Note Making	1	
6.	Book/Story Review/Article Review	1	
7.	Group Discussion	1	
8.	Short Oral Presentations (preferably recorded for self-analysis)	1	
9.	Extempore (preferably recorded for self-analysis)	1	Individual Task

Sr. No.	Language Laboratory Activities	Duration	Nature of Activities
10.	ICT Based presentations/ Technology based presentation	2	1 in Group & 1 individual
11.	Graph/Chart Interpretation	1/2	Individual Task
12.	Diagram illustration	1/2	Individual Task

List of References:

1. Michael Swan, Practical English Usage. OUP. 1995.
2. F.T. Wood, Remedial English Grammar. Macmillan.2007
3. William Zinsser, On Writing Well, Harper Resource Book. 2001
4. Liz Hamp-Lyons and Ben Heasley, Study Writing. Cambridge University Press. 2006.
5. Sanjay Kumar and PushpLata, Communication Skills Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press
7. Michael McCarthy& Felicity O' Dell, English Vocabulary in Use. CUP 1994
8. Michael McCarthy& Felicity O' Dell, English Collocations in Use. CUP 2005
9. Writing Skills: Success in 20 Minutes a Day. .GP Goodwill's 2013
10. Judith F. Olson, Write Better; Speak better. Reader's Digest.1998
11. How to Say It, Third Edition: Choice Words, Phrases, Sentences, and Paragraphs for Evry Situation Original Edition, Rosalie Maggio, Prentice Hall Press, 2009.

2BS02: DIFFERENTIAL EQUATIONS AND STATISTICS
CREDITS - 4 (LTP:3,1,0)
2nd Year, B. Tech. (Civil, Mechanical, Production)

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Ordinary differential equations of higher orders Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	10
2	Partial Differential Equations First order partial differential equations, solutions of first order linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and	12

Unit No.	Topics	Teaching Hours
	boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to solve partial differential equations	
3	Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
4	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
5	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4
Total		42

List of References:

1. Erwin Kreyszig, “*Advanced Engineering Mathematics*”, 9th Edition, John Wiley & Sons, 2006.
2. Chandrika Prasad and Reena Garg, “*Advanced Engineering Mathematics*”, Khanna Book Publishing Co. (P) Ltd., Delhi
3. N.P. Bali and Manish Goyal, “*A text book of Engineering Mathematics*”, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, “*Higher Engineering Mathematics*”, Khanna Publishers, 35th Edition, 2000.
5. W. E. Boyce and R. C. Di Prima, “*Elementary Differential Equations and Boundary Value Problems*”, 9th Edition, Wiley India, 2009.
6. S. C. Gupta, V. K. Kapur, “*Fundamental of Statistics*”, Sultan Chand & Sons, India,
7. S. Ross, “*A first course in Probability*”, Pearson Education India, 2002.
8. Richard A. Johnson, Miller and Freund's – “*Probability and Statistics for Engineers*”, Prentice Hall of India, 2011.

Course outcome:

At the end of this course students will be able to

1. Understand effective mathematical tools for the solutions of ordinary and partial differential equations
2. Analyze and solve ordinary and partial differential equations.
3. Apply effective mathematical tools for the solutions of ordinary and partial differential equations.
4. Understand the concepts and tools of Statistics.
5. Analyze and solve various engineering problems through the tools of Statistics.
Adapt tools of applied statistics and sampling theory and apply them in engineering problems.

2SE01: CONSTRUCTION MATERIAL AND CONCRETE TECHNOLOGY
CREDITS - 4 (LTP:3,0,1)

Course Objective:

1. To impart the knowledge of properties of construction materials and their significance.
2. To enable the modification of overall properties of fresh and hardened concrete and its sustainability in field.
3. To design the concrete mix of different grades and to impart the knowledge of destructive and non-destructive testing techniques.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Construction Materials: Historic development, Advantages of concrete over other materials, Requirements, Types, Uses, Properties and Importance of Construction Materials: Bricks, Stones, Blocks, Lime, Ferrous, Metals of different grades: Mild Steel, Tor Steel and TMT bars, Timber and Wood based products, Terrazzo, Mosaic Tile, Ceramic Tiles, Vitrified Tiles and Natural Stone flooring.	07
2	Concrete Making Materials: Cement: Chemical composition, Hydration of cement, structure of hydrated cement, Tests on cement, Different types of cements. Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining aggregates, Specified grading, Testing of aggregates. Water– General requirements & limiting values of impurities. Admixtures- Additives & admixtures, types, need and benefits. Mineral admixtures- Fly ash, silica fume, blast furnace slag and other pozzolonic materials. Chemical Admixtures- Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and dosage.	10
3	Fresh Concrete: Properties of fresh concrete, Definition and Measurement methods of workability as per IS, factors affecting workability, Segregation & Bleeding, Slump loss, Re-tempering, Site preparations for concreting, Mixing, Conveying, Placing, Compaction, Finishing of concrete. Curing & various methods of curing	08
4	Hardened Concrete: Strengths of hardened concrete. Compressive, Tensile & Flexural strength, & Bond strength, standard test methods as per IS and ASTM, Failure mechanism under compression & tension, Stress-Strain behavior of concrete, Overview of	06

Unit No.	Topics	Teaching Hours
	Modulus of elasticity, Dimensional stability –Creep & Shrinkage, Non-Destructive methods of testing of Hardened Concrete.	
5	Mix design of Concrete : Principles of concrete mix design, Parameters and factors influencing mix design, Indian Standard methods of mix design, Acceptability criteria, variability of results.	05
6	Durability & Permeability of concrete: Causes of deterioration in concrete and durability problems, Factors affecting durability, Carbonation induced & corrosion induced cracking, Alkali-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability problems associated to Marine environment.	03
7	Special Concrete: Advances and future trends in concrete, Overview of Sustainability and Concrete development Advanced cement based composites, Fiber reinforced concrete, Polymer modified concrete, Self-compacting concrete, Light weight concrete, High strength concrete, Light-weight & heavy weight concrete, High volume fly ash concrete. Special concreting methods: Pumped concrete, Ready mix concrete, Under-water concreting, Hot & cold weather concreting, Precast concrete.	06
Total		45

List of References:

1. Neville A.M. “*Properties of Concrete*” Pearson publishing house.
2. Kumar Mehta/Paulo.J. M. Monteiro, “*Concrete Microstructure, Properties and Materials*” Indian Concrete Institute (ICI) Chennai.
3. Shetty M. S., “*Concrete Technology*”, S.Chand & Co. Ltd., New Delhi.
4. Gambhir M. L., “*Concrete Technology*”, S.Chand & Co. Ltd., New Delhi
5. A.R.Santhakumar, “*Concrete Technology*”, Oxford University Press. New Delhi
6. Rangwala, “*Engineering Materials*”, ISBN-13: 978-9380358796, Charotar Publishing House, 2012

Course Outcomes (COs):

1. Create understanding about the use of different construction materials and latest development in ordinary as well as special concrete.
2. Design the concrete mix of desired workability strength and sustainability for actual field requirements using different ingredients.
3. Apply and analyze different types of tests in lab as well as field to assess the strength and sustainability of concrete structures.

2ES01: MECHANICS OF SOLIDS
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

This course is to introduce the basic principles of engineering mechanics and Mechanics of deformable bodies with emphasis on their analysis and application to practical engineering problems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topic	Teaching Hours
1	<p>Introduction & Fundamentals of Statics: Definition of space, time, particle, rigid body, deformable body. Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces. Fundamental Principles of mechanics: Principle of transmissibility, Principle of superposition, Law of gravitation, Law of parallelogram of forces. Coplanar concurrent forces: Resultant of coplanar concurrent force system by analytical and graphical method, Law of triangle of forces, Law of polygon of forces, Equilibrium conditions for coplanar concurrent forces, Lami's theorem. Application of statically determinate pin – jointed structures (Trusses). Coplanar non-concurrent forces: Moments & couples, Characteristics of moment and couple, Equivalent couples, Force couple system, Varignon's theorem, Resultant of non-concurrent forces by analytical method, Equilibrium conditions of coplanar non-concurrent force system.</p>	09
2	<p>Applications of fundamentals of statics Statically determinate beams: Types of loads, Types of supports, Types of beams; Determination of support reactions, Relationship between loading, shear force & bending moment, Bending moment and shear force diagrams for beams subjected to various types of loads and their combinations; Point of contra-flexure, point & magnitude of maximum bending moment, maximum shear force.</p>	07
3	<p>Centroid and moment of inertia: Centroid: Centroid of plane areas and volumes, Examples related to centroid of composite geometry, Pappus – Guldinus first and second theorems. Moment of inertia of planar cross-sections: Derivation of equation of moment of inertia of standard lamina using first principle, Parallel & perpendicular axes theorems, polar moment of inertia, and radius of gyration of areas. Examples related to moment of inertia of composite geometry</p>	05

Unit No.	Topic	Teaching Hours
4	Simple stresses & strains Basics of stress and strain: Application of normal stress & strains: Homogeneous and composite bars having uniform & stepped sections subjected to axial loads and thermal loads, analysis of homogeneous prismatic bars under multidirectional stresses. Principle stresses: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications.	07
5	Stresses in Beams: Flexural stresses : Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I, T, Angle, channel sections. Shear stresses: Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections.	06
6	Columns and Struts: Buckling of columns, different end conditions, effective length, least radius of gyration, Euler's and Rankine's formulae	03
7	Direct and Bending stresses: Members subjected to eccentric loads, middle third rule, kernel of section, chimney subjected to wind pressure, Retaining walls, dams subjected to hydraulic pressure	04
8	Torsion: Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity.	04
9	Physical & Mechanical properties of materials: (laboratory hours) Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending, and torsional & shear loading, Toughness, hardness, Ductility, Brittleness	(00 theory hours)
Total		45

List of References:

1. S. B. Junnarkar and H. J. Shah, “*Applied Mechanics*”, Charotar Publishing House Pvt. Ltd.
2. S. B. Junnarkar and H. J. Shah, “*Mechanics of Structure Vol. I*”, Charotar Publishing House Pvt. Ltd.
3. P. J. Shah, “*Mechanics of Solids*”, S. Chand, New Delhi.
4. N. K. Arora, “*Mechanics of Solids*”, Books India Publications, Ahmedabad.
5. M. N. Patel, P. V. Patel, C. S. Sanghvi, J. S. Thakur, “*Mechanics of Solids*”, Mahajan Publishing House, Ahmedabad.
6. Popov E.V., “*Engineering Mechanics of Solids*” Prentice Hall of India, New Delhi.
7. Hibbler R. C., “*Structural Analysis*” Pearson Education.

Course Outcomes:

After learning the course the students should be able to:

1. Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering.

2. Determine centroid and moment of inertia of a different geometrical shape and able to understand its importance.
3. Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.

2CE01: FLUID MECHANICS
CREDIT - 4 (LTP:3,0,1)

Course Objectives:

1. Understand the properties of fluids
2. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy.
3. Provide a first level exposure to the students to fluid kinematics and dynamics.
4. Apply continuity, energy and momentum equations to engineering problems in the use of orifice, flow meters and notches.
5. Calculate surface resistance in laminar and turbulent flows and understand the basic concept of boundary layer theory.
6. Evaluate the head loss in pipes.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Topics	Teaching Hours
1	Fluid Properties: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; Vapour pressure, Cavitation; Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility.	04
2	Fluid Statics: Fluid Pressure: Pressure at a point, Pascal’s law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometers, Single Column Manometer, U-Tube Differential Manometer, Micro-manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined plane surfaces, and on curved vanes. Buoyancy and stability of floating bodies. Relative equilibrium- Uniform linear acceleration in horizontal and vertical directions, fluid rotation around vertical axis.	11
3	Fluid Kinematics: Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows, Free and Forced vortex flow; Stream line, path	05

Unit No.	Topics	Teaching Hours
	line, streak line and stream tube; One-, two- and three- dimensional continuity equations in Cartesian coordinates. Stream function, Velocity potential function and Flow-net.	
4	Fluid Dynamics: Surface and body forces; Equations of motion-Euler's equation; Bernoulli's equation-derivation; Energy Principle; Practical applications of Bernoulli's equation: Orifice, pitot tube, venturimeter, orificemeter; Momentum principle- Impact of liquid jet on plane surface and curved vane, Forces exerted by fluid flow on pipe bend.	10
5	Laminar and Turbulent Flow: Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Flow through Pipes: Loss of head through pipes, Darcy-Wiesbach equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, power transmission through pipes, nozzles.	10
6	Boundary Layer Analysis- Assumptions and concept of boundary layer theory. Boundary layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Lift and drag forces.	5
Total		45

List of References:

1. Jain A. K., "*Fluid Mechanics*", Khanna Publishers, Delhi.
2. Modi P. N. and Seth S. M., "*Hydraulics and Fluid Mechanics including Hydraulics Machines*", Standard book house, Delhi.
3. Subramanya K., "*Theory and Applications of Fluid Mechanics*", Tata McGraw Hill.
4. Kumar D. S., "*Fluid Mechanics and Fluid Power Engineering*" (SI edition), S. K. Kataria & sons, Delhi.
5. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, "*Fluid Mechanics and Machinery*", Oxford University Press, 2010.
6. R. L. Daugherty, J. B. Franzini and E. J. Finnemore, "*Fluid Mechanics with Engineering Applications*", International Student Edition, McGraw Hill.

Course Outcomes:

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

1. Understand the importance of different fluid properties.
2. Solve manometer problems, calculate hydrostatic forces on plane and curved surfaces and forces on floating bodies.
3. Use principles of mass, energy and momentum conservation to calculate acceleration, discharge, pressure variation and forces in moving fluids.
4. Understand laminar and turbulent flow through pipes and basic concepts of boundary layer flow.
5. Solve hydraulic pipe flow problems for pipes connected in series and parallel.

2HS01: PROFESSIONAL SOFT SKILLS
CREDITS – 2 (LTP:1,0,1)

Course Objectives:

To equip students with Professional soft skills like communication, interviews, group discussion, presentation etc. The subject also will enable them to learn interpersonal skills, work culture and effective management of time and stress. .

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
1	0	2*	2	30	20	20		30

*Will be conducted in Class Room

Course Contents:

Unit No.	Topics	Teaching Hours
1	Communication skills: Process of communication, Flows of Communication in organization, Barriers to communication (Formal Flow – Upward, Downward, lateral and diagonal, Strategies to improve Organizational Communication, Effectiveness in Managerial Communication, and importance of technical communication, Nonverbal communication	2
2	Interviews and Meetings: Types of interview, General preparation for interview, Gathering information about the company, knowing about the role/job position, Types of interviewing questions, Non-verbal communication to win the interview.	2
3	Meeting and Conferences: Planning a meeting (Agenda and notice), Conducting a meeting, Post meeting actions (Minutes), Planning & Conducting a Conference (anchoring and Report writing), and Video/web conferences, Identifying Strengths and Weakness	2
4	Presentation Skills and Letters: Effective Presentation strategies: Purpose, analyzing the audience and locale, organizing the content Oral presentation, Graphic presentation, Presentation aids, Personality Development. Newsletters, technical article and business letters. Technical Reports, characteristics, Importance, objectives, categories of report, format structure of reports, types of reports	4
5	Group Discussion: Qualities needed for effective group discussion. Email etiquettes, Telephone Etiquettes, Role and responsibility of engineer, Work culture in jobs. Work place, rights and responsibilities	3

Unit No.	Topics	Teaching Hours
6	Time and Stress Management: Concept & Importance of Time Management, Techniques of Time Management, and Concept & Importance of Stress Management, Techniques of Stress Management, and Overcoming Stage fear and Interpersonal Relationships	2
Total		15

Activities for Practical (Conducted in Class Room)

Sr. No	Activity	Duration (Hours)	Nature of Activity
1	Mock interview	1	Individual
2	Letter Writing	1	Individual
3	Group Discussion	2	Group
4	Group Discussion	2	Group
5	Presentation	2	Individual
6	Presentation	2	Group
7	CV preparation	1	Individual
8	Extempore (over coming stage fear)	1	Individual
9	Aptitude Test	1	Individual
10	Writing skills	1	Individual

List of References:

1. G,S,B,K Babu Rao, “*Business Communication and Soft Skill*”, Himalaya Publishing house (1st Edition)
2. Diane Hacker, “*Pocket Style Manual*”, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, “*You Can Win*”, Macmillan Books, New York, 2003.
4. Raman Sharma, “*Technical Communications*”, Oxford Publication, London, 2004.
5. “*Ethics in Engineering practice and research*” (2nd Edition) by Caroline Whit beck Cambridge
6. Sharma, R. and Mohan, K. “*Business Correspondence and Report Writing*”, TMH New Delhi 2002.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the communication process and communicate professionally.
2. Participate in Group Discussion and evaluate the same.
3. Develop Interview skills and Write Reports
4. Make effective Presentations.
5. Conduct meetings and conferences.
6. Effectively manage time and stress.

2CE02: ENGINEERING SURVEYING
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

1. Understand conventional and modern methods of surveying.
2. Develop ability to transform basic concept of surveying to field practice.
3. Interpret plans and maps for planning and setting out works.
4. Understand modern surveying techniques for mapping.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p>Basics of Measurement & Mapping</p> <p>Linear Measurement: Linear measurement in horizontal plane; measurement of distance, chainage, offset and linear measurement in vertical plane; levelling. (Recap)</p> <p>Angular Measurement: Angular measurement in horizontal plane; bearings (Recap), angles of triangle or traverse and angular measurement in vertical plane; angles w.r.t. horizontal axis or zenith.</p> <p>Mapping: Concept of projection system and spheroid (mathematical and physical). Understanding coordinates: Geographic coordinate (Latitude, Longitude, and Altitude) and planimetric coordinate (X, Y, Z or N, E, Z).</p>	5
2	<p>Surveying using Conventional Instruments</p> <p>Theodolite Survey: Introduction, the vernier transit theodolite, measuring horizontal and vertical angles, methods of traversing, closing error, computation of latitudes and departure, check in closed and open traverse, balancing of traverse, Gale's table, omitted measurements.</p> <p>Tacheometric survey: Introduction, purpose, principle, instruments, stadia constants, methods, field work, errors and precisions.</p> <p>Trigonometric levelling: Indirect levelling, leveling on steep ground-methods, base of the objects accessible and inaccessible.</p> <p>Plane table Surveying: Principle, instrument, Method and sources of error.</p>	10
3	<p>Surveying using Modern Instruments</p> <p>EDM: EDM Techniques and instruments.</p> <p>Digital Level: Introduction, functional elements and leveling using digital level.</p> <p>Digital Theodolite: Functional elements and angle measurement using digital theodolite.</p> <p>Total Station: Functional elements, types of TS, Working with TS.</p>	7
4	<p>Modern Techniques in Surveying & Mapping:</p> <p>Digital Photogrammetry: Introduction, types of photogrammetry, surveying using aerial photogrammetry.</p> <p>Remote Sensing: Introduction, types of remote sensing, remote sensing development in India, Applications of remote sensing in Civil engineering.</p> <p>Geographical Information System (GIS): Introduction, datasets and data structures, GIS applications.</p> <p>Global Navigation Satellite System (GNSS): Introduction to GPS,</p>	13

Unit No.	Topics	Teaching Hours
5	<p>GLONASS, Galileo, COMPASS and GAGAN. GPS Segments, Positioning techniques, GNSS application.</p> <p>Applications of Surveying:</p> <p>Setting Out of Curves: Setting out of Curves: Introduction, types, setting out methods of simple circular curve, elements of compound and reverse curves, transition curve, types of transition curve, combined curve, types of vertical curves.</p> <p>Computation of Areas & Volume: Computation of Area: Methods to compute area of traverse- area from cross sections, Trapezoidal rule- Simpson's rule, Methods to compute area from plans and maps, use of planimeter. Computation of Volumes- Volume from cross-sections, Trapezoidal and Prismoidal formulae, Determination of capacity of reservoir.</p> <p>Setting Out Works: Setting out Works: Building, Culvert, Bridge and Tunnel.</p>	10
Total		45

List of References:

1. R.Subramanian “*Surveying and leveling*” 2nd edition, 2013, Oxford university press, New Delhi.
2. Dr. A.M. Chandra, “*Plane Surveying*”, 2007, New Age International (P) Ltd., New Delhi.
3. Dr. A.M. Chandra, “*Higher Surveying*”, 2006, New Age International (P) Ltd., New Delhi.
4. Dr. B.C. Punamia, “*Surveying Vol. I&II*”, 2016, Laxmi Publishers. New Delhi
5. S.K. Duggal “*Surveying, Vol. I, II and III*”, 2009, Tata Mcgraw Hill, New Delhi.
6. B. Bhatta, “*Remote Sensing and GIS*”, Oxford University Press, New Delhi.
7. Dr. A.M. Chandra, “*Remote Sensing and GIS*”, Narosa Publishers, New Delhi.
8. Sateesh Gopi, R. Sathikumar, and N. Madhu, “*Advanced Surveying*”, Pearson Education India, 2007.

Course Outcomes (Cos)

At the end of this course students will be able to ...

1. Use conventional instruments to map the parcels of land.
2. Show effectiveness of modern surveying instruments to improve accuracy and to save time and for surveying operations.
3. Analyze the problems of computation of area and volume, setting out of curves and works using surveying knowledge.
4. Appreciate the use of modern techniques for surveying and mapping.

2BS03: NUMERICAL METHODS IN CIVIL ENGINEERING
CREDITS - 2 (LTP: 1,0,1)

Course Objectives:

1. Teach concepts of numerical methods.
2. Application of numerical methods in civil engineering

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
1	0	2	2	30	20	20	30	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Solution of a System of Linear Equations: Gauss-Jacobi Method and Gauss-Siedel method, LU decomposition method, Cholesky's Symmetric break method.	03
2	Roots of Algebraic and Transcendental Equations: Bisection Method, Secant and Newton-Raphson methods.	03
3	Numerical Integration: Simpson's formulae, Gaussian quadrature formulae.	03
4	Finite Differences and Interpolation: Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward, Backward interpolation formulae, Newton's divided and Lagrange's formulae for unequal intervals.	03
5	Numerical solution of Ordinary Differential Equations: Euler method, Modified Euler method, Fourth order Runge-Kutta method	03
Total		15

List of References:

1. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers", Fifth Edition, McGraw-Hill.
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley (1999)
3. C.E. Froberg, "Introduction to Numerical Analysis", 2nd Edition, Addison-Wesley, 1981
4. S. D. Conte and Carl de Boor, "Elementary Numerical Analysis-An Algorithmic Approach" (3rd Edition), McGraw-Hill, 1980
5. S.C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons.
6. Gerald C. F. and Wheatley P.O., "Applied Numerical Analysis", 5th Edition, AddisonWesley, Singapore, 1998.

Course Outcomes (COs):

1. Solve civil engineering problems using numerical methods.
2. Use computational soft tools.

2CE03: HYDRAULIC ENGINEERING
CREDITS – 4 (LTP: 3,0,1)

Course Objectives:

1. Understand turbulent flow (analysis) in pipes and open channels.
2. Solve three reservoir problem, pipe networks problems and understand water hammer phenomenon in pipes.
3. Design hydraulically most efficient channel sections.

4. Solve non-uniform flow problems and hydraulic jump phenomenon in open channel flows.
5. Understand the concept of dimensional analysis and model testing.
6. Study different hydraulic machines with their working principles.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Topics	Teaching Hours
1	Flow through Pipes: Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram. Branching of pipes, three reservoir problem, Analysis of pipe networks-Hardy Cross method, Water hammer phenomenon in pipes and its control measures.	12
2	Open Channel Flow: Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow- Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient. Hydraulically Most efficient channel section.	08
3	Non-Uniform Flow in open Channels- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and direct integration method. Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.	13
4	Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity. Buckingham's Pi method: Dimensionless groups. Similitude, Non-dimensional numbers, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.	06

Unit No.	Topics	Teaching Hours
5	Hydraulic Machines: Pumps and Turbines, Types and Working principles. Introduction to Computational Fluid Dynamics.	06
Total		45

List of References:

1. Modi P. N. and Seth S. M., “*Hydraulics and Fluid Mechanics including Hydraulics Machines*”, Standard book house, Delhi.
2. Jain A. K., “*Fluid Mechanics*”, Khanna Publishers, Delhi.
3. Subramanya K., “*Open Channel Flow*”, Tata McGraw Hill.
4. Kumar D. S., “*Fluid Mechanics and Fluid Power Engineering*” (SI edition), S. K. Kataria & sons, Delhi.
5. Chow V. T., “*Open Channel Hydraulics*”, Tata McGraw Hill.
6. Burnside, C.D., “*Electromagnetic Distance Measurement,*” Beekman Publishers, 1971.

Course Outcomes:

At the end of this course students will be able to ...

1. Solve pipe flow problems for branching pipes and pipe network; and understand the analysis of turbulent flows including water hammer phenomenon.
2. Apply the knowledge of fluid mechanics to address the uniform flow problems in open channels.
3. Solve the problems of gradually and rapidly varied flows in open channels under steady state conditions.
4. Perform dimensional and model analysis for different fluid flow problems.
5. Understand the functions and working principles of hydraulic machineries (pumps and turbines).

2SE02: GEOTECHNICAL ENGINEERING
CREDITS – 2.5 (LTP: 2,0,0.5)

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
2	0	1	2.5	30	20	20	30	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Soil and soil mechanics, origin and nature of soils, IS classification on the basis of size of particles, soil structures.	3
2	Phase diagrams: Basic definitions of terms relating physical properties of soils, different relationships and their derivations, numerical.	5

Unit No.	Topics	Teaching Hours
3	Classification of soils: Index properties, classification of fine grained and coarse grained soils, field identification tests.	5
4	Soil water: Free water and held water, Structural water and adsorbed water.	1
5	Permeability and Seepage: Darcy's law, factors affecting permeability, laboratory and field permeability tests, permeability of stratified soils, use of flow net in 2-D flow conditions.	4
6	Effective Stress Principle: Total stress, neutral stress and effective stress, Critical hydraulic gradient, quick sand condition, Capillary phenomenon.	4
7	Compaction: Factors affecting compaction, Laboratory and Field Compaction of fine grained and coarse grained soils, field control of compaction.	4
8	Subsurface Investigation: Objectives of exploration, planning of exploration program, methods of exploration, types of soil samples and soil samplers, depth of exploration, field penetration tests: SPT, SCPT, DCPT. Bore log and report writing.	4
Total		30

List of References:

1. Gopal Ranjan, Rao A.S.R “*Basic and Applied Soil Mechanics*”, New Age Int. (P) Ltd.
2. Das Braja M., “*Principles of Geotechnical Engineering*”, CENGAGE Learning
3. P. Purushothama Raj, “*Soil Mechanics & Foundation Engineering*”, Pearson Education
4. C. Venkatramaiah, “*Geotechnical Engineering*”, New Age Int. (P) Ltd.
5. Arora K. R., “*Soil Mechanics & Foundation Engineering*”, Std. Publisher

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand basic definitions, relationships and apply the knowledge to solve different geotechnical problems.
2. Analyze the soil behavior under hydrostatic and hydrodynamic conditions.
3. Apply the process and principles of compaction for various field situations.
4. Understand the importance of soil investigation and apply it to different type of projects.

2SE03: STRUCTURAL ANALYSIS - I
CREDITS - 2.5 (LTP: 2,0,0.5)

Course Objectives:

To impart knowledge of structural analysis for simple structures by manual methods.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
2	0	1	2.5	30	20	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Fundamentals of Statically Determinate and Indeterminate Structures: Introduction and types of statically determinate & indeterminate structures. Static and kinematic indeterminacy, stability of structures, Principle of superposition and Maxwell's reciprocal theorems. Computation of internal forces in statically determinate Structures such as plane frame and grids.	06
2	Strain Energy: Resilience, Proof resilience, modulus of resilience. Strain energy due to axial gradual, sudden and impact loads. Strain energy for flexure, Shear and Torsion.	03
3	Displacement of Structures: Differential equation of elastic curve, relation between moment, slope and deflection, Double integration method, Macaulay's method, Moment area method and Conjugate beam method, Castigliano's theorems and Unit Load Method for beam, plane frame and plane truss.	10
4	Influence lines for Structures: Introduction to influence line diagrams for support reaction, Shear force and bending moment for determinate beams for various types of loading conditions. Influence line diagrams for members of trusses. Muller Breslau Principle, Influence line diagrams for indeterminate beams.	06
5	Arches and Cables: Calculation internal forces in cables and three hinged arches. Parabolic, Circular and Segmental arches subjected to various types of loading. Two hinged parabolic arch.	05
Total		30

List of References:

1. Junarkar S.B. and Shah H.J.; "*Mechanics of Structures Vol-I*", Charotar publishing house, Anand.
2. Bhavikatti S S, "*Structural Analysis*" New age publications.
3. Patil H.S., Patil Y.D. and Patel Jignesh, "*Structural Analysis-I*", Synergy Knowledgeware.
4. Popov E.P., "*Engineering Mechanics of Solids*" Prentice Hall of India, New Delhi.
5. Hibbler R C, "*Structural Analysis*" Pearson Education.
6. Wang C. K., "*Indeterminate Structures*", McGraw Hill.
7. www.nptel.iitm.ac.in/courses/

Course Outcomes (COs):

At the end of this course students will be able to.

1. Understand the fundamentals of structures and compute internal forces as well as displacements in statically determinate structures.
2. Apply the concept of Strain Energy to compute displacements in statically determinate structures.
3. Understand the influence line diagrams of various quantities for beams and members of trusses.
4. Analyze different arches and cables under various loading conditions.

2CE04: ENGINEERING GEOLOGY
CREDITS - 3.5 (LTP: 3,0,0.5)

Course Objectives:

The objectives of the course are to:

1. Identify earth constituents their genesis and physical - mechanical properties
2. Evaluate geological dynamic processes and their influence
3. Diagnose geological and tectonic structures, causes and impact on civil structure.
4. Evaluate stress and strain on earth material with respect to rock mechanic
5. Appreciate advance geological explorations methods and techniques in civil engineering projects

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	1	3.5	60	40	20	30	150

Course Content:

Unit No.	Topics	Teaching Hours
1	<p>General & Physical Geology: Introduction: Scope of Geology and branches, Objectives of Engineering Geology Dynamic Earth: Surface features and internal structure of the Earth ; Work of natural agencies and associated features: Earthquakes: Definitions, Basics of earthquake, Causes of earthquake, Earthquake zones of India ; Plate tectonics: Concepts and plate boundaries, Case studies Mass Movement: Definition, Types, Causative internal and external factors, protective measures; Case studies</p>	10
2	<p>Mineralogy and Petrology: Minerals: Definition, way of formation of minerals, physical properties of mineral, Study of common rock forming minerals Rock cycle: Study of three types of rocks with reference to their formation, identification, textural and structural features. Rock as Construction materials and their physical properties.</p>	08

Unit No.	Topics	Teaching Hours
3	<p>Structural Geology and Rock Mechanics: Outcrop, Primary and Secondary structures in rocks, stratification, dip and strike relation. Folds and Faults, types, classification, causative factors, identification in Field and their Engineering implication. Joints in rocks, classification, causative factors; Unconformity, their types and genesis and their Engineering significance. Introduction to rock mechanics, relevance of rock mechanics in evaluating rock and rock mass properties Mechanical Properties of rock for strength parameters and determining common properties Measurement of strength of Intact rock and stress in underground rock, Elastic properties of rock Estimation of rock mass rating, Rock mass classification, classification of rock based on rock mass rating, Geological strength Index for Blocky and Heterogeneous rock mass</p>	12
4	<p>Engineering Geology and Geo-Exploration: Geology of Gujarat, types of soil and rocks and general idea of Indian geology Engineering perspective. Geological and Geophysical Exploration methods, Drilling, Logging, Stages for Geological investigation: Preparation of Geological maps and report, Interpretation of geological maps, Source of geological information for civil engineers. Geology for Site selection of Dam, Tunnel, Reservoir and Highways; Ground water: Basics and engineering difficulties Remote sensing applications for geo-environmental issues and issues pertaining to civil engineering structures and site selection. Important international and Indian examples of failures of civil structures due to geological constrains.</p>	15
Total		45

List of References:

1. Prabin Singh, “*Engineering & General Geology*” 8th S K KATARIA & SONS (KATSON)
2. Blyth, F.G.H. and D E’Freits M.H, “*Geology for Engineers*” 1st ELBS, London 1974.
3. Gokhale and K.V.G.K, “*Principles of Engineering geology*” 1st TataMcGraw Hill, New Delhi 1981.
4. Gokhale, K.V.G.K. and Rao D.M, “*Experiments in Engineering Geology*” Tata Mc Graw Hill, New Delhi 1981.
5. Reddy V, “*Engineering Geology for Civil Engineers*” 1st Oxford & IBH, NewDelhi 1997.
6. Bangar K.M., “*Principles of Engineering Geology*” 3rd Standard Publishers Distributors, New Delhi 1995.
7. Kesavulu, “*Textbook of Engineering Geology*” 1st Macmillan India Ltd, NewDelhi 1993.
8. Mukharjee P.K., “*A text book of Geology*” 7th The World Press Pvt. Ltd 1978.
9. Vasudev Kanithi, “*Engineering Geology*” 1st Universities Press pvt. Ltd. (Hyderabad) 2012.
10. Subinoy Gangopadhyay, “*Engineering Geology*” Oxford University Press 2013.
11. Basudev Bhatta, “*Remote sensing*”. OXFORD
12. F.G.Bell, “*Fundamentals of Engineering Geology*” 1st BS Publication 2005.

Course Outcomes (COs):

1. Recognize relative geo-dynamics and geo environment pertaining to civil works
2. Assess the influence of geological actions on civil project.
3. Analyze and interpret geological process, tools-techniques, products for feasibility of site selection
4. Ascertain safe, suitable and economic civil engineering projects.

2CE05: CONSTRUCTION TECHNOLOGY
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. Study of structural and functional components of building.
2. Overview of construction practices and techniques.
3. Acquaint with importance of temporary structure and building treatments.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Building Construction: Introduction: Overview of construction practices, General building structures & components. Over view of subsoil investigation.	04
2	Shallow Foundations: Shallow & deep foundations, Functions and requirements of shallow foundations, Types of shallow footings for walls & columns. Special shallow footing for buildings. Setting out of foundation layout.	05
3	Masonry Construction: Stone masonry, Brick masonry, Composite masonry, Concrete block masonry. Technical terms, bonds & rules of bonding, common types of bonds. Partition Walls, Cavity walls. Lintels & Arches: Technical terms, types and construction overview.	09
4	Doors and Windows: Doors, Windows, Ventilators: Location, technical terms, size, types, construction and suitability. Factors affecting the selection of size, shape, location and numbers of doors and windows, Fixtures and fastenings.	05
5	Floors and Floorings: Introduction, essential requirements, factors affecting selection, technical terms, and classification. Types: ground floors, upper floor: prevalent construction practices, R. C. C. floor construction. Roofs and Roof Coverings: The requirements of good roof, types of roof coverings for pitched roof. Flat roof – advantages, disadvantages, types of flat roofs and prevalent construction practices.	05

Unit No.	Topics	Teaching Hours
6	Stairs and Staircases: Definition, technical terms, requirements of good stair, fixing of going and rise of a step, types of steps, classification of stairs, planning & design of stair. Introduction to elevators & escalators.	05
7	Wall Finishes: Plastering, pointing and painting.	03
8	Plain and Reinforced Concrete Construction: Pre-cast and cast-in-situ construction practice and precautions.	03
9	Temporary Works: Importance and requirements of temporary supports, timbering in trenches. Formwork & Scaffolding for building components.	03
10	Building Treatments: Overview of building treatments like Damp proofing, Termite proofing, Thermal insulation and fire proofing.	03
Total		45

List of References:

1. Dr. Punmia B.C., Jain A. J. and Jain A. J. "*Building construction*" ISBN: 9788131804285 Editions: Eleventh 2016, Laxmi Publications
2. Birdie-Ahuja. "A *Text Book of Building Construction and Construction Materials (NEW EDITION)*", ISBN: 978-93-84559-23-6, Dhanpat Rai Publications.
3. Varghese P. C. "*Building construction*", ISBN: 978-81-203-3083-2, PHI Learning Pvt. Ltd.,
4. National Building Code-2005, ISBN: 8170610265, BIS, New Delhi.
5. SP:20 Handbook of Masonry works, BIS, New Delhi.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Select appropriate structural and functional components for building.
2. Develop comprehensive understanding about construction process of building components.
3. Apply obtained knowledge to execute normal sized building construction project.

3CE01: WATER AND WASTE WATER ENGINEERING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. Understand characteristics of water and wastewater and its determination
2. Study the population growth, related water demand, wastewater generation and design periods for water and wastewater treatment units
3. Expose the students to understand components of water supply lines and sewer lines.
4. Develop analytical skills and design of water and wastewater treatment units.
5. Provide fundamental knowledge about various disposal standards for sewage

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Water Demand, Population Forecasting, Design Periods, Objectives of water and waste water treatment, Parameters commonly employed to indicate pollution strength, standards for water quality and wastewater disposal, Evaluation of assimilative capacity of water bodies	9
2	Water Treatment Processes Collection and conveyance of water, Selection of water treatment units, Treatment plant site selection, Aeration, Plain Sedimentation, Theory and Design of Mixing devices, Coagulation, Sedimentation, Filtration, Disinfection.	18
3	Wastewater Treatment Processes Collection and conveyance of wastewater, Variation in wastewater flow, Measurement of wastewater flow, Flow diagram of wastewater treatment plant, Preliminary, Primary and Biological treatment processes: Concept and design, Treatment and disposal of sludge.	18
Total		45

List of References:

1. Peavy H. S., Rowe D. R. & Tchobanoglous G. “*Environmental Engineering*”, Mc Graw Hill Int., New Delhi, 1985.
2. Metcalf and Eddy, “*Wastewater Engineering Treatment, Disposal, Refuse*”, T.M.H. Edition, New Delhi, 1995.
3. Water supply Engineering-S.K.Garg , Khanna Publishers, 2015
4. Water supply engineering-B.C.Punmia, Arihant publicatoions, 2016
5. Sewage disposal and air pollution engineering. S.K.Garg,Khanna publishers,
6. Sewage disposal and engineering. B.C.Punmia.Arihant publications, 2016
7. “*Manual on Sewage and Sewerage Treatment*” 3rd Ed. Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi, 1991.
8. “*Manual on Water Supply & Treatment*” 3rd Ed. Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi, 1991.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand assessment procedure and significance of physical, chemical and biological characteristics of water and wastewater.
2. Explain the process of self-purification of the sources of disposal and determine the degree of treatment of sewage based on the source of disposal of wastewater.
3. Evaluate the quantity estimation for public water supplies and sewage generation
4. Describe and design various parameters of collection and conveyance of water and wastewater.
5. Design of water and wastewater treatment units.

3CE02: HIGHWAY AND TRAFFIC ENGINEERING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. Impart knowledge of highway planning, road geometric and structural design of pavement.
2. Learn Methods of construction, quality control, maintenance and Rehabilitation.
3. Introduce to traffic parameters, traffic control, accident causes and remedies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Highway Development Programmes and surveys Scope of highway engineering, Highway planning and development in India, Road patterns, Planning and alignment surveys Major road development plans in India, Organization involved with road development in India, Classification of Rural and Urban roads, Road network in India, Highway alignment surveys	05
2	Highway Geometric Design Design of Horizontal Alignment – Horizontal Curves Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves Design of Vertical Alignments – Ruling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves-Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD] -Geometric Design of Hill Roads [IRC Standards]	09
3	Highway Materials Sub-grade soil, Aggregates, Binder materials, Bituminous materials, Bituminous paving mixes, Cement concrete – their engineering and physical properties, basic tests. Soil stabilization.	06
4	Pavement Design and Construction Rigid and Flexible Pavements- Components and their Functions -Design Principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic - Design Practice for Flexible Pavements [IRC Method and Recommendations- Problems] - Design Practice for Rigid Pavements – IRC Recommendations Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications] - Highway Drainage [IRC Recommendations]	08

Unit No.	Topics	Teaching Hours
5	Pavement Distress, Maintenance and Structural Evaluation Pavement failures, Maintenance, Surface and sub-surface drainage, Hill roads – alignment, construction, drainage and maintenance. Road side development – arboriculture, street lighting. Highway administration, economics and finance, road safety audit, Structural evaluation using BBD, FWD and DCPT.	09
6	Traffic engineering Basic elements, road users - vehicles - traffic flow characteristics, speed – volume studies, surveys, parking studies, Accident studies: causes, collision and condition diagrams, preventive measures, Traffic control: markings, signs, signals, intersections, rotaries.	09
Total		45

List of References:

1. L.R. Kadiyali, “*Highway Engineering*”, Khanna Publishers, New Delhi.
2. L.R. Kadiyali, “*Traffic Engineering and Transport Planning*,” Khanna Publishers, New Delhi.
3. R.Srinivasa Kumar , “*Text book of Highway Engineering* “, 1st published in 2011 and reprint in 2012,2013 , Universities Press (India) Private Limited.,2013.
4. Huang, Yang,H. “ *Pavement Analysis and Design* , 2nd edition , Pearson Prentice Hall.2004.
5. IRC – 37:2001, 2012, 2017, 2018 “*Guidelines for Design of flexible Pavements*”, IRC, New Delhi, 2018.
6. IRC – 67 “*Code of Practice for Road Signs*”, IRC, New Delhi – 2001.
7. IRC: 58, 2015: “*Guidelines for the Design of Plain Jointed Rigid Pavements for Highways*”, IRC, N. Delhi, December, 2002.
8. IRC. Pocket Book for Highway Engineers, New Delhi: Indian Road Congress.2006.
9. IS: 73-2006 Indian standard paving bitumen: specification. New Delhi: Bureau of Indian standard, 2006.
10. MoSRTH. Specification for Road and Bridge works. 5th edition, New Delhi: Ministry of Shipping, Road Transport and Highways, Indian Roads Congress,
11. S.K.Khanna ,C.E.G.Justo, A.Veeraragavan, “*Highway Materials and Pavement Testing (Manual)*”, Nem chand & Bros., Roorkee,5th revision,2009.

Course Outcomes (COs):

At the end of this course students will be able to

1. Perform traffic surveys and implementation of surveys.
2. Carry out highway planning and its classification.
3. Design highway geometrics.
4. Conduct tests aggregates and bituminous materials
5. Design flexible and rigid pavement.
6. Understand pavement failures, importance of drainage, hill roads and their challenges.

3CE03: BUILDING PLANNING, COSTING AND VALUATION
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. Identify the factors to be considered in planning and costing of buildings.
2. Evaluate building plan by applying the bye-laws and planning principles.

3. Impart the knowledge of Estimating, Costing and Valuation for building structures.
4. Prepare and evaluate tender & contract documents.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Building Planning Building planning process: Data requirements for building planning, Involvement of Owner, Consultant and Contractor.	03
2	Conceptual background Principles of building planning, Principles of architecture composition,	05
3	Standards: Building by-laws as per National Building Code, General Building requirements as per Common GDCR.	02
4	Application: Reading and evaluating exercises based on norms and rules studied for Submission drawings, working drawings of residential building & public building.	05
5	Estimating and Costing Purpose and process of estimations and costing. Types of estimates. Principles, Units and general rules of measurements. Building Estimate: Mode of measurements for different items of Building Project. Methods of calculating quantities. Estimating cost of building. Estimates of earthwork for roads/canal structures. Market survey of materials of construction, wages of labor, and items of works.	15
6	Specifications and Rate Analysis Specification: Objectives and importance of specification, Specification of materials, Specification of works, Language of specification writing. Types of specifications. Drafting of detailed specifications for Building & Road projects. Rate Analysis: Prerequisites and factors affecting rate analysis, over head expenses, procedure for rate analysis, schedule of rates. Task work, labor requirement for different works, material requirement for different works, and Rate analysis of different items of work.	07
7	Tenders and Contracts Tender notice, tender document, Types of Contracts. Terms and conditions of contract, Agreement. Abstracting and Billing Purpose of abstract, preparation of abstract, measurements and billing, Checking of bills and final bill.	04

Unit No.	Topics	Teaching Hours
8	Valuation Purpose of valuation, Valuation of property, Depreciation, Sinking fund, Lease hold and free hold property. Obsolescence, Gross income, Outgoing and Net income, Capitalized value and year's purchase.	04
Total		45

List of References:

1. M.G.Shah, C.M. Kale and S.Y.Patki " *Building drawing : with an integrated approach to built environment*", ISBN 0-07-463876-9 Tata Mcgraw Hill, New Delhi
2. N Kumaraswamy and A Kameswara Rao "*Building Planning and drawing*" Charotar Publishing House Pvt. Ltd, Anand, ISBN: 978-93-885039-38-6
3. National Building Code-2005, ISBN: 8170610265, BIS, New Delhi.
4. *Gujarat Comprehensive Development Control Regulations – GDCR: 2017*
5. B. N. Dutta, "*Estimating and Costing in Civil Engineering*", ISBN 978-81-7476-611-3, UBS Publishers' Distributors Ltd. 25th edition, 2002.
6. S. C. Rangwala, "*Estimating, Costing & Valuation*", ISBN 978-93-85039-05-8 Charotar Publishing House Pvt. Anand, Ltd 7th edition, 2015.
7. SP 27 (1987): *Handbook of Method of Measurement of Buildings Works. Reaffirmed 2003.*

Course Outcomes (COs):

At the end of this course students will be able to...

1. Prepare building drawings for different purpose.
2. Associate building bye laws, principles of planning and principles of architectural composition.
3. Calculate quantity estimates for Buildings, roads and canal structures as per specifications.
4. Draft detailed specifications, work out rate analysis and ascertain the quantity of materials for all works related to building projects.
5. Workout cost estimate, valuation and tenders & contract documents of building works.

3HS01: ETHICS AND CONSTITUTION OF INDIA#
CREDITS – 0 (LTP : 2,0,0)

Course Objective:

To create awareness of Engineering Ethics and human values, instill moral social values, loyalty and ethical issues. It will allow the students to assimilate with basic information about Indian Constitution, know its salient features and thus functioning of Democracy in India

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
2	0	0	0	30	20	00	00	50

Course Contents:

Unit No.	Topics	Teaching Hours
1	Professional Ethics: Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift v/s Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.	7
2	Engineering ethics: Definition-Approach-Senses of Engineering Ethics-variety of moral issues– Definition–Ethical theories-Theories about right action Personality– Self-control-Self-interest –Self-respect.	7
3	Constitution and Constitutionalism: Historic perspective of constitution of India, Salient features and Characteristics of constitution of India, Scheme of fundamental rights, Scheme of fundamental duties and its legal status, The directive principles of State policy-its importance and implementation	7
4	Federal Structure: Distribution of legislative and financial powers between the union and states, Parliamentary form of government in India, The constitution powers and status of the President of India, Amendment of Constitution powers and procedure. Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister.	7
Total		28

List of References:

1. Govindrajan.M, Natrajan S, Senthilkumar V.S, “*Engineering Ethics(Including Human Values)*”, PHI publication, latest edition.
2. Reddy.N H, Ajmera, Santosh, “*Ethics, Integrity and Aptitude*”, Tata McGraw Hill.
3. Durga Das Basu (DD Basu): “*Introduction to the Constitution on India*”, (Students Edition.) Prentice –Hall EEE, 19th / 20th Ed., (Latest Edition) or 2008.
4. Shubham Singles, Charles E. Haries, and Et al: “*Constitution of India and Professional Ethics*” by Cengage Learning India Private Limited, Latest Edition – 2018.
5. M.V.Pylee, “*An Introduction to Constitution of India*”, Vikas Publishing, 2002.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Practice the moral values that ought to guide the engineering profession.
2. Discover the set of justified moral principles and apply them to concrete situation.
3. Appreciate the ethical issues and know the code of ethics in different professional bodies.
4. Discover the Federal structure and Constitution of India.
5. Know the successful functioning of democracy in India.
6. Apply the statutes available in the Constitution to the field of engineering.

3CE04: RAILWAY AND BRIDGE ENGINEERING
CREDITS - 3 (LTP: 2,1,0)

Course Objective:

1. Impart basic knowledge of railway track components and their functions.
2. Introduce geometric design, points and crossings, track resistances, signaling and control system.
3. Learn advancement in Railway stations, yards, modernization of railways & High Speed Trains.
4. Acquaint with bridge terminology, types of bridges, bridge hydrology and river training works.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Tutorial Marks	
			ESE		CE	ESE	CE	100
2	1	0	3	30	20	20	30	

Course Content:

Unit No.	Topics	Teaching Hours
1	Railway Engineering in General Permanent way and railway track components, different gauges in India, conning of wheels, function and types of rails, creep of rails, sleepers – types, spacing and density, rail fixtures and fastenings, ballast.	05
2	Geometric design of railway track Gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves. Track Resistances: Railway traction and track resistance, stresses in railway tracks, sleepers, ballast. Points & Crossings. Railway stations: requirements, facilities, classifications, platforms, and types of yards. Modernization of railways- Metro rail.	09
3	Railway tunnel Preliminary consideration, surveying, shafts, driving in soft ground, Driving tunnels in soft ground, Mucking, ventilation and dust control and lighting	04
4	Bridge Engineering Definition, components of a bridge, importance of bridge, classification of bridges based on structural behavior and materials, Bridge components: superstructure, bridge piers, abutments, wing walls, bridge foundations, bridge joints and bearings. Factors affecting site selection. Types of loads. Engineering feasibility studies for bridges: Need for investigations, selection of bridge site, preliminary data to be collected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, afflux, scour depth. (Metro alignment linked with bridge)	06
6	Methods Erection of different types of bridges. River training works and maintenance of bridges. Testing and strengthening of bridges.	06
Total		30

List of References:

1. Chandra Satish and Agrawal M.M., “*Railway Engineering*”, ISBN: 978-0198083535, Oxford University Press, New Delhi.
2. Saxena S.C. and Arora S. P., “*A Text Book of Railway Engineering*”, Dhanpat Rai & Sons, New Delhi.
3. Bindra S.P., “*Principles and Practice of Bridge Engineering*”, Dhanpat Rai & Sons, New Delhi.
4. Victor D.J., “*Essential of Bridge Engineering*”, Oxford & IBH Pub. Co. Ltd. Mumbai.
5. Ponnuswamy S., “*Bridge Engineering*”, ISBN: 9780-070656956, Tata McGraw Hill, New Delhi, 2003.
6. IRC Bridge code, Indian railway bridge code, IS 456.IS 800, IS 875
7. Learning Websites: NPTEL Sites

Course Outcomes (COs):

At the end of this course students will be able to

1. Apply the knowledge of railway track components, materials and fixtures and fastenings.
2. Solve problems of railway track geometrics, train resistance, points and crossings, Signaling and control system.
3. Carry out feasibility study of rail tracks.
4. Compute economical spans, hydraulic design of bridge and carry out erection and maintenance of bridge.

3CE05: HYDROLOGY AND WATER RESOURCES ENGINEERING
CREDITS - 4 (LTP: 3,1,0)

Course Objective:

1. Develop understanding about different components of the hydrological cycle and enable the students to estimate runoff, infiltration, evaporation, ground water flow and peak floods.
2. Develop understanding for reservoir capacity and design principles of embankment dams and gravity dams.
3. Estimation of irrigation water requirement and understanding of diversion head works and different canal structures.
4. Understand concepts of drought management.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Content:

Unit No.	Topics	Teaching Hours
1	Surface and Subsurface Hydrology Hydrologic cycle, Climate and water availability, Water balances, Precipitation and its measurement, Evaporation, Evapo-transpiration and Infiltration, Runoff.	12

Unit No.	Topics	Teaching Hours
	Groundwater Hydrology: Darcy's law, Well hydraulics, Well losses, Yield of a well. Tube well.	
2	<p>Hydrograph Analysis and Flood Control</p> <p>Hyetograph, drainage basin characteristics, Hydrograph concepts, components, assumptions and limitations of unit hydrograph, derivation of unit hydrograph, S-hydrograph.</p> <p>Indian rivers and floods, causes of floods, Alleviation, Levees and floodwalls, floodways, channel improvement, flood damage analysis. Design flood, Flood estimation, Flood frequency analysis, Flood routing: reservoir and channel routing.</p>	08
3	<p>Reservoir Planning and Dam Engineering</p> <p>Reservoir: Types, Investigations, Zones of storage, Determination of reservoir storage capacity and safe yield, Mass curve analysis, Reservoir sedimentation and control.</p> <p>Dams: Types, site assessment and selection of type of dam.</p> <p>Embankment dams: Types and Characteristics, Seepage analysis – principles of design – Stability analysis of embankment dams – slip circle method.</p> <p>Gravity dams: Concrete dams and characteristics, Forces acting on gravity dam- concepts and criteria for gravity dam analysis- design features and stability. Spillway: Types and energy dissipation.</p>	12
4	<p>Irrigation and Canal Structures</p> <p>Irrigation- necessity, advantages & disadvantages, methods of irrigation, Duty & Delta, Irrigation command area-different terms, calculation of Irrigation water requirements, Irrigation efficiency. Introduction to diversion headwork, components of diversion headwork.</p> <p>Canals: Types, Canal cross sections and components of canal section, balancing depth, Design of lined canal, canal structures- Head regulator, cross regulator, falls, escapes and outlets. Cross drainage works- aqueduct, syphon aqueduct, super passage, canal syphon and level crossing.</p>	10
5	<p>Drought Management and Water Harvesting</p> <p>Drought- Causes of drought, water conservation and augmentation, drought contingency planning, Rain water harvesting, Rain Water Harvesting in buildings.</p>	03
Total		45

List of References:

1. Subramanya, K., "*Engineering Hydrology*", Tata McGraw Hill Publishing Co., New Delhi
2. Sharma, R. K. and Sharma, T. K., "*Hydrology and Water Resources Engineering*", Dhanpat Rai Publications, New Delhi
3. Chow, V. T., Maidment, D. R. and Mays, L.W, "*Applied Hydrology*", McGraw Hill International Edition, New York.

4. Modi, P. N., “Introduction to water resources and waterpower engineering”, Standard Publication, New Delhi
5. Creager, W. P., Justin, J. D. and Hinds, J., “Engineering for dams”, Wiley & sons, New York
6. Asawa, G. L., “Irrigation and water resources engineering”, New Age International Ltd., New Delhi.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Compute mean precipitation, infiltration rate and runoff from a catchment area and work out yield from a well.
2. Construct unit hydrograph and S-hydrograph, and compute peak flood flow and design flood for hydraulic structures.
3. Workout reservoir capacity using a mass curve, develop idea about reservoir sedimentation and its control.
4. Estimate seepage through embankment dam using seepage theory and work out factor of safety of gravity dam for different forces acting on it.
5. Calculate irrigation water requirement for the given cropping pattern in canal command and design of lined canals.
6. Suggest measures of water conservation in drought prone areas.

3HS01: ETHICS AND CONSTITUTION OF INDIA#
CREDITS – 0 (LTP : 2,0,0)

Course Objective:

To create awareness of Engineering Ethics and human values, instill moral social values, loyalty and ethical issues. It will allow the students to assimilate with basic information about Indian Constitution, know its salient features and thus functioning of Democracy in India

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
2	0	0	0	30	20	00	00	50

Course Contents:

Unit No.	Topics	Teaching Hours
1	Professional Ethics: Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift v/s Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.	7
2	Engineering ethics: Definition–Approach–Senses of Engineering Ethics–variety of moral issues–Definition–Ethical theories–Theories about right action	7

Unit No.	Topics	Teaching Hours
	Personality– Self-control- Self-interest –Self-respect.	
3	Constitution and Constitutionalism: Historic perspective of constitution of India, Salient features and Characteristics of constitution of India, Scheme of fundamental rights, Scheme of fundamental duties and its legal status, The directive principles of State policy-its importance and implementation	7
4	Federal Structure: Distribution of legislative and financial powers between the union and states, Parliamentary form of government in India, The constitution powers and status of the President of India, Amendment of Constitution powers and procedure. Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister.	7
Total		28

List of References:

1. Govindrajan.M, Natrajan S, Senthilkumar V.S, “*Engineering Ethics(Including Human Values)*”, PHI publication, latest edition.
2. Reddy.N H, Ajmera, Santosh, “*Ethics, Integrity and Aptitude*”, Tata McGraw Hill.
3. Durga Das Basu (DD Basu): “*Introduction to the Constitution on India*”, (Students Edition.) Prentice –Hall EEE, 19th / 20th Ed., (Latest Edition) or 2008.
4. Shubham Singles, Charles E. Haries, and Et al: “*Constitution of India and Professional Ethics*” by Cengage Learning India Private Limited, Latest Edition – 2018.
5. M.V.Pylee, “*An Introduction to Constitution of India*”, Vikas Publishing, 2002.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Practice the moral values that ought to guide the engineering profession.
2. Discover the set of justified moral principles and apply them to concrete situation.
3. Appreciate the ethical issues and know the code of ethics in different professional bodies.
4. Discover the Federal structure and Constitution of India.
5. Know the successful functioning of democracy in India.
6. Apply the statutes available in the Constitution to the field of engineering.

3SE01: ADVANCED GEOTECHNICAL ENGINEERING
CREDITS – 3.5 (LTP: 3,0,0.5)

Course Objectives:

1. This course will enable the students to apply the knowledge to various foundations and stability problems of soil structures.
2. Introduction to the advanced topic such as application of geosynthetics for different site conditions have been also covered.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	1	3.5	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Stress distribution in soils: Boussinesq's theory, stress distribution diagrams, stress distribution due to different shaped loads, New-mark's influence chart, Westergaard's theory and approximate methods.	5
2	Compressibility of soils: Immediate settlement, Terzaghi's theory of one dimensional consolidation, spring analogy concept, primary and secondary consolidation settlements, factors affecting consolidation, consolidation test and determination of various consolidation parameters, preconsolidation pressure and its determination, computation of magnitude and rate of consolidation.	8
3	Shearing Strength of soils: Failure theories, laboratory shear tests, total and effective shear strength parameters, UU, CU & CD tests, pore pressure coefficients, stress-strain and volume change behaviour and pore pressure variations during shearing, factors affecting shearing strength of soils.	6
4	Basics of foundation: Types of foundation, Factors affecting the selection of type of foundations, steps for selection of types of foundation.	1
5	Bearing Capacity of Shallow Foundation : Design criteria, significant depth, modes of shear failures. Terzaghi's bearing capacity theory, bearing capacity determination using IS Code. Bearing capacity by using SPT data and by plate load test.	7
6	Pile foundations : Introduction, load transfer mechanism, types of piles according to their composition. Piles subjected to vertical loads: pile load carrying capacity from static formula & dynamic formulae (ENR and Hiley), Pile load test, Pile group capacity, efficiency and settlement. Negative skin friction. Introduction to Under reamed piles.	7
7	Stability of Slopes: Infinite and finite slopes, factor of safety, types of slope failures, stability analysis of infinite and finite slopes, effects of tension crack and submergence, method of slices, Taylor's stability no.	4
8	Earth Pressure: Types of lateral earth pressures, Rankine's and Coulomb's earth pressure theories and their application for determination of lateral earth pressures under different conditions, Culmann's Graphical method.	5

Unit No.	Topics	Teaching Hours
9	Geosynthetics: Introduction and applications of geosynthetics in civil engineering, Concepts of Reinforced Earth Walls.	2
Total		45

List of References:

1. Gopal Ranjan, Rao A.S.R “*Basic and Applied Soil Mechanics*”, New Age Int. (P) Ltd.
2. Das Braja M., “*Principles of Geotechnical Engineering*”, CENGAGE Learning
3. Swami Saran, “*Reinforced Soil & its Engineering Applications*”, I.K. International Publishing House P. Ltd.,
4. J. E. Bowles, “*Foundation Analysis and Design*”, Tata McGraw Hill Pub
5. P. Purushothama Raj, “*Soil Mechanics & Foundation Engineering*”, Pearson Education
6. C. Venkatramaiah, “*Geotechnical Engineering*”, New Age Int. (P) Ltd.
7. Arora K. R., “*Soil Mechanics & Foundation Engineering*”, Std. Publisher

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Compute stresses induced in soil due to different types of loading and apply the knowledge to settlements problems in the foundation engineering.
2. Determine the shearing strength of soils and apply it in different geotechnical solutions viz. foundation engineering, stability analysis of slopes and earth pressures computations.
3. Select most suitable type of foundation and evaluate load carrying capacity of shallow and deep foundations.
4. Understand the applications of geosynthetics in civil engineering projects.

3SE02: STRUCTURAL ANALYSIS - II
CREDITS – 4 (LTP: 3,1,0)

Course Objectives:

1. To impart knowledge of analysis of the various structures using different methods.
2. To impart the concept of plastic method.
3. To explain the concept and analysis of pre-stressed elements.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Analysis of Framed Structures: Analysis of Indeterminate Beams, Trusses and Plane Frames using energy principle, Analysis of Indeterminate Beams using Unit load method.	06

Unit No.	Topics	Teaching Hours
2	Fixed and Continuous Beams: Computation of fixed-end actions due to Primary Loads and secondary effects, beams of varying moment of inertia. Theorem of three moments.	04
3	Slope Deflection Method: Analysis of continuous beams due to Primary Loads and secondary effects, Analysis of simple portal frame with and without sway.	06
4	Moment Distribution Method: Analysis of continuous beams due to Primary Loads and secondary effects, Analysis of simple portal frame with and without sway.	07
5	Matrix Methods for Structural Analysis: Flexibility method and Stiffness method to analyze framed structures by system approach with and without secondary effects.	08
6	Plastic Method: Concept, Assumptions, Shape factor for different cross section, Collapse load, Load factor, Plastic modulus of section, Plastic moment of resistance, Computation of collapse load for fixed beam, continuous beam and plane frame.	06
7	Pre-Stressed Elements Introduction, Properties of high strength materials, Basics of prestressing – pre tensioning and post tensioning, Load-balancing concept, losses in prestress.	04
8	Approximate Method: Introduction, Approximate method of Structural analysis for multi- storeyed frames with lateral loads by Portal and Cantilever method. Substitute frame method for gravity loads.	04
Total		45

List of References:

1. Junarkar S.B. and Shah H.J.; “*Mechanics of Structures Vol-II*”, Charotar publishing house, Anand.
2. Wang C. K., “*Indeterminate Structures*”.
3. Bhavikatti S S, “*Structural Analysis*” New age publications.
4. Patil H.S., Patil Y.D. and Patel Jignesh, “*Structural Analysis-I*”, Synergy Knowledgeware.
5. Popov E.P., “*Engineering Mechanics of Solids*” Prentice Hall of India, New Delhi.
6. Hibbler R C, “*Structural Analysis*” Pearson Education.
7. Krishnaraju N., “**Prestressed Concrete**”, Tata McGraw-Hill Private Limited, New Delhi
8. www.nptel.iitm.ac.in/courses/

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Analyze various structures with secondary effects for various loadings.
2. Apply Plastic method of analysis.
3. Determine the stresses in prestressed elements.

3SE03: DESIGN OF STEEL STRUCTURES
CREDITS – 4 (LTP: 3,1,0)

Course Objectives:

1. To impart the concepts of design philosophies and material behavior.
2. To introduce design of structural steel elements as per IS codes of practice.
3. To introduce design of structural steel connections.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	1	0	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Design philosophy: Working stress method, Limit state method, Concepts of strength, stiffness, stability and serviceability, Advantages and Disadvantages of steel structures, Introduction to structural steel and standard rolled sections, Introduction to IS:800, Concepts of loading and load combinations as per IS:875.	03
2	Industrial Shed: Introduction to various structural elements and its layout. Calculation for gravity loads, wind loads and load combinations.	03
3	Introduction to Connections for Axially Loaded Members: Bolted connections: Types of bolts, types of failures, strength of bolt, design of various bolted connections. Welded connections: Types of weld, design of welded connections, Introduction to lug angle.	04
4	Tension Members: Determination of Tension capacity, Shear lag effect. Design of plate, single angle and double angle connected through bolting and welding.	06
5	Compression Members: Classification of sections and buckling classes. Design of single angle, design of double angle members, design of axially loaded columns, design of built-up columns, design of lacing and battening.	08
6	Flexural Members: Design of laterally supported and laterally unsupported beams, Introduction to built-up beams, castellated beams, plate girders and gantry girders.	08
7	Members subjected to Combined Forces: Design of members subjected to axial force, uniaxial and biaxial bending.	05

BIRLA VISHVAKARMA MAHAVIDYALA (Engineering College)
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Unit No.	Topics	Teaching Hours
8	Column Bases: Design of slab base footing, Introduction to design of gusseted base footing.	03
9	Framed Connections: Bolted and Welded framed connections for beam to beam and beam to column, Introduction to moment resisting connections.	05
Total		45

List of References:

1. N. Subramanian, “*Design of Steel Structures*”, Oxford University Press, New Delhi.
2. S. K. Duggal, “*Limit State Design of Structures*” McGraw Hill Education Pvt. Ltd., New Delhi.
3. K. S. Sai Ram, “*Design of Steel Structures*” Pearson, New Delhi.
4. M. R. Shiyekar, “*Limit State Design in Structural Steel*” Prentice-Hall of India Pvt.Ltd.
5. M. L. Gambhir, “*Fundamentals of Structural Steel Design*” Tata McGraw-Hill Education.
6. IS: 800 - Code of Practice for General Construction in Steel
7. IS: 875 - (Part I to V) - Code of Practice for Structural Safety of Building Loading Standards
8. IS: 226 - Structural steel (Standard Quality)
9. SP: 6(1) - Structural Steel Section

Course Outcomes:

Students will be able to

1. Estimate design loads on the structural steel components.
2. Design various steel structural components of structures.
3. Design various types of steel connections.

3CP81: FUNDAMENTALS OF COMPUTER NETWORKS AND SECURITY
CREDITS- 3 (LTP: 3,0,0)

Course Objective:

To learn the fundamentals of computer networks and network security concepts.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Components, Direction of Data flow, networks, Components and Categories, types of Connections, Topologies, Protocols and Standards, ISO / OSI model, Transmission Media, Coaxial Cable, Fiber Optics, Line	8

Unit No.	Topics	Teaching Hours
2.	Coding Modems Networks basic Error, detection and correction, Parity, LRC, CRC, Network Layer, Internetworks, Packet Switching and Datagram approach, IP addressing methods, Subnetting, Routing, Distance Vector Routing, Link State Routing, Routers.	8
3.	Networking protocols Functions of transport layer, Multiplexing, De-multiplexing, Sockets, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion Control, Quality of services (QOS), Integrated Services, Domain Name Space (DNS), SMTP, FTP, HTTP, WWW, Security, Cryptography.	10
4	Security at the application layer Email architecture, Email Security, PGP-Pretty Good Privacy, PGP Certificates, Trust model in PGP, Key rings, S/MIME-simple multipurpose Internet Mail Extension	7
5	Security at the transport Layer SSL Architecture, Key Exchange algorithms, Encryption/ Decryption algorithms, Hash Algorithms, Protocols related to SSL, TLS- Transport layer security, version, cipher suite	6
6	Security at network layer: Transport mode, Tunnel mode, comparison, Security protocols, services provide by IPSec, Security Association, Security Policy, Internet Key Exchange	6
Total		45

List of References:

1. Behrouz A forouzan, “*Data Communication and networking*”, Mc-Graw hill.
2. Behrouz A forouzan, “*Cryptography and Network Security*”.
3. William Stallings, “*Network Security Essentials: Applications and Standards*”

Course Outcomes (COs):

At the end of this course students will be able to...

1. Understand the concepts of Data Communication, Networking and Reference models
2. Understand the concepts of Internetworking Devices and Routing techniques
3. Understand the Application layer protocols like DNS, SMTP, SNMP, FTP, HTTP etc.
4. Understand the concepts of Security at Application layer.
5. Understand the concepts of Security at the Transport Layer.
6. Understand the concepts Security at Network layer.

3CP82: FUNDAMENTALS OF OPERATING SYSTEMS
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To learn the fundamentals and various functions of operating systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	00		00

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Functions of operating systems, processes, files, command interpreter, Different types of operating systems, operating system interface. Operating system structure: Monolithic, Layered, Hexokernels, Virtual Machines and Client-Server.	05
2	Processes and their implementation Process states and state transition diagram, Inter process communication: shared memory and message passing, Race condition, critical sections, mutual exclusion, semaphores and monitors. Threads and thread implementation. Process scheduling: Objectives, First come first serve, shortest job first, Round-robin, Priority-based scheduling and Multilevel feedback queue Scheduling algorithms. Scheduling algorithms of Real Time Operating system.	12
3	Deadlocks Definition and simple examples, deadlock detection, recovery, avoidance and Prevention.	04
4	Memory management Fixed and variable size partitions, protection of user address space, Swapping, virtual memory systems, demand paging, working set, page replacement strategies, Segmentation.	09
5	File system Files, Directories and Special files, access methods, Implementing Files and Shared Files, Disk space management and file space allocation methods, file system security, reliability and performance, File-System Backups, File-System Consistency, Reliability and Performance.	09
6	Input and output Basic concepts, I/O software layers: interrupt handlers, device drivers, and device-independent I/O software. Disk arm scheduling algorithms, clocks, power management.	06
Total		45

List of References:

1. Andrew S. Tanenbaum, “*Modern Operating Systems*”, Prentice Hall International
2. Silberschatz and Galvin, “*Operating System Concepts*”, John Willey and Sons
3. William Stallings, “*Operating Systems*” Prentice Hall of India
4. D.M.Dhamdhare, “*Operating Systems*”, Tata McGraw Hill

Course Outcomes (COs):

At the end of this course students will be able to...

1. Understand basic functions of operating system, system call and design structures
2. Explore the process management policies, process synchronization, Dead lock detection and prevention mechanisms used in different operating systems
3. Analyze scheduling algorithms used in general purpose and real time operating systems
4. Compare different memory management schemes and page replacement algorithms.
5. Understand file systems from user and design perspective.
6. Understand role of device driver in I/O management.

3IT81: CYBER SECURITY
CREDITS –3(LTP: 3,0,0)

Course Objective:

To learn importance of securing applications and to make aware about Cyber Security Cyber law, Cyber Crime.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	-		-

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: A brief history of the internet, Application security, Data security, Security technology-Firewall and VPNs, Access control, Security threats, Malicious software, Network and denial of services attack, Electronic payment system, E-Cash, Credit/Debit cards, Digital signature.	5
2	Cyber Security And Cyber Crime Investigation: Introduction to cyber security, Introduction to cyberspace, Survey of malware and its existence, Definition of security hole, Security patch, Viruses, Worms, Trojan horses, Social engineering, Avoiding Malwares, Spyware, Keyboard loggers, Ransomware, E-Mail and SPAM, Spoofing, Spammer's tools.	7
3	Vulnerability Scanning: Introduction to vulnerability, Vulnerability scanning, Different web vulnerabilities, Open Port and Service Id, Banner disclosure, Traffic probe, Web application testing, Penetration testing.	7
4	Port Scanning: Understanding port and services tools, Port scanning tool- Nmap, Netcat, Network sniffers and injection tools, Wireshark.	5

Unit No.	Topics	Teaching Hours
5	Network Defense Tools: Firewall basics, Packet filter Vs firewall, How a firewall protects a network, Packet characteristic to filter, Stateless Vs Stateful firewalls, Network address translation (NAT) and port forwarding, The basic of virtual private networks.	6
6	Web Application Tools: Scanning for web vulnerabilities tools: Nikto and W3af, Web application testing using DVWA, Manual SQL injection scanning using DVWA, Password Cracking and Brute-Force tools, Wi-Fi passwords cracking WEP & WAP/WAP2 with Aircrack-ng.	8
7	Introduction to Cyber Crime: Cyber Crimes, Types of cybercrime, Hacking, Attack vectors, Cyberspace, Traditional problems Associated with Computer Crime, Introduction to incident response, Cybercrime against individual, Cybercrime against property Cybercrime against organization, Cybercrimes against society, Cybercriminals.	7
Total		45

List of References:

1. Mike Shema, “*Anti-Hacker Tool Kit (Indian Edition)*”, Mc Graw Hill.
2. Nina Godbole and Sunit Belpure, “*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*”, Wiley Publication
3. Dafydd Stuttard and Marcus Pinto, “*The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*”, WileyPublication

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Learn the concepts of confidentiality, availability and integrity in Information Security.
2. Explain the concepts cyber-attack, cybercrimes, cyber laws and also how to protect themselves and ultimately society from such attacks.
3. Develop Secure Web Application through vulnerability scanning and understanding the importance of data privacy and protecting data.
4. Distinguish and classify the forms of cybercriminal activity and the technological methods used to undertake such crimes.
5. Investigate assumptions about the behavior and role of victims in cyberspace, and use basic web-tools to explore behavior on-line.
6. Analyze and assess the impact of cybercrime on government, businesses, individuals and society.

3IT82: INTERNET TECHNOLOGY
CREDITS -3 (LTP: 3,0,0)

Course Objective:

To provide knowledge regarding working of Internet, implementation of network with different topologies and server configuration.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction To Internet: Internet, Growth of internet, Owners of the internet, Anatomy of internet, ARPANET and internet, History of WWW, HTTP protocol, Request and response messages, Methods of HTTP, HTTPS, SMTP, IMAP, POP3 and DNS, Internet applications, Impact of internet on society, Transmission infrastructure, Internet Standards: Standards bodies and the standards process, IETF, ITU, IEEE, ATM forum.	8
2	Internet Technology, Protocols And Addressing: Packet switching technology, Internet protocols: TCP/IP, Router, Internet addressing scheme: Machine addressing (IP address), E-mail addresses and Resources addresses.	6
3	Internet Network: Network definition, Common terminologies: LAN, WAN, Node, Host, Workstation, Bandwidth, Interoperability, Network administrator, Network security, Network components: Servers, Clients, Communication media, Types of network: Peer to Peer, Client server, Addressing in internet: DNS, Domain Name and their organization, understanding the internet protocol address, Network topologies: Bus, Star and ring, Ethernet, FDDI, ATM and intranet.	8
4	Networking Hardware And Software Components: Network interface cards, Network cables, Network connecting devices, Core Components: Hardware platforms, Internet server components, Web servers, E-mail servers, FTP servers, Proxy servers, News servers, Directory servers, Mirrored servers.	6
5	Access Methods and Internet Working: Access Network Architectures: Access Network characteristics. Differences between Access Networks, Local Area Networks and WideArea Networks. Access Technologies: Why there is an upper limit on modem speeds. Voice grade modems, ADSL, Cable Modems, Frame Relay.	5
6	Internet Application: FTP, Telnet, Email, Chat. World Wide Web: HTTP protocol. Search Engines. E-Commerce and security issues including symmetric and asymmetric key, encryption and digital signature, and authentication. Emerging trends, Internet telephony, virtual reality over the web, etc.	6

Unit No.	Topics	Teaching Hours
7	Internet Security Management Concepts, Information Privacy And Copyright Issues: Overview of internet security, Firewalls, Internet security, Management concepts and information privacy and copyright issues, Basics of asymmetric cryptosystems.	6
Total		45

List of References:

1. Greenlaw R and Hepp E, “*Fundamentals of Internet and www*”, 2nd EL, Tata McGraw-Hill, 2007.
2. D. Comer, “*The Internet Book*”, Pearson Education, 2009.
3. P. J. Deitel, H. M. Deitel, “*Internet and World Wide Web: How to program*”, Pearson publication.
4. M. L. Young, “*The Complete reference to Internet*”, Tata McGraw Hill, 2007.
5. Douglas E Comer, “*Computer Networks and Internets With Internet Applications*”, Pearson.
6. Douglas E Comer, “*Internetworking with TCP / IP, Principles, Protocols & Architecture*”, 6th Edition, PHI.
7. William Stallings “*Data & Computer Communications*” 8th Edition.
8. A.Farrel IElseviers, “*The Internet and its protocols – A Comparative Approach*” , Morgan Kaufmann Publishers.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the current topics in Web & Internet technologies.
2. Describe the basic concepts for network implementation.
3. Learn the basic working scheme of the Internet and its working.
4. Understand fundamental working of networking hardware and software technology.
5. Understand various internet application and its importance.
6. Identify the various security hazards on the Internet and need of security measures.

3IT83: SOFTWARE PROJECT MANAGEMENT
CREDITS – 3 (LTP: 3,0,0)

Course Objective:

To provide understanding of various stages of software development and quality management process.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	-	-	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Project Management: The management spectrum, The people, The product, The process, The project, Software development life cycle, Typical software roles and responsibilities, Components, Review of models for software development, The W5HH principle.	4
2	Project Life Cycle And Effort Estimation Software process and process models, Choice of process models, Rapid application development, Agile methods, Extreme Programming, SCRUM, Managing interactive processes, Basics of software estimation, Effort and Cost estimation techniques, COCOMO II A Parametric productivity model - Staffing Pattern.	8
3	Activity Planning And Risk Management Objectives of activity planning, Project schedules, Activities, Sequencing and scheduling, Network planning models, Forward pass & backward pass techniques, Critical path (CRM) method, Risk identification, Assessment monitoring, PERT technique, Monte carlo simulation, Resource allocation, Creation of critical patterns, Cost schedules.	8
4	Quality Planning: Quality concepts, Procedural approach to quality Management, Quantitative approaches to quality management, Quantitative quality management planning, Setting the quality goal, Estimating defects for other stages, Quality process planning, Defect prevention planning.	4
5	Quality Management: Quality concepts, Software quality assurances, software reviews, formal technical reviews, Formal approaches to SQA, Statistical software quality assurances, Change Management: software Configuration management, The SCM repository, SCM Process, Configuration management for web engineering.	4
6	Project Management in Maintenance of Projects: Introduction, Software project maintenance life cycle, Process, estimation, Configuration management, Metrics, Defect prevention.	8
7	Project Execution And Closure: The review process, Planning, Overview and preparation, Group review meeting, Rework and follow-up, one-person review, Guidelines for reviews in projects, Data collection, Analysis and control guidelines, Introduction of reviews and the NAH syndrome.	6
8	Software Testing Tools: Test case generation Methodology, Study of various testing tools.	3
Total		45

List of References:

1. R. S. Pressman, “*Software Engineering*”, 7thed ,Tata McGraw Hills.
2. Pankaj Jalote, “*Software project management in practice*”, Addison-Wesley.
3. B. Hughes & M. Cotterell, “*Software Project Management*”, Tata McGraw Hills.
4. Mantel et al., “*Project Management – Core text Book*”, Wiley .
5. Roger S. Pressman, “*Software Engineering: A practical Approach*”, McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand significance of Software development life cycle.
2. Understand steps of software estimation.
3. Analysis of various risk management technique.
4. Reconstruct software using quality management technique.
5. Calculate overall time of software using project execution cycle.
6. Apply software testing tool on real time software.

3IT84: ENTERPRISE RESOURCE PLANNING
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To understand the business process, project management life cycle and emerging trends of ERP.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	-		-

Course Contents:

Unit No.	Topics	Teaching Hours
1	ERP and Related Technologies: Introduction, Related Technologies, Business Intelligence, E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, Supply chain management, Customer relationship management, Management information system, Decision support system, Executive information system.	8
2	ERP Manufacturing Perspective : MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP - Distributed Requirement Planning, PDM - Product Data Management.	5
3	ERP Implementation: Implementation Challenges, Strategies, Life Cycle, Pre-implementation Tasks, Requirements Definition, Methodologies, Package selection, Project Teams, Process Definitions, Vendors and Consultants, Data Migration, Project management, Post Implementation Activities.	10
4	ERP in Action and Business Modules: Operation and Maintenance, Performance, Maximizing the ERP System. Business Modules: Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.	10

Unit No.	Topics	Teaching Hours
5	ERP Case studies and ERP Tools: E-Commerce to E-business, E-Business structural transformation, Flexible Business Design, Customer Experience, Create the new techno enterprise, New generation e-business leaders, memo to CEO, Empower your customer, Integrate Sales and Service, Integrated Enterprise applications. Introduction to ERP Tools: JD Edwards-Enterprise One, Microsoft Dynamics-CRM Module.	8
6	Emerging Trends of ERP: Extended ERP systems and ERP add-ons, Business analytics, Enterprise architecture planning, ERP usage in Real world, ERP implementation, Future of ERP applications. Trends in ERP Systems: Web enabled, wireless technologies, cloud computing.	4
Total		45

List of References:

1. Alexis Leon, “ERP demystified”, Third Edition, Tata McGraw-Hill, 2014
2. Alexis Leon, “Enterprise Resource Planning”, Third Edition, Tata McGraw Hill, 2012
3. Ravi Shankar & S. Jaiswal, “Enterprise Resource Planning”, Galgotia.
4. Annetta Clewto and Dane Franklin, “Guide to Planning ERP Application”, McGraw-Hill

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Analyze the life cycle of ERP and its related technologies.
2. Identify implementation strategy used for ERP.
3. Explain the performance and maintenance operations of ERP.
4. Examine the working and design principles of various business modules of ERP.
5. Understand the basic tools of ERP.
6. Apply different emerging technologies for implementation of ERP.

3EE81: ENERGY AUDIT & CONSERVATION
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To enhance practical exposure in energy management of industrial utilities such as electrical as well as thermal.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
01	General Aspects: Basics of electrical & thermal energy, energy units and conversion. Energy Scenario: Primary & Secondary energy, Commercial & Non-Commercial energy, Nonrenewable & renewable energy, Globally energy reserves and production, Energy conservation and its importance. Energy Conservation Acts: 2001, 2010, Electricity act 2003, National action plan on climate changes, Integrated energy policy, Schemes under EC act 2001. Perform Achieve and Trade (PAT) by BEE in 2008.	05
02	Energy Management & Audit: Definition as per EC act-2001, Objective, Need, Types, Benchmarking. Management : Top management commitment & support, Energy policy & planning, Evaluating Energy Performance, Management Tools for Effective Implementation- 5S, KAIZEN, TPM, TQM, ISO 50001, Financial analysis: techniques, Role of ESCOs, project management technique- critical path method, pert analysis. Energy Monitoring & Targeting: Definition, Key elements, CUSUM analysis, Industry 4.0.	07
03	Renewable Energy Sources: Concept & Fundamental, Applications: solar-thermal, solar –electrical, wind energy, biomass energy, hydro energy, fuel cell, energy from waste, wave energy, tidal energy, geothermal energy. Global energy Issues: Acid rain, Ozone layer, depletion, global warming & climate change, loss of biodiversity.	05
04	Energy Efficiency And Performance Of Electrical Utilities: Electric motor, Air compressed system, HVAC and refrigeration system, Fans & Blowers, Pumps & Pumping System, Cooling towers , Lighting system, DG, ECBC codes. Case study.	10
05	Energy Efficiency & Performance Of Thermal Utilities: Boiler, furnace, Insulation & Refractories, Heat exchangers. Case study.	10
06	Energy Audit Case Study: Thermal Power Plant, Textile Industry, Ceramic Industry And Cement Industry.	05
Total		42

List of References:

1. General aspects of energy management and energy audit, Guide book EA-EM, BEE, India.
2. Energy efficiency in electrical utilities, Guide book EA-EM, BEE, India.
3. Energy efficiency in thermal utilities, Guide book EA-EM, BEE, India.
4. Energy performance assessment for equipment and utility systems, Guide book EA-EM, BEE, India.
5. Doty, Steven; Turner, Wayne C, Energy Management Handbook (8th Edition), Fairmont Press, Inc., 978-0-88173-707-3
6. Amlan Chakrabarti, Energy Engineering and management, PHI Publication

Course Outcomes (COs):

After learning this course the students will be able to:

1. Understand the recent energy management scenario and nee schemes.

2. Operate and control the industrial process.
- 3: Identify the utility problems for energy management in different sectors.
4. Solve the industrial energy management and control issues.
5. Solve the problems in different utilities individually.

3EE83: INSTALLATION AND COMMISSIONING OF ELECTRICAL EQUIPMENT
CREDITS - 3 (LTP:3,0,0)

Course Objective:

It is required to carry out/supervise installation, commissioning and maintenance of various electrical equipment in power stations, substations and industry. This course will enable the students to understand the concepts, principles and acquire basic skills of installation, commissioning and maintenance of electrical equipment in power stations, substations and industry.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	100
3	0	0	3	60	40	--	---	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Installation of Electrical Equipment: Introduction unloading of electrical equipment at site, inspection storage foundation alignment of electrical machines, Tools/Instruments necessary for installation inspection, storage and handling of transformer, switchgear and induction motor preparation of technical report.	04
2	Commissioning and Testing: Tests before commissioning of electrical equipment; Electrical and Mechanical test, specific tests on – transformer, induction motor, alternator, need of gradually loading of various machines, tests to be performed after commissioning and before starting the machine, various instruments required for testing, commissioning of switchgear, test report on commissioning and test certificate of electrical equipment, preparations before commissioning of power transformer, commissioning-power transformer, three phase induction motor, transformer insulation oil: properties as per IS, sampling, testing and filtering/purifying, standard tests as per IS, measurement of insulation resistance of different equipment's/machines, methods of Drying the winding of electrical equipment's and its record, classification and measurement of insulation resistance, Polarization Index, appropriate insulation test for specific purpose	08
3	Maintenance of Electrical Equipments: General aspect of maintenance, classification, preventive maintenance-concept, classification, advantages, activities, functions of the maintenance department, breakdown maintenance-concept, advantages, activities reasons of failure of electrical equipment due to poor maintenance, factors for preparing maintenance schedule, frequency of maintenance, maintenance schedule of transformer below and above	08

Unit No.	Topics	Teaching Hours
	1000kVA, maintenance schedule - induction motor, circuit breaker, overhead line, storage Battery, probable faults due to poor maintenance in transformer, induction motor, circuit breaker, overhead lines and battery	
4	Trouble Shooting: Causes of fault in electrical equipment's, Internal and external Instruments and tools for trouble shooting, common troubles in electrical equipment – DC Machines, AC Machines, Transformers, Circuit-breaker, underground cable, electrical installation, need of trouble shooting chart, advantages, trouble shooting chart – DC Motor, DC Generator, Transformer, Synchronous Motor, Induction Motor, Circuit-breaker, troubleshooting chart for Domestic appliances- electrical iron, ceiling fan, Washing machine, Air cooler, Vacuum cleaner Fluorescent tube light: Construction, working and troubleshooting chart.	06
5	Earthing: Necessity of earthing, system earthing; advantage of neutral earthing of generator in power station, equipment earthing: Objective Types of earth electrodes, Methods of earthing; plate earthing, pipe earthing and coil earthing, Earthing in extra high voltage and underground cable Earthing resistance, factor affecting Determination of maximum permissible resistance of the earthing system, measurement of earth resistance: voltmeter-ammeter method, earth tester method, ohm meter method and earth loop tester method Earthing, grounding and bonding, Comparison between equipment earthing and system grounding Earthing procedure – Building installation, Domestic appliances, Industrial premises Earthing in substation, generating station and overhead line	06
6	Electrical Accidents and Safety: Causes of electrical accidents, Factors affecting the severity of electrical shock, Actions to be taken when a person gets attached to live part, Safety regulations and safety measures, Indian electricity supply act 1948- 1956, Factory act 1948, Procedure of shut down for substation and power lines, Permit to work : certificate of (i)requisition for shut down(ii) Permit to work and (iii) Line clear certificate Instruction for the safety of persons working on a job with a permit to work, Fire extinguishers- For fixed installation and portable devices	04
Total		36

List of References:

1. Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi
2. Ramesh. L, Chakrasali, "Testing & Commissioning of Electrical Equipment", Prism Books Pvt. Ltd., 2014.
3. Paul Gill, "Electrical power equipment maintenance and testing", CRC Press, 2008.
4. Singh Tarlok,"Installation, commissioning and maintenance of Electrical Equipment's. K. Kataria and Sons, New Delhi,
5. Philip Kismet, "Electrical Equipment Handbook: Troubleshooting and Maintenance", McGraw-Hill, 2003.
6. Relevant Indian Standards (IS Code) and IEEE Standards for-Installation, maintenance and commissioning of electrical equipment/machines.

Course Outcomes (COs):

After learning the course, the students will be able to

1. Installation of Electrical Equipment's
2. Perform commissioning and testing of electrical equipment's
3. Preparation of maintenance schedule of different equipment and machines
4. Trouble shooting chart for various electrical equipment, machines and domestic appliances
5. Procedure of different types of earthing for different types of electrical installations
6. To become familiar about electrical safety regulations and rules during maintenance.

3EL81: ELECTRONICS COMMUNICATION SYSTEM
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. To introduce the basic principles and techniques used in Electronic Communications, Digital modulation techniques, Cellular Technology.
2. To introduce fundamental of networking, LAN, Wireless technologies and advance Communication systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	Introduction to Electronic Communication: The Significance of Human Communication, Communication Systems, Types of Electronic Communication, Modulation and Multiplexing, The Electromagnetic Spectrum, Bandwidth.	06
2.	Digital Communication Techniques: Digital Transmission of Data, Parallel and Serial Transmission, Data Conversion, Pulse Modulation, Digital Signal Processing.	07
3.	Fundamentals of Networking and LAN and Ethernet: Network Fundamentals, LAN Hardware, Ethernet LANs, Advanced Ethernet.	06
4.	Cell Phone Technologies: Cellular Telephone Systems, A Cellular Industry Overview, 2G and 3G Digital Cell Phone Systems, Long Term Evolution and 4G Cellular Systems , Base Stations and Small Cells.	08
5.	Wireless Technologies : Wireless LAN, PANs and Bluetooth, Zigbee, WiMAX and Wireless Metropolitan Area Networks, Infrared Wireless, Ultra wideband, Additional wireless application.	08

Unit No.	Topics	Teaching Hours
6.	Satellite and Optical Communications: Satellite orbits, Satellite Communication Systems, Satellite Subsystems, Satellite Applications, Global Navigations Satellite Systems (GNSS), Optical Principals, Optical Communication System, Fiber Optic Cables, and Wave Division Multiplexing Technique.	10
Total		45

List of References:

1. Louis E. Frenzel Jr., “Principles of Electronic Communication Systems”, Tata Mc-Graw Hill.
2. Frenzel., “Communication electronics, principles and applications”, Tata Mc-Graw Hill.
3. George Kennedy, Bernard Davis, SRM Prasanna, “Electronic Communication Systems”, Tata McGraw-Hill .
4. Behrouz A Forouzan, “Data Communications and Networking”, Tata Mc-Graw Hill.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand the basic concept Communication system.
2. Apply network fundamentals for LAN and Ethernet.
3. Analyze Cellular Technologies.
4. Analyze advance communication systems.

3EC81: INTRODUCTION TO CELLULAR COMMUNICATION
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To understand the concept of mobile communication, frequency reuse, wireless model, GSM & CDMA network, various wireless protocols & its applications related to mobile communication.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	Evolution of Mobile Communication Systems : Introduction-base station, mobile station, MSC, forward and reverse channel, control channel, Paging system, Cordless telephone system, Cellular telephone system, Advantages and disadvantages of mobile communications, Comparison of wireless systems, applications of wireless communications.	04

Unit No.	Topics	Teaching Hours
2.	Cellular Concept – System Design Fundamentals : Introduction, frequency reuse, channel assignment strategies, handoff strategies, umbrella cell concept, interference and system capacity, co-channel and adjacent channel interference, cell splitting, sectoring, microcell zone concept.	06
3.	Mobile Communication Engineering : Introduction, Radio paths, Propagation attenuation, Basic propagation mechanisms, mobile radio channel, simulation of wireless fading channels, free space propagation model, outdoor propagation model.	08
4.	GSM & CDMA Systems : GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, CDMA architecture.	12
5.	3G and 4G Digital Mobile Technology : 2.5G TDMA evolution path, GPRS technology, EDGE technology, 2.5G CDMA technology, Need of 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, W-CDMA air interface, TD-SCDMA technology, CDMA 2000 technology. 4G-LTE.	09
6.	Emerging Wireless Network Technologies : IEEE 802.11 WLAN technology, IEEE 802.15 WPAN technology, IEEE 802.16 WMAN technology, Mobile adhoc networks (MANETs), Wireless sensor networks, RFID technology, IEEE 802.21 standards overview, Case studies of latest wireless technologies.	06
Total		45

List of References:

1. T. L. Singal, “*Wireless Communications*”, Tata McGraw Hill , 2nd Edition, 2011.
2. T. S. Rappaport, “*Wireless Communications: Principles and practice*”, Pearson, 2nd Edition, 2010.
3. A. Goldsmith, “*Wireless Communications*”, Cambridge university press, 1st Edition, 2005.
4. B. Razavi, “*RF Microelectronics*”, Prentice Hall, 1st Edition, 1998.
5. W.C.Y. Lee, “*Mobile Communications Engineering*”, McGraw Hill Telecomm., 2nd Edition, 1998.

Course Outcomes (COs) :

By learning this course students will be able to ...

1. Understand the basics of mobile communication systems.
2. Design the cellular system and improve the coverage and capacity of system.
3. Analyze and design the various mobile propagation model.
4. Design GSM and CDMA wireless networks.
5. Study the 3G and 4G digital mobile technology.
6. Compare the recent emerging protocol of wireless communication system.

3EC82: APPLIED ELECTRONICS
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

The basics of applications based electronics fundamentals are covered for the students of different braches other than electronics and communication.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	00		00

Course Content:

Unit No.	Topics	Teaching Hours
1.	Operational Amplifiers : Ideal operational amplifier, Operational amplifier Stages, Operational amplifier parameters, Equivalent circuit of op-amp, Ideal Voltage transfer Curve, Open-Loop Op-amp configurations, Closed-Loop op-amp configurations	06
2.	555 Timer Circuits : Block diagram, Use as Astable multivibrator and monostable multivibrator	04
3.	Transducers : Capacitive Transducer, Inductive Transducer, Linear Variable Differential Transformer, Oscillation Transducer, Potentiometric transducer, Electrical strain gauges, Resistance thermometer, Thermistor, Thermocouple, Piezoelectric Transducer, Photoelectric transducer	07
4.	Introduction to Electronics Communication : The significance of Human Communication, Communication systems, Types of Electronics Communication, Modulation and Multiplexing, The electromagnetic Spectrum, Bandwidth	06
5.	Optoelectronic Devices : Photoconductive sensors, Photovoltaic sensors, Photo emissive sensors, Light emitters, Liquid Crystal Display, Opto-coupler	07
6.	Memories and Microcontroller : Introduction to semiconductor memories, The AVR microcontrollers' history and features, AVR architecture ,AVR programming in C.	07
7.	Consumer Electronics : Washing machines (Electronic Controller, Fuzzy logic machines and automatic washing Machines), Audio systems, I-pods, RFID, Barcode Scanner and decoder, Photocopier machines, Introduction to organic electronics and internet of things (Industry 4.0)	08
Total		45

List of References:

1. S Salivahanans, N Kumar, A Vallavaraj, “*Electronic devices and circuits*”, 2nd Edition, McGraw Hill, 2008

2. Santiram KAL, “*Basic Electronics Devices, Circuits and its Fundamentals*”, 5th Edition, PHI Publication, 2006
3. M.A. Mazidi, Sarmad Naimi, Sepehr Naimi, “*The AVR Microcontroller & Embedded Systems using Assembly and C*”, 1st Edition, Pearson Education, 2011.
4. Louis E. Frenzel, “*Principles of Electronic Communication Systems*”, 3rd Edition, McGraw Hill Publication, 2014
5. Alasdair Gilchrist, “*Industry 4.0*”, Apress, 2016

Course Outcomes (COs):

1. Understand the fundamental s of Operational amplifier and its applications.
2. Analyze and able to design sensor based applications.
3. Understand the Principles of Electronics Communication.
4. Understand and able to analyze Modern Communication systems and its applications.
5. Able to use of the CAD tools and programming of AVR on C platform.
6. Design and understands the various modern electronics based real time industrial applications.

3ME81: INDUSTRIAL ENGINEERING AND QUALITY ASSURANCE
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. To select appropriate plant location and layout.
2. To apply the concept of productivity and work-study.
3. To understand different aspects of quality assurance and their applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Topics	Teaching Hours
1	Plant Location Selection and Layout: Nature of location decision, Importance of plant location, Dynamic nature of plant location, Choice of site for selection, Comparison of location, types of plant layout and selection of layout, Quantitative methods of plant layout: CRAFT and CORELAP, Relationship diagrams, Principles factors governing flow pattern, travel chart.	08
2	Productivity and Work Study: Definition of productivity, application and advantages of productivity improvement tools, reasons for increase and decreases in productivity. Areas of application of work study in industry, Reaction of management and labor to work study. <i>Method Study:</i> Objectives and procedure for methods analysis, Recording techniques: String Diagram, Operations Process Chart, Flow Process Chart, Flow diagram, Man-Machine, Multiple Activity Chart, Travel Chart, and Two Handed	12

Unit No.	Topics	Teaching Hours
	process chart, Therbligs, Micro-motion and macro-motion study: Principles of motion economy, SIMO chart, Normal work areas and work place design. <i>Work Measurement:</i> Objectives, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards	
3	Job Evaluation and Wage Plan: Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans, Non monetary incentives.	05
4	Inspection and Statistical Quality Control: Inspection – functions, types, objectives and benefits, quality control principles, Concepts of quality circles, Total quality management, PDCA cycle, concept of Zero Defect, Basic Concept ISO 9000, ISO 14000 and QS 9000, Six sigma: Concept, Principle, Methodology, Scope, Advantage and limitations. SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability. Acceptance sampling, sampling plans, OC curves and AOQ curves Quality assurance, Quality audit.	10
5	Industrial Legislation: Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, Employees provident fund scheme 1952.	03
6	Ergonomics: Scope and objectives of ergonomics, Man-machine interface, anthropometry, Application of human factors in engineering, Work place design.	04
Total		42

List of Reference:

1. Banga and Sharma, “*Industrial Engineering and Production Management*”, Khanna Publishers
2. Barnes, R.L., “*Motion and Time Study, Design & Measurement of Work*”, 7th edition, John Wiley & Sons, New York, 1980
3. Currie R.M, “*Work Study*”, 4th edition, ELBS & Pitman, London, 1977
4. M. Mahajan, “*Industrial Engineering and Production Management*”, 2nd edition, Dhanpat Rai & CO. (P) LTD, 2002.
5. M. Mahajan, “*Statistical Quality Control*”, 3rd edition, Dhanpat Rai & CO. (P) LTD, 2002.
6. Martand Telsang, “*Industrial Engineering and Production Management*”, 2nd edition, S Chand & company, 2002.
7. International Labour Organisation (ILO), “*Introduction to Work study*”, Oxford and IBH Publishing.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Select an appropriate plant location and develop optimized plant layout.
2. Apply the concepts of productivity and work-study.
3. Evaluate job and wage plans using different methods.
4. Analyze the concept of inspection and quality assurance to enhance productivity.
5. Understand industrial legislation.
6. Explain the concepts of ergonomics in designing of various products

3ME82: PROJECT MANAGEMENT
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To illustrate Project management practices

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	0		0

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to project management: Project management vs general management, life cycle of projects, selection of projects to meet organizational goals. Types of Projects, Government Regulatory Framework, Market Analysis, Technical Analysis. Management of the organization & the team: the project manager's role, responsibilities; selection of a project manager, projects & organization.	08
2	Planning the project: The planning process, work break down structure, multidisciplinary teams. Budgeting the project: methods of budgeting, cost estimating & its improvement, budget uncertainty & risk management. Brief idea on Project Financing. Project cash flow, Financial estimates and Projections, cost of capital.	08
3	Scheduling the project: CPM & PERT networks, project uncertainty & risk management, Gantt chart, Use of computer aided tools for the analysis.	08
4	Allocating resources to the project: Expediting a project, resource loading & levelling, allocating resources to projects, Goldratt's critical chain.	08
5	Monitoring & controlling the project: The plan-monitor-control cycle, data collecting and reporting, earned value, project control, designing the control system, scope creep & change control.	05
6	Project Execution. Various phases of project execution, Timely execution of project, various statutory approvals, OH & S (Occupational Health and Safety) aspects during project execution, Case Study Evaluating & terminating the project: Evaluation, project auditing, and project termination. Project quality assurance.	05
Total		42

List of References:

- Samuel J Mantel Jr., Jack R Meredith, Scott M Shafer, Margaret M Sutton, M R Gopalan, "Project Management", Wiley India Pvt. Ltd.
- Eliyahu M. Goldratt, "Critical Chain: A Business Novel", North River Press 1997.
- Dr. B. C. Punmia, K. K. Khandelwal "Project Planning and Control with PERT and CPM", Laxmi Publication (P) Ltd.

4. Chandra Prasanaa, “*Projects-Planning analysis, Selection, Implementation and Review*” –Tata Mcgrow-Hill-

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Appraise project manager’s role
2. Apply the concepts of project planning and budgeting
3. Apply the concepts of scheduling of projects
4. Apply the concepts of allocation of resources to projects
5. Apply methods of monitoring of projects
6. Appraise how to evaluate and terminate projects

3PE81: PRINCIPLES OF SUPPLY CHAIN MANGEMENT
CREDITS – 3 (LTP: 3,0,0)

Course Objective:

To develop skills to set analyze an individual corporation’s current supply chain practices, to compare those with best industry practices and provide a road-map for improvement.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Supply Chain Management: Definition of Supply Chain, Objectives of Supply Chain, Supply Chain principles, building blocks of a supply chain network, Types of supply chains, Supply Chain as a source of competitive advantage, business processes in supply chains. Strategic, tactical, and operational decisions in supply chains, supply chain design issues, role and importance of Supply Chain Management, Supply Chain Management methodology. Functional view of Supply Chain Management.	07
2	Supply Chain Drivers and Metrics: Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing, Obstacles to Achieving Fit	04

Unit No.	Topics	Teaching Hours
3	Designing Distribution Networks & Network Design in the Supply Chain: The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network. The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation	09
4	Coordination in Supply Chain: Role and importance of Supply Chain Coordination, Coordinating procurement, Coordinating pricing decision, coordinating process and product design, coordination for reduced sourcing, vendor development and supplier partnership, Business cycle ownership with Supply Chain Management, Supply Chain integration through push-pull mechanism, Bullwhip Effect. Lack of Supply Chain Coordination ,The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Building Strategic Partnerships and Trust Within a Supply Chain, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning,	09
5	Supply Chain Globalization & IT Enablement of Supply Chains The impact of Globalization, enterprise globalization strategies, the global integrated enterprise, requirements and challenges, operational differences, potential hidden costs and total cost strategy. Role of ICT in Supply chains, ICT tools: Information Technology in a supply chain, Upcoming use of Cloud computing, RFID, Use of Telecommunication,e-Procurement,B2B & B2C end of supply chains,Impact of Lead time,Concpet of Block chain.	09
6	Supply Chain Management Performance Measures: Performance Measurement of Supply Chain Management, Traditional and Contemporary approaches (Supply Chain Operation Reference Model (SCOR), Performance Benchmarking, Balance Score Card)	04
Total		42

List of References:

1. Ronald Ballou, “*Supply Chain Management*”, Pearson Education.
2. Sunil Sharma, “*Supply Chain Management – Concepts, Practice & Implementation*”, Oxford University Press.
3. N. Chandrasekaran, “*Supply Chain Management – Process, Systems and Practice*”, Oxford University Press.
4. David Simchi Levi, Philip Kaminsky, Edith Simchi Levi, “*Designing and Managing the Supply Chain*”, Tata McGraw Hill.
5. Blanchard, B.S., “*Logistics Engineering & Management*”, Prentice Hall, New Jersey, 1997
6. Sunil Chopra and Peter Menidl, “*Supply Chain Management- Strategy Planning and Operations*”, Prentice Hall, 2001.
7. Manish Govil and Jean Marie Prop, “*Supply Chain Design and Management: Statistical and Tactical Perspectives*”, Academic Press, San Diego.
8. Sridhar Tayur, Ram Ganeshan and Micheal Magazine, “*Quantitative Models for Supply Chain Management*”, Kluwer Academic Publishers, 2002.
9. R.P. Mohanty and S. G. Deshmukh, “*Supply Chain Management Theories and Practices (Set)*”, Biztantra Publication.

10. Janat Shah, “*Supply Chain Management*”, Pearson Education.
11. Joel Wisner, G. Keong, “*Principles of Supply Chain Management*”, Cengage Learning.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the effect of supply chain on business operations
2. Apply theory and practices to the design and management of supply chains
3. Able to create basic supply network distribution models.
4. Know the world class best practices being carried out in supply chain management.
5. Apply concepts and activities of the supply chain to actual organizations.

3PE82: INDUSTRIAL INTERNET OF THINGS
CREDITS – 3 (LTP: 3,0,0)

Course Objective:

1. To familiarize with Industrial Internet of things for planning to embark in the industrial sector.
2. Introduce the tools and techniques that enable IoT solution and Security aspects

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Industrial Internet of Things (IIoT): Introduction to IOT and IIOT, History of IIOT, Components of IIOT - IOT Market, Trends& future Real life examples, Key terms – IOT Platform, Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT, Scope, History, Vertical and Business Process areas, Importance of building Ecosystems, IIoT Value Chain – who does what? Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.	10
2	Introduction: Sensing & actuation, Communication and Networking Sensor and Interfacing Introduction to Sensors, Transducers, Classification, Roles of sensors in IIOT, Various types of Sensors, Design of sensors, Sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators, Interface, Networks, People & Process, Hype cycle, API, clouds, Data Management Analytics, Mining & Manipulation. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc.	12

Unit No.	Topics	Teaching Hours
3	Basics of Industrial IoT: Industrial Processes, Industrial Internet Systems Internet of Things Applications: Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry, Power Plants, Inventory Management & Quality Control	10
4	Industrial IoT: Data Analytics and Networking : IOT Analytics: Role of Analytics in IOT, Data visualization Techniques, Machine Learning and Data Science – data management, Programming, Introduction to R Programming, Statistical Methods., Plant Safety and Security (Including AR and VR safety applications), Facility Management, Case studies, Privacy, Security and Governance. Advances in IoT.	10
Total		42

List of References:

1. Daniel Minoli, “*Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications*”, ISBN: 978-1-118-47347-4, Willy Publications.
2. Michahelles, “*Architecting the Internet of Things*”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Willy Publications.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “*The Internet of Things: Key Applications and Protocols*”, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
5. Ovidiu & Peter; “*Internet of Things- From Research and Innovation to Market Deployment*”, River Publishers Series

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Describe IOT, IIOT, Understand, design and develop the real life IoT applications.
2. Understand need of various hardware and software, IoT Layers and their relative importance
3. Study various IoT platforms and Security and Realize the importance of Data Analytics in IoT
4. Understand the concepts of Design Thinking.

3CP83: PROGRAMMING WITH PYTHON
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To impart programming skills of python programming language.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Basic elements of python; Control Structures; Strings and Inputs.	04
2	Functions, Scoping and Abstraction Functions and scoping; Specifications; Recursion; Global variables; Modules; Files; System Functions and Parameters.	06
3	Structured Types, Mutability and Higher-Order Functions Tuples; Lists and Dictionaries; Lists and Mutability; Functions as Objects.	04
4	Testing, Debugging, Exceptions and Assertions Types of testing; Black-box and Glass-box; Debugging; Handling Exceptions; Assertions.	04
5	Classes and Object-Oriented Programming Abstract Data Types and Classes; Inheritance; Encapsulation and Information Hiding.	05
6	Advanced Topics Plotting using PyLab; Network Programming – Sockets; Graphics and GUI Programming; Drawing using Turtle, Tkinter and Python; Other GUIs; Database Access.	15
7	Hardware Interfacing Introduction; Arduino IOP, Programming PYNQ-Z1's onboard peripherals - LEDs, switches and buttons; Peripheral Example; Controlling a single LED; Controlling all the LEDs, switches and buttons	07
Total		45

List of References:

1. John V Guttag. “*Introduction to Computation and Programming Using Python*”, Prentice Hall of India
2. R. Nageswara Rao, “*Core Python Programming*”, dreamtech
3. Wesley J. Chun. “*Core Python Programming - Second Edition*”, Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “*Data Structures and Algorithms in Python*”, Wiley
5. Kenneth A. Lambert, “*Fundamentals of Python – First Programs*”, CENGAGE Publication
6. Luke Sneeringer, “*Professional Python*”, Wrox

Course Outcomes (COs):

At the end of this course student will be able to...

1. Develop proficiency in creating applications using the Python Programming Language.
2. Describe various data structures available in Python programming language and apply them in solving computational problems.
3. Test the code written in Python.
4. Draw various kinds of graphs using PyLab.
5. Perform interfacing with different hardware.
6. Create applications with graphical user interfaces.

3CP84: INFORMATION TECHNOLOGY ESSENTIALS
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To provide basic knowledge of the technologies needed for application development.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Networking Essentials Fundamental computer network concepts, Types of computer networks,, Network layers, TCP/IP model, Wireless Local Area Network, Ethernet, WiFi, Network Routing, Switching, Network components, web server	04
2	Web Essentials Creating a Website, Working principle of a Website, Browser fundamentals, Authoring tools, Types of servers: Application Server, Web Server, Database Server, HTML basics, HTML tags and their use, CSS	07
3	Scripting Essentials Need for Scripting languages, Types of scripting languages Client side scripting Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, Server side scripting PHP, Working principle of PHP, PHP Variables, Constants, Operators, Flow Control and Looping, Arrays, Strings, Functions, Cookies, Sessions, database connectivity	20
4	Database Essentials Database management, Database terms, MySQL, commands, Data types, DDL and DML Queries, Accessing MySQL using PHP.	10
5	Application Essentials Design and development of real time information systems using database connectivity, networking and scripting languages.	05
Total		45

List of References:

1. Ralph Moseley and M.T. Savaliya, “*Developing Web Applications*”, Wiley-India.
2. Harwani, “*Developing Web Applications in PHP and AJAX*”, McGrawHill

3. A Silberschatz, H F Korth and S Sudarshan, “*Database System Concepts*”, McGraw Hill. (E-book available on the BVM intranet).
4. Behrouz A Forouzan, “*Data Communication and Networking*”, 5th Edition, McGraw Hill, 2013 (E-Book available on the BVM intranet)
5. W3Schools is a web developers site, with tutorials and references on web development languages such as HTML, CSS, JavaScript and PHP. URL: <https://www.w3schools.com/>
6. MDN Web docs. URL: <https://developer.mozilla.org/en-US/>

Course Outcomes (COs):

At the end of this course students will be able to...

1. Understand the basics of networking.
2. Design and deploy website using HTML and CSS.
3. Design and develop simple web application using client side and server side scripting.
4. Understand database management system.
5. Formulate basic SQL queries.
6. Develop applications using information technologies.

3CP85: OBJECT ORIENTED CONCEPTS AND PROGRAMMING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To impart knowledge about the principles of object-oriented programming paradigm using C++.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits C	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Overview and Concepts of C++ Review of fundamental concepts of Object-oriented programming, Procedural Vs. Object Oriented Programming, Principles of OOP , Benefits and applications of OOP, Introduction to C++, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures	05
2	Objects and Classes Basics of object and class; Private and public members; static data and function members; constructors and their types; destructors; type conversion; new and delete operators. Arrays of objects; Reference variables.	10
3	Functions and Inheritance Simple functions; Call and Return by reference; Inline functions; Macro Vs. Inline functions; Operator overloading; Overloading of functions; default arguments; friend functions; Concept of Inheritance; types of inheritance: single; multiple; multilevel; hierarchical; hybrid; protected members; overriding; virtual	10

Unit No.	Topics	Teaching Hours
	base class.	
4	Dynamic Polymorphism Pointers and Objects; this pointer; virtual and pure virtual functions; Implementing dynamic polymorphism.	05
5	I/O and File Management Concept of streams; cin and cout; Overloading of inserter and extractor operators; C++ stream classes; Unformatted and formatted I/O; manipulators; File stream and C++ classes; File management functions; File modes; Binary and random Files.	05
6	Exception Handling Review of traditional error handling; basics of exception handling; exception handling mechanism; throwing mechanism; catching mechanism; rethrowing an exception; specifying exceptions, Introduction of Advanced topics.	06
7	Introduction to Java Introduction, OOP basics, Packages, Interface.	04
Total		45

List of References:

1. E Balagurusamy, “*Object Oriented Programming with C++*”, McGraw-Hill (E-book available on the BVM intranet)
2. Herbert Schildt, “*The Complete Reference C++*”, McGraw-Hill
3. Deitel, “*C++: How to Program*”, PHI
4. Jana Debasish, “*C++ and Object Oriented Programming Paradigm*”, PHI
5. Saurav Sahay, “*Object Oriented Programming with C++*”, Oxford
6. Herbert Schildt, “*The Complete Reference, Java*”, McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to...

1. Differentiate between object-oriented programming and procedural programming paradigms
2. Understand features of object-oriented programming like encapsulation, inheritance, polymorphism, etc. using C++
3. Design a solution to a given problem using object-oriented programming concepts
4. Prepare an application in C++ using I/O, File management and exception handling concepts.
5. Understand concepts of OOP with Java.
6. Enhance logical reasoning and programming skills.

3IT85: WEB APPLICATION AND DEVELOPMENT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To learn the concepts of web designing to design and implement web application.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Web server, Access and security, Web Protocol(HTTP/1.1): Overview of HTTP, HTTP language elements, HTTP extensibility, SSL and security, Evolution of HTTP/1.1 protocol 2.8 methods-headers and response codes in 1.0 /1.1, Cloud Web hosting, Web Server Basics.	3
2	Web Design: Concepts of effective web design, Web design issues including browser, Bandwidth and cache, Display resolution, Look and feel of the website, Page layout and linking, Sitemap, Planning and publishing website.	4
3	HTML: Basics of HTML, Formatting and fonts, Commenting code, Color, Hyperlink, Lists, Tables, Images, Forms, Frames, Browser architecture and web site structure.	6
4	HTML5: HTML5 New Element, HTML5 Canvas, HTML5 Drag/Drop, HTML5 Video, HTML5 Audio, HTML5 Input type, HTML5 Form Element, HTML5 Form Attribute, Features of HTML5.	5
5	Style sheets: Need for CSS, Introduction to CSS, Basic syntax and structure, Background images, Colors and properties, Manipulating texts, Using fonts, Borders and boxes, Margins, Padding , lists, Positioning using CSS, CSS2, Overview and features of CSS3.	7
6	JavaScript: Client side scripting with JavaScript, Variables, Functions, Pop up boxes, The DOM and web browser environments, Manipulation using DOM, Forms and validations. DHTML: Combining HTML, CSS and JavaScript, Events and buttons.	8
7	PHP: Introduction and basic syntax of PHP, PHP and HTML, Arrays, Functions, String, Form processing, Files, Advance Features: cookies and sessions.	6
8	PHP and MySQL: Introduction to MySQL, Connection to server, Creating database, Selecting a database, Creating a table, Inserting data, Altering tables, Queries, Deleting database, Deleting data and tables.	6
Total		45

List of References:

1. Ralph Moseley and M. T. Savaliya, “*Developing Web Applications*”, Wiley-India.
2. Black Book, “*Web Technologies*”, dreamtech Press.

3. Black Book, “HTML 5”, Dreamtech Pr.
4. Joel Sklar, “Web Design”, Cengage Learning.
5. Harwani, “Developing Web Applications in PHP and AJAX”, McGrawHill.
6. P.J. Deitel & H.M. Deitel, “Internet and World Wide Web How to program”, Pearson.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Able to understand internet concepts that are vital in understanding web development.
2. Understand the role of computer languages and protocols in the workings of the web and able to explain the roles of web development.
3. Describe the strengths and weaknesses of the client-server internet approaches to web design and implementation.
4. Design and apply markup languages for processing, identifying, and presenting of information in web pages.
5. Design and implement an interactive web site(s) with regard to issues of usability, accessibility and internationalization.
6. Design and implement a client-server internet application that accommodates specific requirements and constraints, based on analysis, modeling or requirements specification.

3IT86: JAVA PROGRAMING
CREDITS – 4(LTP: 3,0,1)

Course Objective:

To be familiar with different object oriented concepts which are commonly applied in implementation of various java applications using business logic.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to JAVA: Object-oriented programming paradigms & principles, Key features of JAVA, Byte code and Java development Kit, Lexical issues, Data types, Variables, Control statements, Loop.	4
2	Arrays and Operators: One-dimensional arrays, Multi-dimensional arrays, Arithmetic operators, The bitwise operators, Shift operators, Relational operators, Short-circuit logical operators, The operator, Operator precedence.	4
3	Introduction to Classes and Methods: Class Fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, Overloading methods, Overloading constructors, Using objects as parameters, Recursion, Passing and returning	6

Unit No.	Topics	Teaching Hours
	object form method, Introducing nested and inner classes, Command-line arguments, Understanding keywords: this, final & static.	
4	Inheritance and String Handling: Inheritance basics, Super keyword, Multilevel hierarchy, Method overriding, Dynamic method dispatch, Using abstract classes, The object class, Special string operations, Character extraction, String comparison, Searching strings, Modifying a string, Data conversion using valueOf(), String Buffer class & its methods.	4
5	Packages and Interfaces: Defining a package, Finding packages and CLASSPATH, Access protection, Importing packages, Defining an interface, Implementing interfaces, Applying interfaces, Variables in interfaces.	4
6	Exception Handling: Exception-handling fundamentals, Exception types, Use of try and catch, Multiple catch clauses, Nested try statements, Throw, Throws, Finally keywords, Java's built-in exceptions, Custom exception, Chained exceptions.	6
7	Multithreaded Programming: The java thread model, Creating a thread using implementing runnable & extending thread, Creating multiple threads, isAlive() and join(), Thread priorities, Synchronization, Deadlock.	4
8	Input/Output and File Operation: Streams, Byte streams and character streams, The predefined streams, Reading console input, Writing console output, The PrintWriter class, Reading and writing files.	4
9	The Applet Class: Applet basics, Applet architecture, An applet skeleton, Simple applet display methods, Repainting, Using the status window, The HTML APPLET tag, Passing parameters to applets.	4
10	Introducing the AWT and Graphics: AWT classes, Window fundamentals, Working with frame windows, Creating a frame window in an applet, Working with graphics: Drawing lines, Rectangles, Ellipses, Circles, Arcs and polygons, Sizing graphics, Working with color, Working with fonts.	5
Total		45

List of References:

1. Herbert Schildt, *"The Complete Reference, Java 2"*, Ninth Edition, Tata McGraw Hill .
2. Herbert Schildt & Dale Skrien, *"Java Fundamentals A comprehensive introduction"*, Tata McGraw Hill .
3. E.Balaguruswamy, *"Programming with Java A Primer"*, Tata McGraw Hill.
4. Horstmann & Cornell, *"Core Java Volume-I Fundamentals"*, Eight Edition, Pearson Education.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Create java program for simple business logic.
2. Understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.

3. Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
4. Demonstrate programs on exceptions, multithreading, various collection classes and applets.
5. Understand the concept of file handling.
6. Identify various event classes and methods which are needed for event based applications.

3IT87: OBJECT ORIENTED PROGRAMMING WITH C++
CREDITS – 4(LTP: 3,0,1)

Course Objective:

Analyzing and solving the real-world problems using various concepts of object oriented programming.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to C++: Introduction OOP, Procedural VS. Object oriented Programming, Basic concept of OOP, Principals of OOP, Benefits and applications of OOP, Programming in C++.	3
2	Data types, operators and Control Structures: Data Types, Keyword, Tokens, identifiers, variables, constants, enum, operators, typecasting, control structures.	4
3	C++ Functions: Function Prototyping, Call by value and reference, Return by reference, Inline function and macro function, Default Arguments, Function Overloading.	5
4	Class and objects: Structure vs Class, Member function Declaration, Access Specified for member function, Static data Member and Member Function, Friend Function, Object as Argument, Constructor, Types of Constructor, Destructor.	6
5	Operator Overloading and Type Conversion: Unary and Binary Operator Overloading, Types of Type Conversion.	5
6	Inheritance: Inheritance, Types of Inheritance, Virtual Base Classes, Abstract Class, Constructor in Derived Class.	5
7	Virtual Function and Polymorphism: Polymorphism, Types of Polymorphism, this Pointer, Virtual Function, Pure Virtual Function.	5

Unit No.	Topics	Teaching Hours
8	I/O functions: Formatted and Unformatted I/O Operations, Manipulators.	4
9	File Management: Classes for File Operations, Basic File Operations, File Functions, Error Handling Operations, Command Line Arguments.	4
10	Exception Handling: Try, Catch and Throw, Multiple Catch, Re-throw Exception.	4
Total		45

List of References:

1. E Balagurusamy, “*Object Oriented Programming with C++*”, Second Edition, Tata McGraw Hill.
2. Herbert Schlitz, “*The Complete Reference C++*”, Second Edition, Tata McGraw Hill.
3. Ashok Kamthane, “*Object Oriented Programming with ANSI and Turbo C++*”, Pearson.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design and analyze real world problem effectively.
2. Understand functions and parameter passing.
3. Differentiate the use of class and structure to develop a program.
4. Develop a program show usage of abstraction.
5. Design effective program using various IOS functions.
6. Create a file to manage data using object oriented programming.

3IT88: MOBILE APPLICATION DEVELOPMENT
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

Design and develop useful Android applications with compelling user interfaces by using, extending, and creating your own layouts and Views and using Menus.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Basics of Android Programming: Introduction, History, Features and android architecture, Introduction to java and android, Introducing development framework, Dalvik virtual machine – DVM,	8

Unit No.	Topics	Teaching Hours
	Installation of Android Studio, Android virtual device (AVD) and SDK manager, Android manifest file,	
2	Android Building Blocks: Types of android applications, Activity lifecycle, Intents, services, Content provider, broadcast receivers, Activity classes, Component lifecycle, Layouts, Views and Resources, Activity with Implicit Intents.	7
3	Android User Interface : Buttons, RadioButtons, checkboxes, Pickers, Spinners, Menus: Options menu, contextual menu, Popup menu, Adding menu items, Navigation: Screen Navigation, navigation drawer, Theme and Styles: uses of drawable in android	7
4	Multimedia in Android: Introduction to audio and video in Android, Android persistence, Android preferences, Using file system, Accessing SD cards, Location and maps, Using GEOCoder, Android text to speech, Paranoid android, Internet services, Broadcast receivers, Sensor manager, different Parsing techniques like JSON Parsing and SAX Parsing.	10
5	Database Connectivity: SQLite database, SQLite data types, Cursors and content values, SQLite open helper, Adding, Updating and deleting content, Firebase database, connection of firebase database with android app.	7
6	Test and Debug Android Application : Basics of testing, testing and commercializing applications, Activity testing, service testing, Content provider testing, Test classes, Debugging using DDMS, Configuration changes, Security and permissions, Web services integration, Deployment.	6
Total		45

List of References:

1. Mike Wolfson, “*Android Developer Tools Essentials*”, O’Reilly Media Publications.
2. Jeff Friesen, “*Learn Java for Android Development*”, A press Publications, 2nd Edition.
3. Kevin Brothaler, “*OpenGL ES 2 for Android -The Pragmatic Programmers*”.
4. Wei-Meng Lee, John Wiley and sons, “*Android Application Development Cookbook*”, 2013

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design and develop user Interfaces for the Android platform.
2. Gain knowledge to create and publish their own Apps for Android devices
3. Understand the limitations and features of developing application for mobile devices
4. Learn database connectivity using real time database.
5. Analyze different parsing techniques.
6. Apply different Testing techniques on android applications.

3EE82: RENEWABLE ENERGY TECHNOLOGIES
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

The subject aims to provide the student with the knowledge of upcoming renewable energy technology, applications and be able in the future to design and development of various energy technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course content:

Unit No	Topics	Teaching Hours
1	Introduction: Renewable Sources of Energy, Grid-Supplied Electricity, Distributed Generation-Renewable. Various non-conventional energy resources; Introduction, availability, classification, relative merits and demerits. Energy Policy and Regulations, CDM prospects (carbon credits)	6
2	Solar Energy: Introduction ,Photo voltaic power generation, spectral distribution of energy in solar radiation, solar cell Configurations, voltage developed by solar cell, Solar Cell Efficiency and losses , practical solar cell performance, commercial photo voltaic systems, specifications for PV systems, Applications , Design of roof top solar PV system .Introduction and Application of Solar thermal Energy .	6
3	Wind Energy : Introduction, Site selection criterion, Classification of wind power plants, wind characteristics, performance and limitations of energy conversion systems. Power from wind, properties of air and wind, types of wind Turbines, operating characteristics, New Developments.	6
4	Geothermal Energy: Introduction ,Resources of geothermal energy, Types of Geo thermal Energy , Environmental Consideration, Power generation methods, Hybrid systems	6
5	Wave and Tidal Wave energy: Introduction, Mechanism and wave motion, Properties of waves and power content, vertex motion of waves, Device applications. Types of ocean thermal energy conversion systems, Application of OTEC systems, Examples.	6
6	Biomass Energy Conversion: Introduction, Technologies available for thermal and power generation applications, Bio-fuels and decentralized energy systems (Co—operative Rural power plant, Biogas generation, Waste minimization and utilization.	6

Unit No	Topics	Teaching Hours
7	Advanced Technologies: Introduction of Green Building Concepts, CO ₂ Sequestration, Electric Vehicle, Fuel Cells, Hydrogen Energy, Building material selection ,Designing of building ,Heat transfer concepts ,Green building rating systems etc.	6
Total :		42

List of References:

1. G. D Rai, “*Non-conventional energy sources*”, Khanna Publishers.
2. Chetan Singh Solanki, “*Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers*”, PHI Publisher, 2013.
3. S.P. Sukhatme, “*Solar Energy - Principles of thermal collection and storage*”, TMH, 2008.
4. Dr. R K Singal, “*Non-Conventional Energy Resources*”, S.K Kataria & Sons.
5. Thomas Ackermann, “*Wind Power in Power System*”, John Willey & Sons, 2005.
6. Felix A. Farret, M. Godoy Simoes, “*Integration of Alternative Sources of Energy*”, John Wiley & Sons, 2006.

Web Resources:

1. Non-Conventional Energy Systems, Electrical Engineering Prof. L. Umanand, IISc Bangalore
<https://nptel.ac.in/courses/108/108/108108078>

Course Outcomes (COs):

After learning this course the students will be able to:

1. Comprehend Solar Energy technologies and applications.
2. Learn wind and other Energy generation technologies and applications.
3. Design of solar PV system and associated problems.
4. Identify Energy generation problem as per environmental conditions and Geographical Locations.
5. Learn advance technologies and limitations.
6. Solve Field problems using recent technological development as per need of an hour.

3EE84: INDUSTRIAL AUTOMATION
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

Understand automation technologies and identify advantages, limitations and applications of the same. Develop ability to recognize, articulate and solve industrial problems using automation technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component:

Term work [15]	Allied Evaluation [15]
Report/Presentations/Assignment/Journal	Performance/Quiz/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours
1	Programmable Logic Controller (PLC) : An overview of PLC, introduction, definitions and history of PLC, manufacturing and assembly processes, PLC advantages and disadvantages, overall PLC system, CPU, PLC, input and output modules, program recording devices, general programming procedure, Input and Output module interfacing, relation of digital gate logic to contact / coil logic	6
2	PLC Programming: Creating ladder diagrams from process control descriptions, basics of register.	6
3	PLC Functions: Timer function, Counter function, Arithmetic function, Number comparison functions, Numbering systems and number conversion function, Skip and Master control relay functions, Jump functions, PLC data move systems, Digital bit functions and applications, Sequencer function.	8
4	Analog PLC operations: Different PLC operations, applications of PLCs: Stepper motor control, speed control of D.C. motor & Induction motor, lift/elevator control, water level control, Traffic control, Temperature control.	6
5	HMI: Architecture, types and specifications, Interfacing and Networking with PLC, SCADA: Introduction, features and applications.	5
6	Introduction to Distributed Control System: DCS architecture, Communication Protocol.	4
7	Introduction to Industry 4.0 History of industrial revolutions, concept of IR4.0, typical architecture of IR4.0, design principles and major role players in IR4.0, advantages and challenges.	5
Total		40

List of Experiments:

Exp. No.	Suggested List of Experiments
1	Introduction to different PLC programming languages.
2	To develop digital circuits using ladder logic and Codesys software.
3	To develop traffic controller logic using ST 2401.
4	To develop water level controller logic using ST 2401.
5	To develop elevator controller logic using ST 2401.
6	Introduction to Dynalog test bench.
7	To demonstrate set and Reset using Push Buttons.

Exp. No.	Suggested List of Experiments
8	To develop NOT, AND & OR logic using switches and indicators.
9	To develop NAND & NOR logic using switches and indicators.
10	To develop industrial control systems.
11	Industry Visit : Process Industry , Automation Industry

List of References:

1. John W. Webb, Ronald A. Reis, “Programmable Logic Controllers”, 5th Ed., PHI, 2012.
2. John R. Hackworth, Fredrick D. Hackworth Jr., “Programmable Logic Controllers: Programming Methods and Applications”, Pearson,
3. William Bolton, “Programmable Logic Controllers”, 4th Edition, Elsevier.
4. L.A. Bryan and E. A. Bryan, “Programmable Controllers – Theory and implementation,” Second edition, An Industrial text company publication, USA, 1997.
5. Richard L. Shell and Ernest L. Hall, “Handbook of industrial automation,” CRC press 2000.

Web Resources:

Video Course on “Industrial Automation & Control” by Prof Siddhartha Mukhopadhyay (IIT, Kharagpur) available at:
<https://nptel.ac.in/courses/108/105/108105088/>

Course Outcomes (COs):

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

1. Understand the basics of PLC programming.
2. Understand the different parameters of PLC.
3. Design different process control applications through ladder logic.
4. Analyze & explain different functions of PLC.
5. Build and experiment with PLC based SCADA systems for various industrial applications.
6. Implement HMI, distributed control system and Industry standard 4.0

3EL82: BASICS OF EMBEDDED AND IOT SYSTEMS
CREDITS –4 (LTP: 3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of Designing Embedded and IOT Systems for various application.
2. Knowledge for the design and analysis of Embedded and IOT Systems for Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Embedded and IoT Systems: Introduction Embedded and IoT systems, Definition, Examples and components of embedded and IoT Systems, Embedded and IoT Systems Design Process, Various Embedded and IoT cores controllers.	5
2	Hardware/Software Co-design for Embedded and IoT Systems: Microcontrollers for embedded systems, Arduino embedded platform, Peripheral interfacing and programming with Arduino platform, Sensors and Actuator interfacing, Cloud support with Arduino platform.	10
3	Protocols for Embedded and IoT systems: Serial protocols, UART, I2C, and SPI. NFC, Wireless protocols like, RFID, Zig- bee, IEEE 802.15.4e, Thread, 6LoWPAN, Constrained Application Protocol (CoAP), Extensible Messaging Protocol (XMPP) , WebSocket , Advanced Message Queuing Protocol (AMQP) , Message Queue Telemetry Transport (MQTT), Web Real Time Communications (WebRTC), LoRa, SIGFOX, Z Wave.	10
4	OS based Software development: Programming in higher level languages on embedded OS platform, Python and C programming, Various aspects of the OS designed for the IoT environment, open source OS for IoT such as Contiki OS, TinyOS etc.	05
5	IoT based Embedded Systems: Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and Raspberry Pi based development board, IoT Cloud Platform and IoT client applications on mobile phones.	05
6	Case Studies of Embedded and IoT Systems: Embedded application development through Arduino and Raspberry Pi based development boards, Development of mini Project on new version of Operating systems and development board. That project should also address to the current societal needs.	05
Total		45

List of References:

1. Muhammad Ali Mazidi Shujen Chen, Sepehr Naimi Sarmad Naimi “*Embedded Programming Using C Language*”, 1st Edition, Freescale ARM Cortex-M.
2. Steve Ferbur, “*ARM System on Chip*”.
3. Rajkamal, “*Embedded System: Architecture, Programming and Design*”, TMH3.
4. Dr. Ovidiu Vermesan, Dr. Peter Friess, “*Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems*”, River Publisher

Course Outcome:

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

1. Knowledge of theory and practice related to Embedded and IOT System.
2. Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.
3. Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.

Sr. No.	Suggested List of Experiments
1.	Study of Open source operating system used in Embedded Design.
2.	Introduction to Arduino based Embedded System Programming.
3.	LED Interfacing program for Arduino based Embedded System
4.	Interfacing Push button Switch interfacing with Arduino based Embedded System
5.	External Peripheral Interfacing with Arduino based Embedded System.
6.	On Chip peripheral programming with Arduino/Raspberry Pi based Embedded System
7.	Serial Communication Protocol programming with Arduino/Raspberry Pi based Embedded Systems.
8.	Wireless communications with Arduino/Raspberry Pi Embedded IOT Platform.
9.	Bluetooth communication interfacing with Arduino/Raspberry Pi Embedded IOT Board.
10.	WiFi module interfacing with Arduino/Raspberry Pi Embedded IOT Board.
11.	Embedded Systems design with IOT capability.
12.	IOT based Temperature monitoring embedded system with open source cloud tools.
13.	Introduction to RTOS
14.	RTOS based task performances

3EL83: SENSORS TECHNOLOGY
CREDITS-3(LTP:3,0,1)

Course Objective:

1. Introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.
2. Provide students with opportunities to develop basic skills in the understanding the operation of electronic sensors based technology.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Electronics Measurement and Instrumentation: Transducers and sensors- Accuracy and precisions, types of errors, statistical analysis, probability of errors, limiting errors, sensitivity, linearity, hysteresis, resolution, reproducibility, transfer function.	6
2	Analog Signal Conditioning: Signal conditioning, Loading effects, Bridges for measurement techniques, Attenuators and Amplifiers, Passive filters, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers.	6
3	Digital Signal Conditioning: Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Single channel and multi-channel Data Acquisition System (DAS).	6
4	Temperature Sensors: Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, Other Thermal Sensors.	6
5	Pressure, force, displacement and weight measurement: Capacitive and inductive transducers, Displacement Sensor (LVDT), Strain Sensors – strain gauges, its principle, applications, types of strain gauges, Load cells, Piezo-electric sensors, Motion sensors.	6
6	Flow measurement: Basic principle of flow meter, Differential pressure flow meters, Variable area flow meter, Volumetric flow meter, Hotwire anemometer, Magnetic and ultrasonic flow meter, Rota meter, Hall effect transducer working and measurement techniques.	6
7	RF sensing: Basic principle of EM fields, Antenna, RFID, Near Field and Far Field Sensing, Radar and Navigation, EMI & EMC sensing	9
Total		45

List of References:

1. Curtis D. Johnson, “*Process Control Instrumentation Technology*”, Prentice Hall India.
2. D.V.S. Murty, “*Transducers and Instrumentation*”, Prentice Hall India.
3. Helfrick Albert D. and Cooper W. D., “*Modern Electronic Instrumentation and Measurement Techniques*”, Prentice Hall India.
4. Kalsi H. S. “*Electronic Instrumentation*”, Tata McGraw-Hill Education.
5. Shawsney A. K. “*A Course In Electrical and Electronics Measurements and Instrumentation*”, Dhanpat Rai & Sons, 11th Ed., 1999.
6. Bell David A. “*Electronic Instrumentation and Measurements*”, PHI / Pearson Education.
7. Mathew Sadiku, “*Elements of Electromagnetics*”, PHI

Course Outcomes (COs):

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

1. Apply scientific principles for sensing various physical quantities.
2. Understand the operational details of sensors for measurements.
3. Apply measurements techniques for instrumentation.

3EC83: EMBEDDED SYSTEMS AND IOT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

Understand and Design Arduino based embedded systems for branch specific applications.
 Understand and Integrate IoT Platforms to enhance application metrics and accessibility.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Content:

Unit No.	Topics	Teaching Hours
1.	Introduction : Numbering and coding systems, semiconductor memory, CPU architecture, Microcontrollers and Microprocessors, embedded system, Introduction to Arduino Uno and Arduino IDE, Structuring an Arduino Program, Using data types and operations.	04
2.	IO Port Programming : Atmega328p pins and functions, IO port programming, Using a Switch, Reading a Keypad, Visual Output, Connecting and Using LEDs, Driving a 7-Segment LED Display, LCD Display.	07
3.	Serial Communication : Introduction to serial communication, Sending Formatted Text and Numeric Data from Arduino, Sending and Receiving Serial Data in Arduino, GSM modem, Bluetooth.	07
4.	Getting Input from Sensors : Reading Analog Values, Detecting Light, Detecting Motion (Integrating Passive Infrared Detectors), Measuring Distance, Detecting Vibration, Detecting Sound, Measuring Temperature, Reading RFID Tags, Tracking Rotary Movement, Detecting Acceleration.	09
5.	Physical Output : Controlling a Servo, driving a Brushless Motor, Controlling Solenoids and Relays, making an Object Vibrate, Controlling the Direction and Speed of a Motor with an H-Bridge, Driving a Stepper Motor.	08

Unit No.	Topics	Teaching Hours
6.	Introduction to IoT : Defining IoT, Characteristics of IoT, design of IoT, Functional blocks of IoT, Communication models & APIs, IOT platforms. ESP8266- Introduction. Domain specific applications of IoT : Home automation, Industry applications, Environmental applications.	10
Total		45

List of References:

1. Michael Margolis, “*Arduino Cookbook*”, First Edition, O'Reilly Media, March 2011.
2. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, “*The AVR Microcontroller and Embedded Systems: Using Assembly and C*”, 1st Edition, Pearson Education, 2012.
3. Michael McRoberts, “*Beginning Arduino*”, 2/E, Apress, 2013
4. Cornel Amariei, “*Arduino Development Cookbook*”, Packt Publishing, 2019.
5. Michael McRoberts, “*Beginning Arduino*”, Second Edition, Apress, 2013
6. Marco Schwartz, “*Internet of Things with ESP8266*”, Packt Publishing Ltd., July 2016
7. Marco Schwartz, “*ESP8266 Internet of Things Cookbook*”, Packt Publishing, 2017

Course Outcomes (COs) :

At the end of this course students will be able to ...

1. Recollect basic knowledge about Digital Systems and microcontroller architecture.
2. Understand functions of Arduino pins and illustrate its use.
3. Integrate serial communication for device interfaces and debugging in applications.
4. Make use of sensors for monitoring different quantities in application.
5. Integrate actuators in application for physical movement and control.
6. Understand concepts of IoT and design IoT applications.

3ME83: RENEWABLE ENERGY SOURCES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To illustrate renewable energy sources and its effective technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Energy Consumption & Standard of living, Forms of Energy, Classification of Energy Resources, Application of non-conventional energy sources, Energy scenario	4

Unit No.	Topics	Teaching Hours
2	Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications	10
3	Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; wind data and site selection considerations	4
4	Biomass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	8
5	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Ocean Thermal Energy-Availability, theory and working principle, performance and limitations	10
6	Miscellaneous Technologies: Magneto Hydrodynamic Power Conversion: Principle of working of MHD Power plant, performance and limitations. Fuel Cell: Principle of working of various types of fuel cells and their working, performance and limitations Hydrogen Energy: Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	6
Total		42

List of References:

1. G. D. Rai, “*Non-Conventional Energy Sources*”, 1th Edition, Khanna Publishers, Reprint 2010
2. S. P. Sukhatme, “*Solar Energy*”, 3rd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2008
3. B H Khan , “ *Non-Conventional Energy Resources*”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011
4. S.Hasan Saeed and D.K.Sharma, “*Non-Conventional Energy Resources*”, 3rd Edition, S.K.Kataria & Sons, 2012
5. G.N.Tiwari and M.K.Ghosal, “*Renewable Energy Resource: Basic Principles And Applications*”, Narosa Publishing House, 2004
6. Shobh Nath Singh, "*Non-Conventional Energy Resources*", Pearson Education India; First edition (2015).

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Identify energy demand and relate with available energy resources.
2. Analyze solar energy technologies.
3. Outline the wind energy sources.
4. Analyze harnessing of biomass energy.
5. Outline the geothermal and ocean energies.
6. Describe magneto hydrodynamics, hydrogen energy and fuel cell technology.

3ME84: ENERGY CONSERVATION AND MANAGEMENT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To apply energy conservation principles and management techniques to different energy conversion systems

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Energy Scenario: Introduction to energy & power scenario of world, National Energy consumption data and environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing.	8
2	Energy Conservation Act 2001 and related policies: Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, ECBC code for Building Construction.	3
3	Financial Management: Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.	5
4	Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM).	5
5	Energy Conservation in Electrical Utilities : Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux,	8

Unit No.	Topics	Teaching Hours
	Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.	
6	Energy Efficiency in Thermal Utilities and systems: Thermal systems, Boilers, Furnaces, Heat exchangers and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories. Energy conservation in major utilities; pumps, fans, blowers, compressed air systems, Refrigeration & Air Conditioning systems, Cooling Towers, DG sets	13
Total		42

List of References:

1. Witte L.C., Schmidt P.S. and Brown D.R., “*Industrial Energy Management and Utilization*”, Hemisphere Publ., Washington, 1988..
2. Callaghan P.W., “*Design and Management for Energy Conservation*”, Pergamum Press, Oxford
3. Murphy W.R. and McKay G., “*Energy Management*”, Butterworth’s, London, 1987.
4. Bureau of Energy Efficiency, “*Energy Manager Training Manual*”, Reference book No:1 to 4.
5. Dale R Patrick, Stephen W Fardo, “*Energy Conservation Guidebook*”, 2nd Edition, CRC Press.
6. Shobh Nath Singh, “*Non-Conventional Energy Resources*”, Pearson Education India; First edition (2015).

Course Outcomes (COs):

After learning the course the students should be able to:

1. Outline energy scenario, audit and management.
2. Apply energy conservation policy, regulations in industrial practices.
3. Evaluate energy economics.
4. Identify opportunities for rational use of energy.
5. Analyze electrical systems for energy conservation.
6. Analyze the thermal systems for energy efficiency.

3PE83: MANAGING PROJECT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To provides a systematic and thorough introduction to all the aspects of project management.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p>Introduction to Project Management: Definition of Project, Program and Portfolio, Project parameters: Scope, Quality, Cost, Time, Resources, And The scope triangle: Time, Cost, and Resource Availability, The life cycles of Projects. Project Classification. Project Management, Project Management Vs General Management, Principles of Project Management: Defining, Planning, Executing, Controlling, Closing, Phases of Project Management: Scope the Project, Develop the project plan, Launch the plan, Monitor/control project progress, Close out the Project.</p>	06
2	<p>Organizing the Project and Scope of the Project: The PM's Roles, The PM's responsibility to the project, Selection of a project Manager, and The Project team. Developing Conditions of Satisfaction, Establishing Clarity of Purpose, Creating the Project Overview Statement, Parts of the POS, Attachments Submitting a Project for Approval, Submitting a project for Approval, Participants in the Approval Process, The Project Definition Statement.</p>	07
3	<p>Planning the Project and Budgeting the Project: The contents of a Project Plan, The Planning Process- Overview, The Planning Process- Nuts and Bolts, The project action plan, The Work breakdown Structure, Use for the WBS, Generating the WBS, Six criteria to test for completeness in the WBS, Approaches to Building the WBS, Representing the WBS. Methods of Budgeting: Top-Down Budgeting, Bottom-Up Budgeting, Cost Estimating, Improving Cost Estimates, Budget Uncertainty and Risk Management.</p>	07
4	<p>Scheduling the Project- Network Analysis-PERT: Elements of network: Introduction to Project Evaluation and Review Technique, Event, Activity, Dummy, Network rules, Graphical guidelines for network, Common partial situations in network, numbering the events, cycles. Developing the Network: Planning for network construction, modes of network construction, steps in developing network, hierarchies. Time Estimates in PERT: Uncertainties and use of PERT, Time estimates, Frequency distribution, Mean, Variance & standard deviation, Probability distribution, Beta distribution, Expected time. Time Computations: Earliest expected time, Formulation for T_E, Latest allowable occurrence time, Formulation for T_L, Combined tabular computations for T_E, T_L. Network Analysis: Slack, Critical Path and Probability of meeting schedule date.</p>	08
5	<p>Scheduling the Project- Network Analysis-CPM and Allocating the Resources to the Project: Network Analysis :Introduction to Critical Path Method, CPM- Process, CPM - networks, Activity time estimate, Earliest event time, Latest allowable occurrence time, Combined tabular computations for T_E and T_L, Start & Finish times of activity, Float, Critical activities & Critical path. Cost Model: Introduction, Project cost, Indirect project cost, Direct Project cost, Crashing of project network.</p>	08

Unit No.	Topics	Teaching Hours
6	Introduction, Resources Usage Profiles: Histograms, Resources Smoothing, Resources Levelling. Monitoring and Controlling the Project and Closing out the Project: Control versus Risk, Purpose of Controls, Control versus Quality, Progress reporting System, Applying Graphical Reporting Tools: Cost Schedule control, Deciding on Report Level of Detail, Managing project Status meetings, Managing Change, Managing Problem Escalation. Steps in Closing a project, Getting client Acceptance, Installing Project Deliverables, Documenting the Project, Post Implementation Audit, The Final Report.	06
Total		42

List of References:

1. Robert K. Wysocki, Robert Beck. Jr., and David B. Crane, “*Effective Project Management*”, Wiley India.
2. Samuel Mantel, Jack Meredith, Scott Shafer, Margaret Sutton, M. R. Gopalan, “*Project Management Core Textbook*”, Wiley India.
3. Harold Kerzner, “*Project Management: A Systems Approach to Planning, Scheduling and Controlling*”, Wiley India.
4. Dr. B.C. Punamia & K. K. Khandelwal, “*Project Planning and Control with CPM and PERT*”, Laxmi Publications, New Delhi.

Course Outcomes (COs):

After completion of this subject, the students will be able to...

1. Understand about Project, Project management and role of project manager.
2. Define & develop project statement & project plan.
3. Develop & analyze project network diagram with cost model.
4. Estimate project budget and resource allocation.
5. Monitor, control and close out the Project.

3PE84: ADDITIVE MANUFACTURING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

The revolutionary change in factory production techniques & management require a direct involvement of computer-controlled systems in the entire production process with every operation, from product design, to manufacturing, to assembly & product inspection, being monitored & controlled by computers. This subject enhances knowledge-base with possible applications in respective fields of engineering of the students of various disciplines.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Fundamentals of Prototype & Rapid prototyping, Commonly used terms, Difference between rapid prototyping & additive manufacturing (AM) concepts including classes of prototypes and basic aspects of additive manufacturing, Classification & advantages of AM Systems, Applications in engineering field of mechanical, production, civil, structural as well as electronics & information technology (machine part printing, concrete printing, metallic & ceramic part printing, circuit board printing, etc.).	04
2	(a) Additive Manufacturing Process Chain: Fundamental automated processes, Process chain, 3D modeling, Data conversion & transmission, Checking & preparing, Building, and post-processing. (b) Additive Manufacturing Data Formats: STL format, STL file problems/errors & repairing, Consequences of building a valid & invalid tessellated model, Other translators, Standards for representing objects manufactured by additive manufacturing methods.	08
3	Liquid-based Additive Manufacturing: Stereolithography Apparatus (SLA), Polyjet, Perfactory, Solid Object Ultraviolet-Laser Printer (SOUP), Bioplotter & Bioprinting, Rapid Freeze Prototyping (RFP), Other notable liquid-based AM systems - Two Laser Beams, Solid Ground Curing (SGC).	09
4	Solid-based Additive Manufacturing: Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Selective Deposition Lamination (SDL), Paper Lamination Technology (PLT), Ultrasonic Consolidation, Benchtop System, Multi-Jet Modeling System (MJM), Other notable solid-based AM systems – Offset Fabber, Shape Deposition Manufacturing (SDM) process	09
5	Powder-based Additive Manufacturing: Selective Laser Sintering (SLS), EOSINT Systems, Laser Engineered Net Shaping (LENS), Electron Beam Melting (EBM), Selective Laser Melting (SLM), ColorJet Printing (CJP), Aerosol Jet System (AJS), Digital Part Materialisation (DPM), Other notable powder-based AM systems, Three Dimensional Printing (3DP) to be covered in laboratory.	09
6	Evaluation and Benchmarking: Using Bureau Services, Setting Up a Service Bureau, Technical Evaluation Through Benchmarking, Industrial Growth, Future Trends.	03
Total		42

List of References:

1. Chua C. K., Leong Kah Fai & Lim Chu Sing, “3D Printing & Additive Manufacturing”, World Scientific Publishing Co. Pvt. Ltd., 2017.
2. Chua C. K., Leong Kah Fai & Lim Chu Sing “Rapid Prototyping: Principles and Applications”, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition
3. Ian Gibson, “Additive Manufacturing Technologies”, Springer, 2015.
4. Amit Bandyopadhyay, “Additive Manufacturing”, CRC Press, 2015.

5. Andreas Gebhardt, “*Additive Manufacturing*”, Hanser Publications, 2016.
6. Adedeji B. Badiru, “*Additive Manufacturing Handbook*”, CRC Press, 2017.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand and differentiate the concept of rapid prototyping & additive manufacturing (AM) including classes of prototypes and basic aspects of AM & its applications.
2. Understand and describe the AM process chain, classification & advantages of AM Systems.
3. Understand AM data formats, their limitations/errors & Standards for AM parts.
4. Understand and describe basic terminology/specifications, principles, benefits, limitations & applications of various additive manufacturing techniques.
5. Explain the process steps, set-ups and case studies related to liquid-based, solid-based & powder-based AM methods.
6. Understand and explain the requirement of service bureau, the procedure and reasons for evaluation & benchmarking as well as futuristic development of these manufacturing techniques.

3SE04: DESIGN OF RC STRUCTURES
CREDITS – 4 (LTP: 3,1,0)

Course Objectives:

1. To impart the concepts of design philosophies and material behavior.
2. To introduce design of basic RCC elements as per IS codes of practice.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Design philosophy: Working stress method, Limit state method, Introduction to analysis, design and detailing of RC structures, review of Concepts of loading and load combinations as per IS:875. Materials of RC, Strength and stress-strain curves of concrete and steel, Introduction to IS:456, SP16.	02
2	Bond and Development Length: Concepts and codal provisions, bond and development length in beams, slab, columns and footings.	02
3	Multistory building: Load transfer mechanism, Gravity load analysis	04

Unit No.	Topics	Teaching Hours
4	Limit State Design of RC Flexural Elements: Beams: Singly and doubly reinforced rectangular and flanged beams, under reinforced and over reinforced sections, shear reinforcement design, Slabs: One way and two way slabs, simply supported and continuous slabs.	14
5	Limit State Design of RC Compression Elements: Design of columns: Axial load, uniaxial and biaxial bending	10
6	Limit State Design of Footings: Design of isolated pad footing, Design of isolated sloped footing. Design of rectangular beam type combined footing and design concepts of rectangular slab type combined footing, Introduction to other types of footings such as trapezoidal, strap beam, raft.	11
7	Introduction to Precast Elements: Design of Short columns: Axial load, uniaxial and biaxial bending Design of Long columns: Axial load, uniaxial and biaxial bending	02
Total		45

List of References:

1. S. N. Sinha, “*Reinforced Concrete Design*”, Tata McGraw Hill
2. A. K. Jain, “*Design of Concrete Structures*”, Nemchand Publication
3. V. L. Shah & S. R. Karve, “*Limit State Theory & Design of Reinforced Concrete*”, Structure Publishers, Pune
4. V. L. Shah & S. R. Karve, “*Design of Multi-storied Building (G+3)*”, Structure Pub., Pune
5. KrishanaRajuN., “*Advanced Design of Concrete Structures*”, Tata Mc-Graw Hill, Delhi
6. Dr. H.J. Shah, “*Reinforced Concrete*”, Vol-I & II; Charotar Pub. Anand
7. Charles E. Reynolds, James C. Steedman (Author), Anthony J. Threlfall, “*Reinforced Concrete Designer's Handbook*”; CRC press-Taylor and Francis.
8. Krishna Raju, R.N. Pranesh, “*Reinforced Concrete Design: IS: 456-2000 Principles and Practice*”, New age International publishers.
9. Varghese P.C, “*Limit State Design of Reinforced Concrete*”; PHI learning
10. Kim S. Elliott, “*Precast Concrete Structures*”; CRC press-Taylor and Francis.
11. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
12. IS: 875 - (Part I to V) – Indian Standard Code of Practice for Structural Safety of Building Loading Standards
13. SP:16 - Design aids for Reinforced Concrete
14. SP:34 – Handbook on Concrete Reinforcement and Detailing

Course Outcomes (COs):

1. Understand design philosophies and material behavior of RC elements.
2. Understand the load distribution mechanism and Behaviour in RC multi-storied structures.
3. Design RC elements as per IS codes of practice.
4. Design suitable foundation for different structures.

4SE01: EARTHQUAKE ENGINEERING
CREDITS - 3 (LTP: 2,0,1)

Course Objective:

1. To impart the knowledge of behavior of civil engineering structures during earthquakes.
2. To explain seismic analysis of framed and masonry structures.
3. To introduce the concepts of ductile detailing.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
2	0	2	3	30	20	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to seismology Fundamentals of earthquake engineering, plate tectonics, Causes of earthquakes, types of earthquakes, important earthquake parameters such as magnitude and intensity, Philosophy of earthquake resistant design	2
2	Concept of single degree of freedom Systems Concept of natural frequency and degree of freedom, Equation of motion for single degree of freedom (SDOF) system, Concepts of response of SDOF systems (free, forced, undamped and damped), concept of resonance.	3
3	Response of multi degree of freedom Systems Concept of response spectrum, Equations of motion for multi degree of freedom (MDOF) systems, Natural frequencies and mode shape for MDOF systems, Normalization of modes, Dynamic analysis and calculation of base shear of MDOF systems by response spectrum method as per IS 1893, Modal combinations.	6
4	Seismic analysis of buildings Concepts of floor diaphragms and lateral load resisting systems, Importance of strength, stiffness, ductility and configuration, various structural irregularities, calculation of centre of mass, centre of stiffness and eccentricity, lateral-torsional analysis of building as per seismic coefficient Method, Calculation for base shear and its distribution along height.	8
5	Ductile Design and detailing Importance of ductile detailing, capacity design concept, strong column weak beam theory, Concepts of ductile detailing and design of beams and columns as per IS: 13920.	5
6	Seismic analysis & design of masonry buildings Seismic detailing of masonry buildings as per IS: 4326, Provision of various types of bands and vertical reinforcements, Calculation for rigidity of masonry wall, Concept of lateral load analysis of masonry building.	4

Unit No.	Topics	Teaching Hours
7	Special topics Structural controls, Introduction to base isolation and dampers, Introduction to reinforced masonry structures.	2
Total		30

List of References:

1. Mario Paz, “*Structural Dynamics - Theory and Computations*”, Pearson Education
2. Pankaj Agarwal & Manish Shrikhande, “*Earthquake Resistant Design of Structures*”, Prentice Hall of India, New Delhi
3. Jai Krishna A.R, Chandrasekharan A. R, Brijesh Chandra, “*Elements of Earthquake Engineering*”, South Asian Publishers, New Delhi
4. Chopra A. K., “*Dynamics of Structures*”, Pearson Education, New Delhi
5. Ray W. Clough & Joseph Penzien, “*Dynamics of Structures*”, McGraw Hill
6. S. K. Duggal, “*Earthquake Resistant Design of Structures*”, Oxford university Press
7. S. R. Damodarasamy and S. Kavitha, “*Basics of Structural Dynamics and Aseismic Design*”, Prentice Hall of India, New Delhi
8. Dr. C. V. R. Murty, “*Earthquake Tips*”, Indian Institute of Technology Kanpur and Building Materials and Technology Promotion Council, New Delhi
9. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
10. IS: 1893 - Indian Standard Criteria for Earthquake Resistant Design of Structures
11. IS: 4326 - Indian Standard Code of Practice for Earthquake Resistant Design & Construction of Buildings
12. IS:13920 - Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces
13. IS:13827 - Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings
14. IS:13828 - Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings
15. IS:13935 - Indian Standard Guidelines for Repair and Seismic Strengthening of Buildings
16. SP 22 - Explanatory Handbook on Codes for Earthquake Engineering

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the basics concepts of earthquake engineering.
2. Perform the static and dynamic seismic analysis of buildings.
3. Apply the concepts of ductile detailing for beam, column and beam-column joints.
4. Understand the concepts of structural control strategies and reinforced masonry buildings.

4CE01: PROJECT MANAGEMENT AND EQUIPMENT
CREDITS - 4 (LTP: 3,1,0)

Course Objective:

1. Increase awareness about construction project management.
2. Impart knowledge about different tools of management.
3. Impart the knowledge of Civil Engineering Construction Equipment.
4. Developing analytical and comprehensive approach to select appropriate construction equipment.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Construction projects and management, objectives, scope, project phases, feasibility study. Work breakdown structure (WBS). Estimating activity duration.	04
2	Management techniques: Conventional techniques: Gantt Bar chart, Mile stone chart. Network techniques: Introduction, Terminology, Types of networks, activities from WBS, Network rules, Time Grid Diagram. Critical Path Method: Network analysis and uses, Updating, Time Cost Optimization, Resource allocation, Cash flow analysis. PERT: PERT analysis and uses, Difference between CPM and PERT. Introduction of Line of balance and Precedence Networks. Project scheduling and procurements. PM Software: MS Project and Primavera: Introduction and applications.	20
5	Introduction to Construction Equipment: Their contribution and importance in construction Industry, Classification of Equipment. Economic-equipment-decision making.	04
6	Financial aspects related to construction equipment: Time value of money. Discounted present worth analysis, Depreciation, Cost of owning and operating construction equipment, Basics of equipment replacement policy.	04
7	Engineering fundamentals: Related to performance of IC engines, rim pull, drawbar pull, Coefficient of traction, Gradability, Soil fundamentals.	03
8	Equipment: <ul style="list-style-type: none"> • Overview of construction equipment. • Tractors and related equipment: Bulldozers, Rippers, Scrapers. • Excavating Equipment: Power Shovels, Draglines, Hoes, Clam Shells and trenching machines, their basic Parts, operation, Output estimation, Factors influencing output and methods to enhance it. 	10

Unit No.	Topics	Teaching Hours
	<ul style="list-style-type: none"> • Hauling equipment: Trucks and wagons, operation and guideline for selection and deployment. • Concrete Batching plant: Classification, Components, Selection, installations and operation. • Construction Cranes: Types, selection, installations and operation. • Overview of other construction equipment like Belt conveyor system, Air compressors, Drilling and blasting equipment, Pile boring / driving equipment, based on assignments group discussion. 	
Total		45

List of References:

1. Chitkara, K. K., Construction Project Management Planning, Scheduling and Controlling, Tata McGraw Hill, New Delhi. ISBN 10: 0070680752 ISBN 13: 9780070680753.
2. Kumar Neeraj Jha, Construction project management theory and practice, Pearson publications Delhi. ISBN 9789332542013
3. Srinath, L.S., PERT & CPM Principles and Applications, Tata McGraw Hill, New Delhi.
4. Sengupta and Guha, "Construction Management and Planning", Tata McGraw Hill, New Delhi. ISBN : 9780074623985
5. Punamia, B.C. and Khandelwal, K.K., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi, ISBN 10: 8131806987, ISBN 13: 9788131806982

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Demonstrate construction project management skills and apply tools of project management.
2. Select appropriate Network-based management technique and carryout Network-Analysis.
3. Apply up-to-date information about equipment and its management for civil engineering works.
4. Recommend most appropriate equipment for construction project.

4CE02: CONSTRUCTION SAFETY AND QUALITY MANAGEMENT
CREDITS - 2 (LTP: 2,0,0)

Course Objective:

1. To make students aware of quality planning, quality assurance, quality control and its Standards.
2. To teach various safety practices that has to be adopted at construction sites and to know the finer aspects of safety programs, apply policies, procedures, standards, occupational safety and health principles.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
2	0	0	2	30	20	0	0	50

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Introduction to quality; Importance of quality; Quality transition - quality control and inspection, quality assurance, total quality management; Evolution of quality management.	06
2	Quality control Planning and control of quality during design of structures; Tools and techniques for quality management; Inspection of materials and machinery.	06
3	Quality assurance Quality assurance in construction; Systems quality management; Quality standards/codes in design and construction; (ISO:9000).	06
4	Total quality management Total quality management (TQM) - principles, tools and techniques. Introduction to safety; Safety and health programs in construction industry; Planning for safety provisions; Analysis of construction hazards and accidents.	06
5	Construction hazards and safety Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation; Construction safety and health manual.	06
Total		30

List of References:

1. B. G. Dale, *Managing quality*, 4th ed., Blackwell Publishing, Oxford, 2003. ISBN-13: 978-0631236146.
2. D. Reese and J. V. Eidson, *Handbook of OSHA construction safety and health*, 2nd ed., CRC Press, Bocaaton, 2006.
3. F. Harris, R. McCaffer and F. Edum-Fotwe, *Modern Construction Management*, 6th ed., Blackwell Publishing, Oxford, 2006 ISBN: 978-0-470-67217-4.
4. K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, *Construction Management Fundamentals*, 2nd ed., McGraw Hill, New York, 2008. ISBN-13: 978-0073401041.
5. S. J. Holt, *Principles of construction safety*, Blackwell Publishing, Oxford, 2008. ISBN: 978-0-470-69052-9.
6. Rumane, Abdul R. "*Quality Management in Construction Projects*", CRC Press ISBN: 978-1-4396-3876-6.
7. PMBOK Guidelines. ISBN: 978-1-628-25184-5.
8. Thorpe, B., Sumner, P., and Duncan, J. (1996). *Quality Assurance in Construction*. Surrey, U.K.: Gower Publishing Ltd. ISBN: 9781315245522.
9. *Safety Management in Construction Industry – A Manual For Project Managers*. NICMAR Mumbai. ISBN: 9788185448220.
10. ISI for safety in Construction – Bureau of Indian Standards.
11. Dr Helen Lingard, Steve Rowlinson, "*Occupational Health and Safety in Construction Project Management*", Routledge ISBN 9781138103191.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Prepare QAQC plan for a construction project.
2. Apply quality assurance tools and quality control, with national and international standards of construction safety.
3. Implement safety concepts, safety principles and safety requirements to construction Project.
4. Analyze and evaluate workplace to occupational safety and health hazards.

4CE31: PROJECT - I
CREDITS - 6 (LTP: 0,6,0)

Course Objective:

1. Impart knowledge of Industry/project working.
2. Increase awareness of existing problem, need of their solution and concern to society as civil engineer.
3. Teach importance of Research, Literature review, paper writing, patent drafting and communications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
0	6	0	6	00	00	80	120	200

Course Contents:

Unit No.	Topics	Teaching Weeks
1	Introduction : The students are required to take civil/structural engineering project as part I defined by supervisor or by user and prepare relevant planning, design etc. All students are required to undergo the 'shodh yatra' the exercise to define the problem. Student can carry out field project / computational project / experimental project / simulation project under the guidance of faculty members.	03
2	Literature survey and project methodology: Students are required to carry out literature survey and decide the project methodology under the guidance of faculty/industry guide.	04
3	Project work: Student has to work for selected Industry/project/topic and at the end of semester project report should be prepared for submission. Continuous evaluation will be done by the project supervisor/guide/expert & end semester evaluation would be done by internal and external examiner/s.	08
Total		15

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Identify, define and analyze the peculiar Civil engineering problems of Industry/Society/Governments/ User.
2. Apply knowledge of mathematics, science & engineering all together to find the solution of problem/project under study.
3. Develop/Design solution of problem under study through literature survey and engineering insights with reference to the present context of study.
4. Able to work efficiently as individual investigator as well as in team-work.
5. Prepare presentation and communicate authentically about the problems under study with appropriate solution, at appropriate audience.
6. Draft/write/present/publish 'technical paper' on the problem/project/topic under study at seminar/conference/engineering journal/competition.

4CE32: PROJECT - II
CREDITS - 6 (LTP: 0,6,0)

Course Objective:

1. Impart knowledge of Industry/project working.
2. Increase awareness of existing problem, need of their solution and concern to society as civil engineer.
3. Teach importance of Research, Literature review, paper writing, patent drafting and communications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
0	6	0	6	00	00	80	120	200

Course Contents:

Unit No.	Topics	Teaching Weeks
1	Introduction : The students are required to take civil/structural engineering project as part I defined by supervisor or by user and prepare relevant planning, design etc. All students are required to undergo the 'shodh yatra' the exercise to define the problem. Student can carry out field project / computational project / experimental project / simulation project under the guidance of faculty members.	03
2	Literature survey and project methodology: Students are required to carry out literature survey and decide the project methodology under the guidance of faculty/industry guide.	04

Unit No.	Topics	Teaching Weeks
3	Project work: Student has to work for selected Industry/project/topic and at the end of semester project report should be prepared for submission. Continuous evaluation will be done by the project supervisor/guide/expert & end semester evaluation would be done by internal and external examiner/s.	08
Total		15

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Identify, define and analyze the peculiar Civil engineering problems of Industry/Society/Governments/ User.
2. Apply knowledge of mathematics, science & engineering all together to find the solution of problem/project under study.
3. Develop/Design solution of problem under study through literature survey and engineering insights with reference to the present context of study.
4. Able to work efficiently as individual investigator as well as in team-work.
5. Prepare presentation and communicate authentically about the problems under study with appropriate solution, at appropriate audience.
6. Draft/write/present/publish ‘technical paper’ on the problem/project/topic under study at seminar/conference/engineering journal/competition.

4CE33: INDUSTRIAL PROJECT
CREDITS - 6 (LTP: 0,6,0)

Course Objective:

1. Impart knowledge of Industry/project working.
2. Increase awareness of existing problem, need of their solution and concern to society as civil engineer.
3. Teach importance of Research, Literature review, paper writing, patent drafting and communications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
0	6	0	6	00	00	80	120	200

Course Contents:

Unit No.	Topics	Teaching Weeks
1	Introduction : The students are required to take civil/structural engineering project as part I defined by supervisor or by user and prepare relevant planning, design etc. All students are required to undergo the 'shodh yatra' the exercise to define the problem. Student can carry out field project / computational project / experimental project / simulation project under the guidance of faculty members.	03
2	Literature survey and project methodology: Students are required to carry out literature survey and decide the project methodology under the guidance of faculty/industry guide.	04
3	Project work: Student has to work for selected Industry/project/topic and at the end of semester project report should be prepared for submission. Continuous evaluation will be done by the project supervisor/guide/expert & end semester evaluation would be done by internal and external examiner/s.	08
Total		15

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Identify, define and analyze the peculiar Civil engineering problems of Industry/Society/Governments/ User.
2. Apply knowledge of mathematics, science & engineering all together to find the solution of problem/project under study.
3. Develop/Design solution of problem under study through literature survey and engineering insights with reference to the present context of study.
4. Able to work efficiently as individual investigator as well as in team-work.
5. Prepare presentation and communicate authentically about the problems under study with appropriate solution, at appropriate audience.
6. Draft/write/present/publish 'technical paper' on the problem/project/topic under study at seminar/conference/engineering journal/competition.

4CE42: AIR POLLUTION AND CONTROL
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

1. To provide general understanding of quality of air and impact on local and global effects of air pollution on human, materials, properties and vegetation.
2. To study the fate and transport of air pollutants and its measurement techniques.
3. To discuss the various types of air pollution control equipment and their design principles and limitation.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hrs.
1	History, Sources And Effects Of Air Pollution: Air Pollution- Definition, Sources, Types and classification, Its effect on human health, vegetation, materials and properties, Air pollution Episodes and lesson learnt, Global effects: Global Warming and Cooling, Acid Rain, Dust dome effects and Heat Island effect, Ozone Layer Depletion,	10
2	Meteorology And Air Pollution: Introduction to Meteorology- factors influencing air pollution, Lapse rates, Atmospheric stability conditions and temperature inversions, Plume behavior, Maximum Mixing Depths, Effective Stack height, Types of dispersion models: Gaussian model - Introduction, Dispersion Equation for Point Source at GL.	10
3	Air Pollution Sampling, Air Act(Prevention And Control) Act'81 And Ambient Air Quality Standards: Ambient air and stack sampling – pollutant measurement methods– Principles and instruments, Ambient air quality standards, Introduction to Air Act'81 and ambient air quality standards, Vehicle Emission standards	08
4	Air Pollution Control Equipments And Methods: Particulate Control: Principles and techniques for Control of particulate emission: Settling chambers, Cyclone Separators, Wet collectors, Fabric Filters, Electrostatic Precipitators. Other removal methods like Absorption, Adsorption and Precipitation. Gaseous Control: Principles and techniques for Control of particulate emission: Adsorption, Absorption and other methods Auto Exhaust: Catalytic Converters, Add on devices, Engine modification, Alternative fuels for emission control.	17
Total		45

List of References:

1. Wark Kenneth and Warner C.F, “Air pollution its origin and control”. Harper and Row Publishers, New York, 1997.
2. Rao C.S., “Environmental pollution control engineering”, New age international Ltd, New Delhi, 2007.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. “Environmental Engineering”, McGraw Hills, New York 1985.
4. De Nevers, N., “Air Pollution Control Engineering”, McGraw Hill, New Delhi, 1995
5. Rao M. N., “Air Pollution”, Tata Mc-Graw Hill Publication

Course Outcome:

At the end of the course student will be able

1. Classify and identify the sources of air pollutants and predict the effects of air pollutant on human health and environment.
2. Apply and relate the significance of various air pollution dispersion models.
3. Analyze the air quality and relate with air pollution regulation
4. Design various air pollution control equipment and evaluate its use.

4CE43: GEOMATICS ENGINEERING
CREDITS - 4 (LTP: =3,0,1)

Course Objectives:

1. Learn photogrammetry and remote sensing for preparing Land use/Land cover maps.
2. Understand mapping using GIS.
3. Knowing location of various objects on the surface of earth for mapping.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction To Geomatics Engineering And Map Projection Systems Importance of Geomatics Engineering, Disciplines covered under geomatics engineering, Map scale and classification of maps, Map numbering system. Coordinate Systems in Two and three Dimensions, Datums and Geodetic Coordinate Systems, Map Projection Systems, Types of map projections.	7
2	Photogrammetry and Remote Sensing Photogrammetry Definition and importance, Basic Concepts and terms, Aerial Photogrammetry: Types of photographs, Flight strips and overlaps, Flying height and scale of vertical aerial photograph, Flight Planning.	18
	Fundamentals of Remote Sensing: A Remote Sensing System, Electromagnetic Spectrum, Interaction of Electromagnetic Radiation with the Atmosphere and with Earth Surface, Spectral reflectance curves, Spatial, Spectral Radiometric and Temporal Resolutions of remote sensing data.	
	Remote Sensing Data Acquisition: Platforms, Sensors, Characteristics of remote sensing imaging sensors, Types of scanning system, Sensors Operating in the Visible and Infrared Regions, Sensors Operating in the Active Microwave Region.	

Unit No.	Topics	Teaching Hours
	<p>Visual Image Interpretation: Image Interpretation Tasks, Elements of Image Interpretation, Image interpretation keys, Interpretation of Images Acquired in Different Wavelength Regions, Thematic Map Preparation Using Visual Image Interpretation.</p> <p>DIGITAL IMAGE PROCESSING: Digital Image Processing System, Components of a digital image processing system, Digital Remote Sensing Data, Data formats, Histogram and image statistics, Remote Sensing Image Distortion and Rectification, Image Enhancement Image Classifications, Various remote sensing software packages.</p>	
3	<p>GIS and GNSS</p> <p>Geographic Information System (GIS): GIS basics, Spatial Data Models: Vector data model and Raster data model, Spatial Data Input, Non spatial data input, Errors in data input and editing, Database Models and Database Management System. SPATIAL DATA ANALYSIS: Simple Data Retrieval and Query, Measurements of lines, other distances and polygons in GIS, Transformation Functions: Vector to raster and raster to vector transformations, Georeferencing, Mosaicking or edge matching. Neighbourhood Functions, Integration of Data or Map Overlay, Various GIS software packages.</p> <p>Global Navigation Satellite System (GNSS): Concept, Various GNSS systems, Global Positioning System (GPS), GPS segments, GPS measurements, GPS errors and biases, Surveying with GPS, Coordinate transformations and Accuracy considerations.</p>	13
4	<p>Applications of Geomatics Engineering In Civil Engineering</p> <p>Large and Small Scale Topographic Mapping, Digital Elevation Model Using SAR Interferometry, Engineering Surveys: Water supply schemes, Road and railway engineering, Town and country planning, Water logging and flood prevention, Land Use Land Cover Mapping, Water Resources Applications: Ground water, Runoff, Soil moisture, Hydrological modelling.</p>	7
Total		45

List of References:

1. Arora Manoj K. & Badjatia, R.C., “*Geomatics Engineering*”, Nem Chand & Bros, 1st Edition, Roorkee, Uttarakhand, ISBN: 978-81-85240-62-6.
2. Chandra A.M. and Ghosh S.K., “*Remote Sensing and Geographical Information System*”, Narosa Publishing House, 2nd Edition, New Delhi. ISBN: 978-1842652788, 2006
3. Bhatta B., “*Remote Sensing and GIS*”, Oxford University Press, 2nd Edition, New Delhi. ISBN: 9780198085423, 2011.
4. Lillesand T.M., Kiefer R.W. and Chipman J.W., “*Remote Sensing and Image Interpretation*”, 5th edition, John Wiley and Sons, India, ISBN: 978-8126513352, 2011
5. Kang-tsung Chang, “*Introduction to Geographic Information Systems*”, McGraw-Hill Education, 4th edition, ISBN: 9780070658981, 2017.

Course Outcomes (COs):

1. Apply up-to-date information of photogrammetry and remote sensing to prepare LU/LC maps.
2. Ability to develop various thematic maps.
3. Use Geomatics engineering for location based mapping.
4. Understand to apply Geomatics engineering to solve problems related with Civil engineering.

4CE44: HYDRAULIC MACHINES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. Study working of different types of hydraulic machines and their design principles.
2. Study the development of hydropower and its advantages over other types of power development.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Basics Of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle, Applications to radial flow turbines.	05
2	Hydraulic Turbines – I: Layout of a typical Hydropower installation -Heads and efficiencies - classification of turbines - Pelton wheel -Francis turbine -Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency - hydraulic design of turbines -draft tube -types of draft tubes -theory and function efficiency.	17
3	Hydraulic Turbines – II: Governing of turbines-surge tanks -unit speed -unit quantity -unit power -specific speed, performance characteristics of turbines -geometric similarity, Cavitation and precautionary measures.	04
4	Pumps: Pump installation details –classification -Types of pumps -hand pump - centrifugal, reciprocating, submersible pumps –CF pump –priming -work done - Monomeric head -minimum starting speed –maximum suction lift -efficiencies - specific speed -multistage pumps -pumps in parallel -performance of pumps - characteristic curves –NPSH –cavitation and precautionary measures.	14
5	Hydropower Generation: Classification of hydropower plants -Comparison of different types of power plants -Components of hydropower plant -Definition of terms -load factor, utilization factor, capacity factor -estimation of hydropower potential.	05
Total		45

List of References:

1. P. N. Modi & S. M. Seth, “*Fluid Mechanics, Hydraulic and Hydraulic Machines*”, Fourth edition in SI units, Standard book house, New Delhi, 2017
2. R. K. Bansal, “*A text of Fluid mechanics and hydraulic machines*”, Revised Ninth edition, Laxmi Publications (P) ltd., New Delhi, 2010
3. Jagdish Lal, “*Hydraulic Machines (including Fluidics)*”, 6th reprint, Metropolitan Book Company, 1994
4. R. K. Rajput, “*Fluid mechanics and Fluid Machines*”, S. Chand & Co., Delhi, 2018

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Work out the hydrodynamic force by liquid jet on plane surface and curved vanes for fixed and moving conditions.
2. Apprehend working of impulse and reaction turbines and their component parts.
3. Design & analyze performance characteristics of Pelton wheel, Kaplan turbine and Francis turbine.
4. Comprehend working of different types of pumps and work out the efficiency of centrifugal pump.
5. Compare hydropower plants with other types of power plants and calculate load factor and capacity factor for the hydropower plant.

4CE45: IRRIGATION AND HYDRAULIC STRUCTURES
CREDITS -4 (LTP: 3,1,0)

Course Objective:

1. Understand design concepts of diversion headwork’s, canal regulation and cross drainage works
2. Understand design concepts of embankment dams, concrete dams and spillways

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	1	0	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Diversion Headwork: Bligh’s creep theory, Lane’s weighted creep theory, Khosla’s theory, Design of concrete slope weir, Design of Check dams.	09
2.	Canal Regulation works: Cross regulator and distributary head regulator - Sarda fall – Glacis fall – well type fall - canal outlets – types of outlets - design principles of canal structures.	09
3.	Cross drainage works: Determination of maximum flood discharge and waterway for drain, fluming of	07

Unit No.	Topics	Teaching Hours
	canal, uplift pressure on underside of barrel roof and at the floor of the culvert, design of bank connections.	
4.	Embankment Dams: Seepage analysis, principles of design, Stability analysis of embankment dams, settlement and deformation of rock fill dams.	06
5.	Concrete Dams: Design features and stability analysis of concrete dams – roller compacted concrete gravity dams	07
6.	Spillways: Ogee spillway - cavitation on spillway – design features of ogee spillway – Chute spillway – design principle –Energy dissipation – design of different types of stilling basins.	07
Total		45

List of References:

1. Modi, P.N., Irrigation, “*Water Resources and Water Power engineering*”, Standard book house, New Delhi.
2. Punmia, B.C. and Pande, B.B, “*Irrigation and Water Power Engineering*”, Laxmi Publication Pvt. Ltd., New Delhi
3. Sharma, R.K., Irrigation “*Engineering and Hydraulic Structures*”, Oxford & IBH, New Delhi
4. Novak, P., Moffat, A.I.B., Nalluri, C. and Narayan, R., *Hydraulic structures* Unwin Press, London
5. Michael, A.M., *Irrigation: Theory and Practice*, Vikas Publishing House Pvt. Ltd., Bombay Course

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Design weirs on permeable foundations using various theories and suggest suitable type of cross drainage structures and canal regulation works.
2. Carry out stability analysis of embankment dam under sudden drawdown and steady seepage conditions.
3. Calculate normal stresses, principle stresses and shear stresses at heel and toe of dam and factor of safety of gravity dam against overturning, sliding and shear friction factor.
4. Design an ogee spillway and a chute spillway.
5. Suggest suitable energy dissipation measures.

4CE46: URBAN TRANSPORTATION SYSTEM
CREDITS - 4 (LTP: 3,1,0)

Course Objectives:

1. Impart the knowledge of urban transportation system.
2. Developing analytical and comprehensive approach to select appropriate mode of transportation.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	1	0	4	60	40	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Urbanization: Urban class groups, transportation problems and Identification, impacts of transportation, urban transport system planning process, modeling techniques in planning.	04
2	Urban mass transportation systems: Urban transit problems, travel demand, types of transit systems, public ,private para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and demerits, comparison of systems, coordination, and types of coordination.	09
3	Introduction to land use planning models: Land use and transportation interaction. The transportation study area definition; division into traffic zones; network identification and coding; types of trips, characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks.	08
4	Travel demand modeling: Trip generation-zonal regression and category analysis, Trip distribution-growth factor models, gravity model, opportunity models, Desire line diagram. Modal split analysis-trip end trip interchange models, logit models, Trip assignment techniques-route choice, diversion curves, shortest path algorithms, all-or-nothing assignment, capacity restraint models and Direct demand models.	15
5	Mass transit systems: Introduction to routing and scheduling, transit Systems performance parameters. Corridor identification and corridor screen line analysis. ITS, Multi modal hub Non-motorized mode	09
Total		45

List of References:

1. W. Dickey, “*Metropolitan Transportation Planning*” Tata McGraw-Hill, New Delhi.
2. Vukan R. Vuchic, “*Urban Transit: Operations, Planning and Economics*”, Wiley Sons Publishers.
3. Kadiyali L.R., “*Traffic Engineering and Transport Planning*”, Khanna Publishers.
4. Khisty, C.J.” *Transportation Engineering – An Introduction*”, Prentice-Hall, NJ.
5. C. S. Papacostas, “*Fundamentals of Transportation System Analysis*”, PHI.
6. James H. Banks, “*Introduction to Transportation Engineering*”, WCB-McGraw Hill, New York.
7. Dr. H.R. Varia and Dr. P.J. Gundaliya, “*Urban Transportation Engineering*“, Mahajan Publishing House.

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Apply up-to-date information for planning and operation of urban transport.
2. Execute various transportation related surveys.
3. Evaluate relative importance of various modes and their capacities.
4. Solve travel demand forecasting problems.
5. Recommend most appropriate transport modes based on performance evaluation.

4CE47: GREEN BUILDING MATERIALS AND TECHNIQUES
CREDITS - 3 (LTP: 2,0,1)

Course Objective:

1. To imbibe basics of green design and sustainable development concept.
2. To identify various area of implementing strategies for green design in projects to enhance built environment.
3. To learn institutional guidelines for development and certification of green designs.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	100
2	0	2	3	30	10	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Green Building Concept: Overview of green building movement; Concept of Green building and sustainable development; Issues and strategies of Green building and sustainable development; Objectives Principals and Benefits of Green building design; Introduction to High performance building; integrated design process of high performance building; Green project requirements and strategies; Overview of various green rating systems worldwide	08
2	Green Building Materials and Indoor Environment Quality: Introduction; Low emitting materials; Building and material reuse; Construction waste management; Regional materials; Life cycle cost assessment of building materials and products; Factors affecting indoor environment quality; Ventilation and filtration; Building materials and finishes- Emittance level; Indoor Environment quality best practice.	08
3	Water: Reduce, Reuse and Recycle: Introduction; Waste water strategy and water reuse/recycling; Water fixtures and water use reduction strategies.	04
4	Energy efficient designs: Passive cooling and day lighting- Active solar and photovoltaic- Building energy analysis methods-Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and	06

Unit No.	Topics	Teaching Hours
	aesthetics- Impacts of lighting efficiency- Energy audit and energy targeting- Technological options for energy management. Thermal comfort	
5	IGBC Guidelines: Introduction; IGBC green new building Rating system – Overview and process – project checklist; Sustainable architecture and design; Site selection and planning; Water conservation and energy efficiency; Building materials and resources; Indoor Environment quality; Innovation and development	04
Total		30

List of References:

1. Sam Kubba, “*Hand book of Green building Design and construction*”, Elsevier Architecture Press.
2. Abe Kruger and Carl Seville, “*Green building: principals and practice in residential construction*”, Cengage Learning.
3. IGBC Green New building rating system (Version 3.0), March 2015.
4. GRIHA Manual Volume-1: Introduction to National Rating System by Ministry of New and Renewable Energy, Government of India and the energy and resource institute, New Delhi.
5. Kibert, C. “*Sustainable Construction: Green Building Design and Delivery*”, John Wiley & Sons, 2005

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Demonstrate green concept skills and apply tools of Green building assessment.
2. Select appropriate green building material and technique.
3. Design sustainable and energy efficient civil engineering project.
4. Carry out Green Building rating using IGBC guidelines.

4CE48: PAVEMENT ANALYSIS AND DESIGN
CREDITS – 3 (LTP: 2,0,1)

Course Objectives:

1. Understand the basic characteristics of the material used in the pavement construction.
2. Learn the stress analysis in flexible and rigid pavement.
3. Study design of flexible and rigid pavement using IRC, Asphalt Institute, and AASHTO methods.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
2	0	2	3	30	20	20	30	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Pavement Types and Materials: Types and component parts of pavements; highway and airport pavements. Basic characteristics of materials used in pavements.	04
2	Stresses in Flexible Pavements: Layered system concepts. Stress solution for one, two and three-layered systems. Fundamental design concepts. Stress analysis in flexible pavements using software packages.	04
3	Stresses in Rigid Pavements: Westergaard's theory and assumptions. Stresses due to curling, stresses and deflections due to loading, frictional stresses. Stresses in dowel bars and tie bars. Stress analysis in rigid pavements using software packages.	04
4	Factors Affecting Pavement Design: Variables considered in pavement design. Classification of axle types, standard and legal axle loads, tyre pressure, contact pressure, ESWL, EWLF and EAL concepts, Axle load spectrum, Traffic analysis: ADT, AADT, truck factor, growth factor, lane distribution factor, directional distribution factor and vehicle damage factor.	04
5	Design of Flexible Pavements: IRC method of flexible pavement design. Asphalt Institute's methods with HMA and other base combinations. AASHTO method of flexible pavement design. Design of flexible pavement shoulders, Design of flexible overlay.	05
6	Design of Rigid Pavements: IRC method of plain jointed and continuously reinforced rigid pavement design. AASHTO method of rigid pavement design, Design of Rigid overlay. Block-pavements, FWDM, MORTH	05
7	Design of Pavement Drainage: Detrimental effects of water, methods for controlling water in pavements. Drainage materials: aggregates, geotextiles, pipes. Estimation of inflow, determination of drainage capacity.	04
Total		30

List of References:

1. R Srinivasa Kumar, *Highway Engineering*, Universities Press, Hyderabad, India, 2012.
2. Asphalt Institute. Thickness Design – Asphalt Pavements for Highways and Streets Manual Series No. 1 (MS-1), Asphalt Institute, Kentucky, USA, 1999.
3. Das, A. *Analysis of Pavement Structures*, CRC Press, Taylor and Francis Group, Florida, USA, 2015.
4. Huang, Y.H. *Pavement Analysis and Design*, Second Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi, India, 2008.
5. Relevant latest IRC Guidelines.
6. Mallick, R.B. and T. El-Korchi *Pavement Engineering – Principles and Practice*, CRC Press, Taylor and Francis Group, Florida, USA, 2009.
7. MEPDG-1. Mechanistic-Empirical Pavement Design Guide - *A Manual of Practice*, Interim Edition, American Association of State Highway and Transportation Officials, Washington, D.C., USA, 2008.

8. Papagiannakis, A.T. and E.A. Masad *Pavement Design and Materials*, John Wiley and Sons, New Jersey, USA, 2008.
9. Yoder, E.J. and M.W. Witzak *Principles of Pavement Design*, Second Edition, John Wiley and Sons, New York, USA, 1975.

Course Outcomes (COs):

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

1. Analyze the stresses and strains in a flexible pavement using multi-layered elastic theory.
2. Analyze stresses and strains in a rigid pavement using Westergaard's theory.
3. Design a flexible pavement using IRC, Asphalt Institute, and AASHTO methods.
4. Design a rigid pavement using IRC and AASHTO methods.

4CE49: DIGITAL LAND SURVEY PROJECT
CREDITS – 3 (LTP: 1, 0, 2)

Course Objective:

1. Learn Digital Surveying Instruments.
2. Understand Digital Techniques used in Mapping.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
1	0	4	3	30	20	40	60	

Course Contents:

Unit No.	Title	Theory Hours	Practical Hours
1	Surveying For Mapping Understanding surveying data, data conversion from distance, direction and angles to mapping coordinates.	02	06
2	Maps, Datum And Map Projection Systems Map Numbering Systems, Map scale and classification of maps, Datum and Coordinate systems, Map projection systems, National Map Policy and Instructions by Survey Of India (SOI) for Publication of Maps.	03	06
3	Digital Surveying Instruments Surveying measurements using Electromagnetic Distance Measurement Instrument (EDMI), Digital Level, Digital Theodolite, Total Station and Global Navigation Satellite System (GNSS), Data format conversion for mapping coordinates, Map preparation in software.	05	24

Unit No.	Title	Theory Hours	Practical Hours
4	Digital Techniques Used in Mapping Mapping from Photographs collected by Photogrammetry, High resolution remote sensing: Georeferencing, mosaicking and digitization of mapping objects. Geographical Information System (GIS): Digitization of objects from paper maps or images, attribute data input and map preparation.	05	24
Total		15	60

List of References:

1. Satheesh Gopi, R. Sathikumar, N. Madhu, "Advanced Surveying: Total Station, GIS and Remote Sensing" 1st Edition, 2003, Pearson Education India, ISBN: 9788131700679.
2. Arora Manoj K. & Badjatia, R.C., "Geomatics Engineering", Nem Chand & Bros, 1st Edition, Roorkee, Uttarakhand, ISBN: 978-81-85240-62-6.
3. Yuhong He Qihao Weng, High Spatial Resolution Remote Sensing: Data, Analysis, and Applications, 1st Edition, 2018, CRC Press. ISBN 9781498767682.
4. Survey of India, "Instructions for Publishing Map by Central/State Government Departments/Offices and Private Publishers" 2015, <http://surveyofindia.gov.in/>.

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Perform surveying measurements using Digital surveying instruments.
2. Prepare maps from collected survey data.
3. Apply digital techniques in mapping of parcels of land.

4CE50: TRAFFIC ENGINEERING AND FIELD STUDIES
CREDITS – 3 (LTP=1,0,2)

Course Objectives:

1. To understand traffic and its components, factors affecting road traffic for intersection design.
2. Explain sampling of data, analysis and interpretation of data in conducting various surveys.
3. Learn the relationships between the parameters of traffic flow and concept of roadway capacity and LOS.
4. To understand traffic movements, types of intersections, their design, design of signals and traffic regulations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
1	0	4	3	30	20	40	60	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction of Traffic Engineering: Components of road traffic - the vehicle, driver and road. Objectives and scope	03

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Unit No.	Topics	Teaching Hours
	of traffic engineering. Road user characteristics; human and vehicle characteristics, factors affecting road traffic. Concepts of passenger car units for mixed traffic flow.	
2	Traffic Studies: Volume studies, Speed studies, Origin and destination studies and parking studies	05
3	Traffic Safety and Level-of-service: Accidents, Lighting, Capacity and Level-of-service analysis	02
4	Traffic Regulations and Control: Regulations and control of traffic and method of control. General regulations; Regulations on Vehicles, drivers and Traffic management	02
5	Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Introduction of pedestrian actuated and traffic adoptive signals.	03
Total		15

Practical on field work and computation works:

Unit No.	Topics	Teaching Hours
1	Classified Volume Count Survey: Sampling in traffic volume studies; adequacy of sample size; application of sampling methods for traffic studies, objectives, methods of traffic study, equipment, data collection, analysis and interpretation (including case studies)	06
2	Spot Speed Survey: Sampling in spot speed studies; adequacy of sample size; objectives, methods of spot speed survey, equipment, data collection, analysis and interpretation (including case studies) of Spot speed	06
3	Speed and Delay Survey: Methods for speed and delay studies, objectives, data collection, analysis and interpretation (including case studies) of Speed and delay (Moving car method / floating car method)	06
4	Origin and Destination Survey: Adequacy of sample size; application of sampling methods for O-D studies, objectives, methods of O-D study, equipment, data collection, analysis and interpretation (including case studies) of Origin – destination.	06
5	Parking Survey: Selection of sample size; objectives, methods of traffic study, data collection, analysis and interpretation (including case studies) of Parking.	06
6	Accident studies and analysis: Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.	06
7	Traffic Control And Regulation Survey: Traffic Signals - Design of Isolated Traffic Signal by Webster method, Warrants for signalisation, Signal Co-ordination methods.	06

Unit No.	Topics	Teaching Hours
8	Rotary Intersections design: – Existing rotary design with Diverging, Merging, Weaving, Weaving Length, Advantages and Disadvantages. Rotary Design Elements – Design Speed, Radius at Entry, Radius at Exit, Width of Rotary Carriage way, Entry and Exit angles, External kerb line, Super elevation and camber- Capacity of rotary.	08
9	Non-motorised traffic survey (Pedestrians survey)	02
10	Presentations	04
Total		60

List of References:

1. Kadiyali, L.R., '*Traffic Engineering and Transport Planning*', Khanna Publications.
2. Drew, D.R., '*Traffic Flow Theory and Control*', McGraw Hill Book Co.
3. IRC Third Highway Safety Workshop, Lecture Notes 1978 and other IRC publications.
4. Papacostas, C.A., "*Fundamentals of Transportation Engineering*", Prentice-Hall of India Private Limited, New Delhi.2000. 6. William R. McShane and Roger P. Roess, '*Traffic Engineering*', Prentice hall, New Jersey,2000
5. Mc Shane W. R. and Roes R.P., "*Traffic Engineering*", Prentice Hall, Englewood Cliffs, New Jersey 1990.
6. Pignataro L J., "*Traffic Engineering: Theory and Practice*", Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1973.
7. Matson T.M., Smith W.S., and Hurd F.W., "*Traffic Engineering*", McGraw Hill Book Company, Inc. New York.
8. Jotin Khisty B. Kent Lall, "*Transportation Engineering: An Introduction*", Prentice Hall of India, Pvt., Ltd., New Delhi-11

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Apply knowledge of traffic, its components, and factors affecting road traffic in intersection design.
2. Carryout sampling data in conducting various surveys and analysis.
3. Estimate the capacities of roadways and intersections and level of service.
4. Design road islands, intersections, road lightings, traffic signals, for traffic movement and regulations.

4CE51: BUILDING CONSTRUCTION PROJECT
CREDITS – 3 (LTP: 1,0,2)

Course Objective:

1. Industry ready knowledge of building construction project study.
2. Impart field application through hands on practice of civil engineering software.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory		Practical		
			ESE	CE	ESE	CE	150	
1	0	4	3	30	20	40		60

Course Contents:

Unit No.	Topics	Teaching Hours	
		L	P
1	Building Project Planning Process.	04	06
2	Pre-Project Planning: Ideation, Building concepts, feasibility studies, and approval.		06
3	Topography studies, Legal Requirements & Bye-Laws.	02	06
4	Basic & detailed design and approval.		06
5	Architectural drawings and modelling.	03	06
6	Materials, services and other installations detailing.		06
7	Estimation, Tendering Process & Contracting.	02	06
8	Preparation of DPR and Execution plan.	02	06
9	Time, Cost and Quality Management.	02	06
10	Final submission and Presentation.		06
Total		15	60

List of References:

- Chitkara, K. K., “*Construction Project Management Planning, Scheduling and Controlling*”, Tata McGraw Hill, New Delhi. ISBN 10: 0070680752 ISBN 13: 9780070680753.
- Kumar Neeraj Jha, “*Construction project management theory and practice*”, Pearson publications Delhi. ISBN 9789332542013
- Srinath, L.S., “*PERT & CPM Principles and Applications*”, Tata McGraw Hill, New Delhi.
- Sengupta and Guha, “*Construction Management and Planning*”, Tata McGraw Hill, New Delhi. ISBN : 9780074623985
- Punamia, B.C. and Khandelwal, K.K., “*Project Planning and Control with PERT and CPM*”, Laxmi Publications, New Delhi, ISBN 10: 8131806987, ISBN 13: 9788131806982
- National Building Code (SP: 27), 2005.
- GDCR, 2016, Government of Gujarat.

Course Outcomes (COs):

After learning the course the students shall be able to:

- Design, execute and manage the Building Project.
- Prepare the detailed project report with all required sanctions.
- Carry out tendering and contracting of Building Projects.

4CE52: BUILDING SERVICES AND TREATMENTS
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. Provide information about building services, their maintenance and Treatments.
2. Impart knowledge of different types of building services, maintenance and Treatments.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Definitions, Classification of building services, Types of services and selection of services, Objective and uses of services.	02
2	Building Water Supply and Drainage System: Types of pipes used, laying jointing, testing, testing for water tightness plumbing system for building, internal supply in buildings, municipal bye laws and regulations, Sanitation in buildings, pipe systems, storm water drainage from buildings, septic tanks soak pits.	06
3	Electrification of Building: Types of wires, wiring systems and control gears, planning electrical wiring for building, main and distribution boards.	04
4	Ventilation and Air-conditioning: Ventilation and its importance, natural and artificial systems, Air Conditioning: Definition, Purpose, Principles, Types of Air Conditioners, Window type and packaged air-conditioners, Central type, Window Type, Split Unit, chilled water plant, fan coil systems, water piping, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers.	08
5	Safety in buildings: Safety, Ability of systems to withstand fire, Preventive systems, Fire escape system design, planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, heat and smoke detectors, dry and wet risers, Automatic sprinklers, Capacity determination of OHT and UGT for firefighting needs.	05
6	Mechanical Services in Buildings: Lift- Types of Lifts, Freight elevators, Passenger elevators, Hospital elevators, Uses of different types of elevators Design Considerations, Location, Sizes, Component parts, Lift Well, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push.	07

Unit No.	Topics	Teaching Hours
	Dumbwaiters- Different types of Dumbwaiters Uses of different types of Dumbwaiter. Escalators- Different types of Escalators. Conveyors- Different types of Conveyors moving ramps and walks, and their uses.	
7	Acoustic and Sound Insulations: Requirement of good Acoustic, Factors to be followed for noise control in buildings.	03
8	Maintenance: Definition, Need, Types of Maintenance, Maintenance of various services in buildings.	05
9	Treatments: Preventive, Corrective treatments for Building Components, Fire resistant, water resistant, thermal insulation, acoustical construction and anti-termite treatment.	05
Total		45

List of References:

1. A C Panchdhari, “*Maintenance of Buildings*”, 2006, New Age International, ISBN: 812241012X, 9788122410129
2. A.F.C. Sherratt, “*Air-conditioning and Energy Conservation*”, the Architectural Press, London, 1980.
3. E.C. Butcher and A.C. Parnell, “*Designing for Fire Safety*”, John Wiley and Sons, 1993.
4. Jain, V.K., “*Fire Safety in Buildings*”, New Age International, ISBN: 978-81-224-3083-7 Publication Year: 2010
5. R. Udaykumar, “*A text book on Building Services*”, Eswar Press, Chennai, ISBN-13, 9788178740638. ISBN-10, 817874063X
6. William T. Mayer, “*Energy Economics and Build Design*”, McGraw-Hill Book, Company, 1983.

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Acquire knowledge of building services and treatments.
2. Supervise various building services maintenance.
3. Achieve overall performance and maintainability of building services.

4CE53: SOLID WASTE MANAGEMENT
CREDITS - 3 (LTP: =3, 0, 0)

Course Objective:

1. To understand the sources, types and composition of municipal solid waste and the factors governing their generation
2. To acquire an understanding on the reduction, segregation and storage of wastes at source
3. To familiarize collection, storage and transport of community solid waste
4. Learn processing and treatment of community solid waste
5. Understand ultimate disposal of community solid waste

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits C	Assessment Scheme				Total Marks 100
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	0	0	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Sources and types of municipal solid waste: Solid waste sources, Characteristics and Types, Generation rates-Factors affecting generation rates, Effects of improper disposal of solid wastes - Public health and environmental effects. Solid Waste Management aspects, physical and chemical characteristics of municipal solid waste, Present Indian scenario of Solid Waste Management. Municipal solid waste rules.	09
2	Source reduction of waste: Reduction, Reuse and Recycling - Onsite storage methods- materials used for containers - Handling and segregation of wastes at source - waste segregation and storage – case studies under Indian conditions.	09
3	Collection of municipal solid wastes: Collection vehicles - Manpower - Collection routes - Analysis of collection systems; Need for transfer and transport, Transfer stations - Selection of location, operation & maintenance	07
4	Waste processing: Separation and Processing technologies : Unit Operations, Size reduction, Size separation, Density Separation, Magnetic and Electric Field Separation, Densification. Introduction to waste to wealth and waste to energy concept, Biological and chemical conversion technologies; Resource recovery from solid waste composting and biomethanation. Thermal processing options. Swatchch Bharat Mission.	11
5	Land disposal of solid waste; Sanitary landfills - site selection, design and operation of sanitary landfills - Landfill liners - Management of leachate and landfill gas - landfill closure and environmental monitoring,	09
Total		45

List of References:

- George Tchobanoglous et al, “*Integrated Solid Waste Management*”, McGraw, Hill Publication, 2014 , ISBN-10 : 9339205243, ISBN-13 : 978-9339205249
- Peavy, Rowe and Tchobanoglous (1985), “*Environmental Engineering*”, McGraw Hill Co. 4th Edition, ISBN-10 : 9351340260, ISBN-13 : 978-9351340263

3. Tchobanoglous G., “*Solid Wastes - Engineering Principles and Management Issues*”, Mc Graw Hill Book Company, 1977, ISBN-10 : 0070632359, ISBN-13 : 978-0070632356, ISBN-13 : 978-8131520420
4. Vesiland A., “*Solid Waste Engineering*”, Thompson Books ,2002, ISBN-10 : 9788131520420, ISBN-13 : 978-8131520420
5. Davis M. L. and Cornwell D. A., *Introduction to Environmental Engineering*, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010., ISBN-10 : 9351340260, ISBN-13 : 978-9351340263
6. CPHEEO, *Manual on Municipal Solid waste management*, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

Course Outcomes (COs):

At the end of the course the students will be able to:

1. Explain the various functional elements involved in solid waste management system
2. Categorize and quantify the generation rate of solid waste
3. Analyze the routes for collection, transfer and transportation of solid waste
4. Suggest suitable treatment and disposal option for waste management facility

4CE54: IRRIGATION WATER MANAGEMENT
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. Study the design aspects in border strip, check basin, furrow irrigation, sprinkler and drip irrigation methods.
2. Perform irrigation scheduling with operation and management of canals in command area.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction, Crop water requirement and land grading: Importance of irrigation, Irrigation in world, India and Gujarat, water resources scenario in world, India and Gujarat, role of water in plant growth, water absorption by plants, transpiration, soil plant atmosphere system, extraction of water by plants from soil, soil water availability to plants, Estimation of crops water requirement, evapo-transpiration and consumptive use, methods of estimating evapo-transpiration, effective rainfall, irrigation water requirement, Land grading and field layout, criteria for land levelling, land leveling exercises.	10

Unit No.	Topics	Teaching Hours
2	Methods of Irrigation: Classifications, surface irrigation, subsurface irrigation methods, broad strip, check basin method, furrow irrigation method, adaptability and design aspects of these methods, Sprinkler irrigation, types, components, principles of design of sprinkler irrigation, moisture distribution patterns and uniformity of coverage, hydraulic design of sprinkler system, design problem, Drip irrigation method, layout and components, principles of design of drip irrigation, problems associated with drip irrigation system, Application of fertilizers and pesticides through pressurized irrigation systems.	14
3	Irrigation efficiency & Scheduling of irrigation: Irrigation efficiency, components of project irrigation efficiency, water use efficiency, water storage efficiency, water application efficiency, water distribution efficiency, significance of irrigation efficiencies, improving irrigation efficiency Scheduling of irrigation, time of irrigation, critical stages of water need of crops, criteria of scheduling irrigation, frequency of irrigation, depth of irrigation.	08
4	Problems associated with irrigated areas: Water management in high water table area, Effects and causes of water logging, preventive measures for water logging, Prevention of high water table situation, land drainage, classification of drainage system, signs of bad drainage, Quality of irrigation water, quality of surface and ground water, irrigation with saline water, improving quality of saline water, leaching requirement for irrigation with saline water.	06
5	Management and Performance evaluation of canal system: Management of canal irrigation, need for canal system management, inadequacies of canal irrigation management, objectives and criteria for good canal irrigation management, operation and maintenance of canal irrigation system, Performance evaluation of canal irrigation system, irrigation by rotation (Warabandi), water cooperative society. Automated control system in canal irrigation management.	07
Total		45

List of References:

1. A. M. Michael, "*Irrigation Theory and Practice*", 2nd edition, New Age Publication, New Delhi
2. G. L. Asawa, "*Irrigation Engineering*", New Age Publication, New Delhi, 2006
3. Dilip Kumar Majumdar, "*Irrigation Water Management*", Sixth Printing, PHI, New Delhi, 2010
4. H. Finkel, "*Handbook of Irrigation Technology (Vol. I & II)*", CRC Press, Florida, USA

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Prepare layout of irrigation and drainage systems for fields.
2. Apply design aspects of border strip method, check basin method and furrow irrigation method.
3. Perform hydraulic design of sprinkler and drip irrigation system.
4. Calculate Irrigation efficiencies and understand scheduling aspects of irrigation system
5. Carry out performance evaluation of an irrigation system and understand the irrigation water management aspects.

4CE55: DOCK, HARBOUR & AIRPORT ENGINEERING
CREDITS - 3 (LTP: 3,0,0)

Course Objectives:

1. Study basics of docks, harbour and airports.
2. Learn various marine structures and navigation aids at port.
3. Understand various ground and airside structures including terminal building.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p>Harbour Engineering: General: History, development, classification of harbours, major ports in India, administrative set up, harbor economics. Harbour Planning: Harbour components, ship characteristics, characteristics of good harbour, and principles of harbour planning, size of harbour, site selection criteria and layout of harbors.</p>	8
2	<p>Marine Structures: General, breakwaters - function, types general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories-function, types, suitability, design and construction features. Docks and Locks: Tidal basin, wet docks-purpose, design consideration, operation of lock gates and passage, repair docks - graving docks, floating docks, marine railway. IS code provisions</p>	6
3	<p>Port Amenities and Maintenance: Ferry, transfer bridges, floating stages, and transit sheds, warehouses, cold storage, aprons, cargo handling equipment, purpose and general description. Navigation Aids: Channel and entrance demarcation, buoys, beacons, lighthouse, electronic communication devices. Harbour Maintenance: Costal protection-purpose and devices, dredging-Land maintenance dredging, purpose, methods, dredgers-types, suitability, disposal of dredged material.</p>	8
4	<p>Airport Engineering: General: History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, aircrafts and its characteristics, airport classifications. Airport Planning: Regional planning-concepts and advantages, location and planning of airport elements-airfield, terminal area, obstructions, approach zone, zoning laws, airport capacity, airport size and site selection, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.</p>	10

Unit No.	Topics	Teaching Hours
	Runway Design: Wind rose and orientation of runway, factors affecting runway length, basic runway length, corrections to runway length, runway geometrics and runway patterns (configurations). Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility. Aprons- locations, size, gate positions, aircraft parking configurations and parking systems.	
5	Terminal Area Design: Terminal area elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and circulation network.	5
6	Grading, Drainage and ATC: Airport grading-importance -operations, airport drainage- aims, functions, special characteristics, basic requirements, surface and subsurface drainage systems. Air Traffic Control and Visual Aids: Air traffic control-objectives, control system, control network-visual aids-landing information system, airport markings and lighting.	8
Total		45

List of References:

1. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, “*Airport Planning & Design*”, Nem Chand & Bros., Roorkee.
2. G.V. Rao , “*Airport Engineering*”, Tata McGraw Hill Pub. Co., NewDelhi.
3. R. Srinivasan and S. C. Rangwala, “*Harbour, Dock and Tunnel Engineering*”, Charotar Pub. House, Anand.
4. S. P. Bindra, “*A Course in Docks and Harbour Engineering*”, Dhanpat Rai & Sons, New Delhi.
5. Alonzo Def. Quinn, “*Design and Construction of Ports and Marine Structure*”, McGraw – Hill Book Company, New York.
6. Ashford N. and Wright P.H., “*Airport Engineering*”, John Wiley and Sons, Inc., New York.
7. Horonjeff R. and Mac Kelvey F.X., “*Planning and Design of Airports*”, McGraw Hill Book Co., NewDelhi.

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Identify various component parts of dock, harbour and airports.
2. Apply ship and aircraft characteristics in planning of harbour and airports.
3. Orienting runway using wind rose data.
4. Design airport components Runway and Taxiway.
5. Know importance of navigation aids at harbour and airport.

4CE56: SOFTWARE TRAINING IN CIVIL ENGINEERING
CREDITS – 2 (LTP: 0,0,2)

Course Objective:

1. Awareness and application of different software in civil engineering study.
2. Impart field application through hands on practice of civil engineering software.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	100
0	0	4	2	00	00	40	60	

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p>Construction Engineering Software:</p> <p>Autodesk AutoCAD software: Overview and hands on training of 2D Drafting, Key commands and technique for 2D drawing, User Interface, Setting Units, Preparing Plans, Elevation & Section of typical Building.</p> <p>Autodesk REVIT: Overview and hands on training on 3D modeling of typical Building.</p> <p>Building Information Modeling (BIM): Introduction and applications of BIM, Level-3 to 5.</p> <p>Construction Management Software: Overview and hands on training on Microsoft Project (MSP). Creating a Project, Project Information & Calendar, Tasks & Milestones, Task Relationships & dependencies, Lag and Lead Time, Critical Path & Time Constraints.</p> <p>Introductions to Primavera & its comparison with MSP. Material Inventory Management software, Human Resource Management software.</p>	12
2	<p>Transportations Engineering:</p> <p>TransCAD/CUBE: Introduction and overview of various functions, Four stage (trip generation, trip distribution, model choice and route assignment) travel demand analysis and modeling.</p> <p>AutoCAD Civil 3D/MX Road/Open Roads: Introduction and overview of various functions, Horizontal and vertical alignment design, cross sections, quantity estimation and junction design.</p> <p>Highway Development and Management Model (HDM-4): Introduction to HDM-4, economic analysis, financial analysis, pavement maintenance management and prioritization.</p> <p>IITPave/KGP Back: Computer-aided analysis and design of flexible and rigid pavement</p>	12
3	<p>Water resources engineering:</p> <p>HEC-RAS 5.0.7: Modelling water flowing through systems of open channels and computing water surface profiles. HEC-RAS finds particular commercial application in floodplain management and flood insurance studies to evaluate floodway encroachments.</p> <p>CROPWAT 8.0: The calculation of crop water requirements and irrigation requirements based on soil, climate and crop data. In addition, the program allows the development of irrigation schedules for different management conditions and the calculation of scheme water supply for varying crop patterns. CROPWAT 8.0 can also be used to evaluate farmers' irrigation practices and to estimate crop performance under both rain fed and irrigated conditions.</p>	12

Unit No.	Topics	Teaching Hours
	Water GEMS: Decision-support tool for water distribution networks. The software helps improve the knowledge of how infrastructure behaves as a system, how it reacts to operational strategies, and how it should grow as population and demands increase.	
4	Environmental Engineering: 1. EPANET: Overview and hands on training on EPANET. Modelling water distribution systems, understanding the movement and fate of drinking water constituents within distribution systems, different types of applications in distribution systems analysis. 2. Noise Mapping: Overview and hands on training on Noise Mapping. Assessment of the impact of potential developments or for predicting the effects of noise mitigation methods 3. CMAQ: Overview and hands on training on CMAQ. Estimation of ozone, particulates, toxics and acid deposition. Water GEM, Sewer CAD, Network Design	12
5	Remote Sensing & GIS Software: Remote Sensing Image Processing Software: Introduction and overview of various functions of optical remote sensing software, image formats supported by software, generation of various colour composites, image enhancement, identification of various land use land cover in True colour composite and Standard False Colour composite, Selection of Ground truth and training data as points, lines and polygons, Supervised and unsupervised image classification, Accuracy assessment. Geographical Information System Software: Introduction and overview of various functions, Georeferencing of map in GIS environment, Points, Lines and Polygons creation for various objects, scale and legend to create a map, thematic mapping.	12
Total		60

Course Outcomes (COs):

After learning the course the students shall be able to:

1. Demonstrate the knowledge of Civil Engineering software.
2. Select and use appropriate software during lifelong learning process.

4SE41: ADVANCED DESIGN OF STEEL STRUCTURES
CREDITS - 4 (LTP: 3,1,0)

Course Objective:

1. To elaborate design of industrial steel structures.
2. To introduce design of steel bridges.
3. To introduce use of cold formed steel sections and composite construction.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	1	0	4	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction and Review Review of structural components, Axially loaded members, flexural members, Combined forces, codal provisions of IS:800, SP-6(1)	2
2	Design of Flexural Members Design of laterally supported plated beams, Design concepts of castellated beam.	3
3	Design of Plate Girder Components of bolted and welded plate girder, design of welded plate girder with vertical intermediate stiffeners and load bearing stiffeners, design of all relevant connections.	8
4	Design of Gantry Girder Design of gantry girder section made up of I- section and compression flange strengthened by channel and/or plate section.	7
5	Connections Bolted and Welded connections for beam to beam and beam to column, design of lug angle, bracket connections, design of simple beam end connections, design of moment resistant beam end connections, stiffened and unstiffened connections, design of anchor bolts, design of splices.	10
6	Steel Bridges Introduction, types of bridges, loads, bearings, Design of foot Bridge	6
7	Light Gauge Steel Sections Advantages and disadvantages of light gauge steel sections, types and behavior of light gauge sections, Codal provisions of IS: 801, Design problems.	5
8	Composite Construction Introduction, composite beams, methods of construction, limit state of collapse, limit state of serviceability: deflection, Design problems.	4
Total		45

List of References:

1. N. Subramanian, “*Design of Steel Structures*”, Oxford University Press, New Delhi.
2. S. K. Duggal, “*Limit State Design of Structures*”, McGraw Hill Education Pvt. Ltd., New Delhi.
3. K. S. Sai Ram, “*Design of Steel Structures*”, Pearson, New Delhi.
4. M. R. Shiyekar, “*Limit State Design in Structural Steel*”, Prentice-Hall of India Pvt. Ltd.
5. IS: 226 - Structural steel (Standard Quality)
6. IS: 800 – Indian Standard Code of Practice for General Construction in Steel

7. IS: 801- Indian Standard Code of Practice for cold formed light gauge steel structural members in general building construction.
8. IS: 875 - (Part I to V) - Indian Standard Code of Practice for Structural Safety of Building Loading Standards
9. SP: 6(1) - Handbook for Structural Engineers- Structural Steel Sections
10. IS: 11384: Code of Practice for composite construction in structural steel and concrete.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design industrial steel structural components subjected to gravity and lateral loads.
2. Design suitable connections for steel structures.
3. Analyse and design Foot Bridge.
4. Design industrial components using cold formed steel sections/composite sections.

4SE42: ADVANCED STRUCTURAL ANALYSIS
CREDITS - 4 (LTP: 3,1,0)

Course Objective:

1. To impart knowledge of analysis of the complex structures using different methods.
2. To impart knowledge of unsymmetrical bending, shear center and failure theories.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Column Analogy method Analysis of one span beam and one by one storey portal frame for various types of loading including settlement/rotation of support.	6
2	Moment distribution method Analysis of single bay - single storey Inclined columns frames and gable.	6
3	Kani's method Concepts, application to continuous beams and frames, application to Two storey two bay portal frame.	7
4	Unsymmetrical Bending and Shear Center Unsymmetrical Bending: Introduction, Bending stress through product of inertia, Shear center, Shear flow, Bending of open and closed section beams, Shear stress distribution in rectangular, circular, I, T and C section and the compression with bending stresses, Importance of shear center, Shear of open section beams, Shear of closed section beams.	10

Unit No.	Topics	Teaching Hours
5	Beam Curved in Plan Uses of curved beam, types of internal forces, Analysis of curved beam fixed at ends for point load, Uniformly distributed load, Analysis of circular beam supported symmetrically.	6
6	Effects of Shear Deformations Introduction, Shape factors, Shear deflections of statically determinate beams.	5
7	Theories of Failure Various theories of failures, graphical representation and derivation of equation for each and their application to problems.	5
Total		45

List of References:

1. Wang C. K. “*Intermediate Structural Analysis*”, Tata McGraw Hill book Company, New Delhi.
2. Hibbler R C, “*Structural Analysis*”, Pearson Education.
3. Vidyanathan R., Perumal P., “*Structural Analysis Vol. IP*”, Laxmi publications.
4. Junarkar S.B. and Shah H.J., “*Mechanics of Structures Vol-I & IP*”, Charotar publishing house, Anand.
5. Bhavikatti S.S., “*Structural Analysis Vol I & II*”, new age publications.
6. Bansal R. K., “*Strength of Materials*”, Laxmi publications.
7. Patil H.S., Patil Y.D. and Patel Jignesh, “*Structural Analysis-I*”, Synergy Knowledge ware.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the theory of shear deformation in addition to bending theory.
2. Apply the concept of shear center to various sections used in steel structures.
3. Apply failure theories to different types of materials used in structures.
4. Analyze the complex structures with symmetrical and unsymmetrical loadings using different methods.

4SE43: ADVANCED DESIGN OF CONCRETE STRUCTURES
CREDITS - 3 (LTP: 2,0,1)

Course Objective:

1. To enhance the understanding of Behaviour of RCC members subjected to complex loading.
2. To understand the effects of gravity and lateral loads on multi-storied RCC framed structure.
3. To evaluate the design provisions in water storage and Earth retaining structures.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
2	0	2	3	30	20	20	30	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Design philosophy: Introduction to Design codes, Concepts of loading and load combinations as per different IS codes.	1
2	Limit State Design for Torsion Design of rectangular sections for torsion, shear and bending.	4
3	Limit State Design of Retaining Wall Stability and design of cantilever retaining wall, Design concepts of counterfort, buttress and gravity retaining walls.	4
4	Grid Floors Analysis and Design of grid floor by Rankine Grashroff Classical equivalent and IS 456 Design method.	4
5	Flat Slabs Direct design method, Analysis and design of column strip and middle strip as per IS 456: 2000, Shear in flat slabs, check for deflection.	4
6	Underground and Ground supported Water Tanks a) Introduction to IS: 3370, permissible stresses and uncracked design concepts, Design of circular and Rectangular underground water tanks. b) Seismic Analysis and design of Ground supported circular and Rectangular water tanks.	8
7	Design of Foundations Design of Strip footing, Raft and Pile cap	5
Total		30

List of References:

- S. N. Sinha, “*Reinforced Concrete Design*”, Tata McGrawhill
A. K. Jain, “*Design of Concrete Structures*”, Nemchand Publication
- V. L. Shah & S. R. Karve, “*Limit State Theory & Design of Reinforced Concrete*”, Structure Publishers, Pune
- V. L. Shah & S. R. Karve, “*Design of Multi-storied Building (G+3)*”, Structure Pub., Pune
- KrishanaRaju N., “*Advanced Design of Concrete Structures*”, Tata Mc-Graw Hill, Delhi
- Dr. H.J. Shah, “*Reinforced Concrete*”, Vol-II; Charotar Pub. Anand
- IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
- IS: 875 - (Part I to V) –Indian Standard Code of Practice for Structural Safety of Building Loading Standards
- SP:16 – Design aids for Reinforced Concrete
- IS1893-Part-1- Indian Standard Criteria for Earthquake Resistant Design of Structures (General Provisions and Buildings)
- IS1893- Part-2-Criteria for Earthquake Resistant Design of Structures (Liquid Retaining Tanks)
- IS1893- Part-3- Criteria for Earthquake Resistant Design of Structures (Bridges and Retaining Walls)
- IS 3370 (All parts)- Concrete Structures for Storage of Liquids - Code of Practice
- IS: 13920 - Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.
- IS: 13827 - Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design Grid Floor and Flat slab.
2. Design suitable foundation for different structures.
3. Design water tanks and earth retaining structures.

4SE44: COMPUTER AIDED STRUCTURAL ANALYSIS
CREDITS - 3 (LTP: 2,0,1)

Course Objective:

To impart knowledge of structural analysis for framed structures by computational methods.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
2	0	2	3	30	20	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Stiffness Matrix Method: Types of skeletal structures, Internal forces and deformations. Introduction and applications of stiffness member approach to analyze beams, Trusses, plane frames, grids and Spatial structures.	12
2	Stiffness Method (Special topics) Various secondary effects like deformation of support, pre-straining & temperature. Symmetry/Anti-symmetry, Oblique supports, Elastic supports, Analysis of hybrid structures.	5
3	Introduction to FDM and FEM Introduction to Finite Difference Method for 1 D structural elements. Introduction to Finite Element method: Theory of Stresses: State of stress and strain at a point in two and three dimensions, stress and strain invariants, Hook's law, Plane stress and plain strain problems. Introduction and Application of FEM to One dimensional (bar & beam) problems.	5
4	Computer Programming for Analysis Programming for member stiffness matrix method using professional software tools.	8
Total		30

List of References:

1. W. Gere and weaver, "*Matrix Analysis of Framed Structures*", springer publications.
2. Meghre and Deshmukh, "*Matrix method of analysis*", Charotar publishing house, Anand.
3. Wang C. K. "*Intermediate Structural Analysis*", Tata McGraw Hill book Company, New Delhi.
4. Manuals of STAAD, ETABS, SAP

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Analyze different framed structures using computational methods.
2. Understand FDM and FEM applications.
3. Carry out programming using professional software tools.

4SE45: STRUCTURAL DESIGN PRACTICES
CREDITS - 3 (LTP: 1,0,2)

Course Objective:

To enhance the concepts of Structural Design Practices.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
1	0	4	3	30	20	40	60	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Analysis and design of RCC Structures Analysis and design of RCC framed Structure building with and without Shear wall subjected to Gravity and Lateral loadings using Software. Students need to carry put any real field problem.	7
2	Analysis and design of Industrial Building Analysis and design of Industrial Building with Gantry Girder, Bracings, Connections etc. using Software. Students need to carry out any real field problem. Pre-Engineering Buildings.	8
Total		15

List of References:

1. Pankaj Agarwal & Manish Shrikhande, “*Earthquake Resistant Design of Structures*”, Prentice Hall of India, New Delhi.
2. Dr. C. V. R. Murty, “*Earthquake Tips*”, Indian Institute of Technology Kanpur and Building Materials and Technology Promotion Council, New Delhi.
3. KrishanaRaju N., “*Advanced Design of Concrete Structures*”, Tata Mc-Graw Hill, Delhi
4. N. Subramanian, “*Design of Steel Structures*”, Oxford University Press, New Delhi.
5. S. K. Duggal, “*Limit State Design of Structures*” McGraw Hill Education Pvt. Ltd., New Delhi.
6. K. S. Sai Ram, “*Design of Steel Structures*” Pearson, New Delhi.
7. M. R. Shiyekar, “*Limit State Design in Structural Steel*” Prentice-Hall of India Pvt.Ltd.

8. M. L. Gambhir, “*Fundamentals of Structural Steel Design*” Tata McGraw-Hill Education.
9. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
10. IS: 875 - (Part I to V) –Indian Standard Code of Practice for Structural Safety of Building Loading Standards
11. SP:16 – Design aids for Reinforced Concrete
12. IS1893-Part-1- Indian Standard Criteria for Earthquake Resistant Design of Structures (General Provisions and Buildings)
13. IS1893- Part-2-Criteria for Earthquake Resistant Design of Structures (Liquid Retaining Tanks)
14. IS1893- Part-3- Criteria for Earthquake Resistant Design of Structures (Bridges and Retaining Walls)
15. IS: 1905 - Indian Standard Code of Practice for Structural Use of Unreinforced Masonry.
16. IS: 4326 - Indian Standard Code of Practice for Earthquake Resistant Design & Construction of Buildings.
17. IS 3370 (All parts)- Concrete Structures for Storage of Liquids - Code of Practice
18. IRC: 5, 6, 78, 112
19. IS: 800 - Code of Practice for General Construction in Steel
20. IS: 13920 - Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.
21. IS: 13827 - Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.
22. IS:13828 - Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings
23. IS16700 Criteria for Structural Safety of Tall Concrete Buildings

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design of RCC Structures as per recent practices.
2. Design of *Steel* Structures as per recent practices.

4SE46: DESIGN OF SPECIAL STRUCTURES
CREDITS - 3 (LTP: 3,0,0)

Course Objectives:

1. To enhance the understanding of Behaviour of RCC Special Structures subjected to complex loading.
2. To understand structural design of masonry buildings.
3. To impart the knowledge of Bridge Design.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Design of Folded Stair Design of Folded Staircase	4
2	Domes Design of spherical & conical domes with & without openings	6
3	Chimney Design Factors, Stresses due to temperature, components, Platform and Safety ladders, Steel stacks, Refractory linings, Caps and Foundation.	5
4	Water Tanks Seismic Analysis and design of Intze type Elevated water tank.	6
5	Design of Circular Slab Design of circular slab supported on edges and with centrally supported slab.	5
6	Analysis and Design of Masonry Structures Prism strength, masonry failure theories, slenderness, aspect ratio, permissible stresses, reinforced and unreinforced masonry, bed stones & bed plates, design of wall for compression, in-plane/outof-plane bending and shear, design of reinforced and unreinforced masonry shear walls.	9
7	Analysis and Design of Bridges Classification, investigations and planning, choice of type of bridges, Various forces acting on bridges, Load distribution theories, General design considerations, analysis and design of T-Deck Girder bridges. Introduction to design of cable stayed and cable suspended bridges.	10
Total		45

List of References:

1. Pankaj Agarwal & Manish Shrikhande, “*Earthquake Resistant Design of Structures*”, Prentice Hall of India, New Delhi.
2. Anand S. Arya, “*Masonry and Timber Structures including Earthquake Resistant Design*”, Nemchand & Bros., Roorkee.
3. Dr. C. V. R. Murty, “*Earthquake Tips*”, Indian Institute of Technology Kanpur and Building Materials and Technology Promotion Council, New Delhi.
4. Raina V.K. “*Concrete Bridge Practice*”, Tata McGraw Hill Publishing Company, New Delhi.
5. Krishnaraju, N., “*Design of Bridges*” Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi.
6. KrishanaRaju N., “*Advanced Design of Concrete Structures*”, Tata Mc-Graw Hill, Delhi
7. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
8. IS: 875 - (Part I to V) –Indian Standard Code of Practice for Structural Safety of Building Loading Standards
9. SP:16 – Design aids for Reinforced Concrete
10. IS1893-Part-1 and Part-2, and Part-3
11. IS: 1905 - Indian Standard Code of Practice for Structural Use of Unreinforced Masonry.
12. IS: 4326 - Indian Standard Code of Practice for Earthquake Resistant Design & Construction of Buildings.
13. IRC: 5, 6, 78, 112
14. IS: 13920 - Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.

15. IS: 13827 - Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.
16. IS:13828 - Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings
17. IS16700 Criteria for Structural Safety of Tall Concrete Buildings

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design of Various special RCC Structures.
2. Carryout structural analysis and design of masonry buildings.

4SE47: REPAIR AND REHABILITATION OF STRUCTURES
CREDITS - 3 (LTP: 3,0,0)

Course Objectives:

1. To impart knowledge of causes of distress and its assessment.
2. To enhance the knowledge of different repair materials and techniques.
3. To explain the different demolition, rehabilitation techniques, maintenance and protection of structures.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	0	3	60	40	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction: Deterioration of structures with aging, Need for rehabilitation.	6
2	Deterioration of concrete structures: Causes of distress Causes of distress in concrete structures, construction and design failures, Distress in concrete due to physical and chemical deterioration Deterioration due to water leakage, fire – detection & mitigation of the same. Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components. Measurement of cracks as per IS456 Annexure F interpretation of the cause of particular type of crack.	10
3	Conditional/damage assessment & Evaluation of structures: Condition assessment and distress-diagnostic techniques, Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability by use of NDT equipments	10

Unit No.	Topics	Teaching Hours
4	Materials and Techniques for Repair Repair materials - Criteria for durable concrete repair, Methodology, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques . Corrosion damage of reinforced concrete - repair and prevention measures - Surface deterioration, Efflorescence, causes, prevention and protection Surface coatings and painting - Water proofing	4
5	Rehabilitation methods Retrofitting, RCC Jacketing, Fibre wrapping, Building and restoration of earthquake damaged masonry structure, Method for foundation rehabilitation; Case studies	5
6	Demolition techniques : Engineered demolition techniques for Dilapidated structures – case studies.	4
7	Allied topics: Protection & maintenance of structures - Deterioration due to ageing, inadequate maintenance Facets of Maintenance, importance of Maintenance various aspects of Inspection. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring / Structural health monitoring (SHM) – Definition maintenance of structures and motivation for SHM, Basic components of SHM and its working mechanism.	6
Total		45

List of References:

1. “Concrete Microstructure, Properties and Materials” P.Kumar Mehta / Paulo J.M.Monteiro,
2. Handbook on Repairs and Rehabilitation of RCC buildings; CPWD, Government of India.
3. A.R.Shanthakumar, “Concrete technology”, Oxford University Press, India
4. M.L.Gambhir, “Concrete Technology”, Tata McGraw-Hill Education
5. Appraisal and Repair of Reinforced concrete R.Holland; Thomas Telford Ltd
6. Testing of Concrete in Structures, J.H.Bungey, S.G.Millard&M.G.Grantham; Taylor & Francis, London & New York
7. Handbook on Nondestructive Testing of Concrete, V. M. Malhotra, Nicholas J. Carino
8. Repair and Strengthening of Concrete structures FIP guide; Thomas Telford, London

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Achieve the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures by different NDT methods.
2. Understanding different repairing materials and its techniques.
3. Apply the different techniques of demolition, rehabilitation, protection and maintenance of structures.

4SE48: PRESTRESSED CONCRETE
CREDITS - 3 (LTP: 3,0,0)

Course Objectives:

1. To explain innovative and newly emerging techniques of prestressing systems.
2. To impart the concepts of analysis and design of prestressed concrete structures.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	100
3	0	0	3	60	40	0	0	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction – Theory and Behaviour Basic concepts, Advantages and Disadvantages, Materials required, Systems and methods of Prestressing, Principles of pre-stressed concrete, Bonded and Unbonded Concrete.	2
2	Analysis of sections Analysis of sections, Stresses at transfer and service loads, Stress concept, Strength concept, Load balancing concept, Effect of loading on the tensile stresses in tendons, Losses of prestress.	6
3	Deflections Effect of tendon profile on deflections, Factors influencing deflections, Calculation of deflections, Short term and long term deflections, Short term deflections of uncracked members, Prediction of long term deflections for the creep and shrinkage, Check for serviceability limit state of deflection.	6
4	Design of Anchorage Zone Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code, design of anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.	4
5	Design for Flexure Basic assumptions for calculating flexural stresses, types of flexural failure, strain compatibility method, simplified method of IS 1343, section with steel in compression zone. Design of One way and Two way slab.	5
6	Design for Shear and Torsion Shear and principal stresses, Ultimate shear resistance of prestressed members, Design of shear reinforcements, Prestressed member in torsion- combined bending and torsion.	5

Unit No.	Topics	Teaching Hours
7	Composite Beams Analysis of Composite beams, Ultimate strength, applications, Elementary idea of composite construction for tee beams in bridges, Shrinkage Stresses.	5
8	Continuous Beams Methods of achieving continuity in continuous beams, Analysis for secondary moments, Concordant cable and linear transformation, Calculation of stresses.	3
9	Analysis and Design for axial forces Analysis and Design of section in axial tension and compression, Design of member for bond and bearing. Analysis and design of pipes.	6
10	Special Topics Concepts of Tanks, Piles, Folded plates, Grid slab, Flat slab, poles etc. – Partial pre-stressing- Definitions, merits and demerits of partial prestressing, principles and design approaches and applications - methods of achieving partial prestressing.	3
Total		45

List of References:

1. Krishna Raju N., “*Prestressed concrete*”, 6th Edition, Tata McGraw Hill Company, New Delhi, 2018
2. Lin T.Y. and Ned.H.Burns, “*Design of prestressed Concrete Structures*”, Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
3. Pandit.G.S. and Gupta.S.P., “*Prestressed Concrete*”, CBS Publishers and Distributers Pvt. Ltd, 2012.
4. Rajagopalan.N, “*Prestressed Concrete*”, Narosa Publishing House, 2002.
5. Dayaratnam.P., “*Prestressed Concrete Structures*”, Oxford and IBH, 2013
6. IS1343 Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi.
7. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
8. National Programme on Technology Enhanced Learning (NPTEL) courses.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Design prestressed concrete elements for various load conditions.
2. Analyze composite and continuous prestressed beams.
3. Apply the concept of Prestressing in Special structures.

4SE49: FOUNDATION ENGINEERING
CREDITS - 3 (LTP: 3,0,0)

Course Objectives:

1. To learn important safety criteria for the different types of foundations.
2. To impart necessary geotechnical engineering skills to analyse and design shallow and deep foundation systems under different loading and soil conditions.
3. To obtain knowledge pertaining to important phenomenon of liquefaction.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	0		0

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction General requirements, bearing capacity computations, settlement computations, use of field tests like SPT as per relevant IS code	6
2	Shallow foundations Different types, proportioning of footings for equal contact pressures, eccentrically loaded footings, soil design of combined footings & strap footing.	7
3	Rafts Different types, bearing capacity and settlement computations of raft on different soil deposits, determination of contact pressure under raft; buoyancy raft, Modulus of subgrade reaction.	5
4	Pile foundation Vertical and lateral load capacity of a pile, settlement analysis of pile groups, under reamed piles, pile load test, introduction to piled raft foundation.	7
5	Well foundations Different types, basic concepts and stability analysis.	4
6	Dynamic analysis of foundations Dynamic soil properties, natural frequency of machine foundation-soil system, different types of machine foundations, static and dynamic criteria for soil-foundation system, design of block foundations as per IS code.	6
7	Foundations on expansive soils, waffle slab/raft, chemical stabilization etc.	3
8	Liquefaction Types, Factors, evaluation of Liquefaction potential and mitigation methods	5
9	Introduction to Geotechnical software	2
Total		45

List of References:

1. Kaniraj S. R., "Design Aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill.
2. Swami Saran, Gopal Ranjan, "Analysis & Design of Foundations & Retaining Structures", Sarita Prakashan.
3. Nainan P Kurian, "Design of Foundation Systems", Narose Pub. House.
4. J. E. Bowles, "Foundation Analysis and Design", McGraw Hill.
5. P. C. Varghese, "Foundation Engineering", Prentice Hall of India Pvt. Ltd.
6. B. M. Das, "Principles of Foundation Engineering", CENGAGE Learning

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Recommend most suitable type of foundation system and carry out soil design for the same.
2. Analyze problems related to expansive soils.
3. Recognize effect of liquefaction along with the remedial measures.
4. Understand the applications of geotechnical suits.

4SE50: SOFTWARE TRAINING IN STRUCTURAL ENGINEERING
CREDITS - 2 (LTP: 0,0,2)

Course Objective:

1. To impart the knowledge of various software in structural engineering.
2. To explain use of software for analysis and design of various structures.
3. To explain use of software for analysis and design of foundations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
0	0	4	2	0	0	40	60	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p>Analysis and Design using Structural Engineering Software</p> <p>Overview of structural engineering software, Use and challenges of using software, Basic concept of linear and non linear structural analysis Modelling of 2D plane structures, Modelling of 3D space structures, Modelling of truss/industrial steel structure, Modelling of masonry walls, Modelling of shear walls, Assigning various supports, special commands, Modelling of connections between various RCC and steel structural members like beam to beam, beam to column, slab to beam, column to footing etc., Creating rigid floor diaphragms in structure, Assigning various loads like gravity, wind, seismic, temperature, prestress load etc. and corresponding analysis, Load combinations as per IS code, Analysis of various structures Design of various super structure elements like beam, column, slab, shear wall, truss etc., Analysis and Design of sub structure elements like foundations, retaining walls etc.,</p>	60

Unit No.	Topics	Teaching Hours
	Design of RCC, Steel and Masonry elements as per relevant IS codes of practice, Detailing of reinforcements in RCC elements, Compilation of software output and report preparation	
Total		60

List of References:

1. Software Manual of STAAD Pro.
2. Software Manual of ETABS
3. Software Manual of SAP 2000
4. Software Manual of STRAP
5. Software Manual of SAFE
6. Software Manual of OASYS
7. Software Manual of STAAD Foundation
8. Software Manual of ANSYS
9. Relevant IS Codes of Practice for Analysis and Design

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Perform the analysis and design of various structural elements and structures.
2. Understand the output and interpretation of results.
3. Prepare the report of analysis, design and structural detailing.

4SE51: GROUND IMPROVEMENT TECHNIQUES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. To impart fundamental knowledge of Ground Improvement Techniques.
2. To make capable of choosing and designing the appropriate method of Ground Improvement according to site conditions and requirement of the project.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction Problematic soils viz. expansive soils, marine deposits, collapsible soils etc.; Factors causing alterations of ground after formation.	3

Unit No.	Topics	Teaching Hours
2	Compaction Surface compaction & deep compaction of cohesive and cohesionless soils; precompression with vertical drains, vibrocompaction etc.	10
3	Drainage and dewatering methods	4
4	Soil stabilization Chemical stabilization, biotechnical stabilization.	6
5	Geosynthetics Application of geosynthetics in different structures like embankments, roads, foundations, drainage etc., designing with geosynthetics.	10
6	Earth reinforcement Stone columns, soil nailing, micropiling etc.	8
7	Grouting technology and its applications	4
Total		45

List of References:

1. P. Purushothama Raj, “*Ground Improvement Techniques*”, Laxmi Publications (P) Ltd.
2. Satyendra Mittal, “*An Introduction to Ground Improvement Engineering*”, Scientific International Pvt. Ltd.
3. P. C. Varghese, “*Foundation Engineering*”, Prentice Hall of India.
4. Shashi K. Gulhati, ManojDatta, “*Geotechnical Engineering*”, Tata McGraw Hill Publishing Co. Ltd.
5. Dr. G.V. Rao & Dr. G. V. S. S. Raju, “*Advances in Geosynthetics*”, Sai Master Geoenvironmental Services Pvt. Ltd.-Hyderabad
6. R. M. Koerner, “*Designing with Geosynthetics*”, Prentice Hall Publication, New Jersey.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand about soil distribution in India and need of ground improvement techniques.
2. Analyze and decide the suitable method of Compaction and dewatering of soil as per need of the project.
3. Understand and apply the suitable method of chemical stabilization.
4. Understand different applications of geosynthetics and the suitable method of application.
5. Analyze and select effective method of soil reinforcement as well as grouting.

CEIS1: INTERNSHIP-I
CREDITS-0 (LTP: 0,0,0)

Course Objective:

1. To strengthen the association of students with construction industry.
2. To create awareness amongst the students the recent trends of civil engineering in industries.
3. To percept the role and responsibility of civil engineer in the industry.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
0	0	0	Non-Credit	0	0	100	00	100

Course Contents:

Unit No.	Topics
1	It is a Mandatory Non Credit course and the student has to complete an Industrial Internship of the duration of two weeks during the summer vacation after Semester IV . The internship should be carried out in any industry with relevant applications of Civil Engineering, preferably under the guidance of a mentor from the same industry
2	The student will maintain a log of work done on daily basis and important ideas or practices that he / she has learnt during the internship. The log-book may also be dually signed by the student and the mentor from the industry.
3	The student has to submit a interim report and final detailed report based on the internship immediately after the completion of the internship
4	The ESE assessment will be based on the following: <ul style="list-style-type: none"> i. The work executed/completed at Industry by student. ii. Poster Presentation on the experience gained. iii. The submission of the log-book and the report. iv. Feedback from the industry mentor in the prescribed format. v. Completion certificate from the industry.

Course Outcomes of Internship/Training (COs):

After completion of the internship students will be able:

1. To learn the application of knowledge in real world problems.
2. To get exposure to team-work and leadership quality.
3. To deal with industry-professionals and ethical issues in the work environment.

CEIS2: INTERNSHIP-II
CREDITS-0 (LTP: 0,0,0)

Course Objective:

1. To strengthen the association of students with construction industry.
2. To create awareness amongst the students the recent trends of civil engineering in industries.
3. To percept the role and responsibility of civil engineer in the industry.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
0	0	0	Non Credit	0	0	100	00	100

Course Contents:

Unit No.	Topics
1	It is a Mandatory Non Credit course and the student has to complete an Industrial Internship of the duration of two weeks during the summer vacation after Semester IV . The internship should be carried out in any industry with relevant applications of Civil Engineering, preferably under the guidance of a mentor from the same industry
2	The student will maintain a log of work done on daily basis and important ideas or practices that he / she has learnt during the internship. The log-book may also be dually signed by the student and the mentor from the industry.
3	The student has to submit a interim report and final detailed report based on the internship immediately after the completion of the internship
4	The ESE assessment will be based on the following: <ol style="list-style-type: none">i. The work executed/completed at Industry by student.ii. Poster Presentation on the experience gained.iii. The submission of the log-book and the report.iv. Feedback from the industry mentor in the prescribed format.v. Completion certificate from the industry.

Course Outcomes of Internship/Training (COs):

After completion of the internship students will be able:

1. To learn the application of knowledge in real world problems.
2. To apply knowledge and skills in real world problems through construction activities.
3. To get exposure to team-work and leadership quality.
4. To deal with industry-professionals and ethical issues in the work environment.