INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)
Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY
CIVIL ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI
(Based on AICTE Model Curriculum)

IARE - R18

B.Tech Regular Four Year Degree Program

(for the batches admitted from the academic year 2018- 2019)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2019 - 2020)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

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"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success"

Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

Branch: Means specialization in a program like B.Tech degree program in Aeronautical Engineering, B.Tech degree program in Computer Science and Engineering etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Certificate Course: It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Detention in a Course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from Semester: Student who doesn't want to register for any semester can apply in writing in prescribed format before the commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and / or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

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

Honours: An Honours degree typically refers to a higher level of academic achievement at an undergraduate level.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech); PG degree program: Master of Technology (M.Tech) / Master of Business Administration (MBA).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech programs offered by Institute, are designated as "IARE Regulations - R18" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of odd or even semester (deadlines are different for summer sessions). However, s/he can choose a substitute course in place of it, by exercising the option within 5 working days from the date of withdrawal.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies including J N T University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies such as Academic Council and Board of Studies (BOS) are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure, and syllabi under autonomous status.

The autonomous regulations, course structure, and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute in order to produce a quality engineering graduate to the society.

All the faculty, parents, and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Program
(for the batches admitted from the academic year 2018 - 19)
&
B.Tech. (Lateral Entry Scheme)
(for the batches admitted from the academic year 2019 - 20)

For pursuing four year undergraduate Bachelor of Technology degree program of study in Engineering (B.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

Preamble:

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology program with 160 credits in the entire program of 4 years, and additional 20 credits can be acquired for the degree of B.Tech with **Honours or additional Minor in Engineering**. These additional 20 credits will have to be acquired with online courses (MOOCs), perhaps for the first time in the country, to tap the zeal and excitement of learning beyond the classrooms. So, the students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive open online courses where the rare expertise of world famous experts from academics and industry are available.

Separate certificate will be issued in addition to regular degree program mentioning that the student has cleared Honours / Minor specialization in respective courses in addition to scheduled courses for B.Tech programs.

1. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEIs) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system in the first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / MOOCs / alternative assessment tools / presentations / self-study etc., or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments.
2. Undergo additional courses of interest.
3. Adopt an interdisciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2. MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3. PROGRAMS OFFERED

Presently, the institute is offering Bachelor of Technology (B.Tech) degree programs in the following disciplines:

1. Aeronautical Engineering
2. Computer Science and Engineering
3. Information Technology
4. Electronics and Communication Engineering
5. Electrical and Electronics Engineering
6. Mechanical Engineering
7. Civil Engineering

4. SEMESTER STRUCTURE

Each academic year is divided into three semesters, TWO being **MAIN SEMESTERS** (one odd + one even) and ONE being a **SUPPLEMENTARY SEMESTER**. Main semesters are for regular class work. Supplementary Semester is primarily for failed students i.e. registration for a course for the first time is generally not permitted in the supplementary semester.

4.1 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation, and conduct of examinations.

4.2 Each main semester shall have a minimum of 90 working days; out of which 75 days are for teaching / practical and 15 days for conduct of exams and preparation.

4.3 The supplementary semester shall be a fast track semester consisting of eight weeks and this period includes time for registration of courses, course work, and examination preparation, conduct of examinations, assessment, and declaration of final results.

4.4 All subjects may not be offered in the supplementary semester. The student has to pay a stipulated fee prescribed by the institute to register for a course in the supplementary semester. The supplementary semester is provided to help the student in not losing an academic year. It is optional for a student to make use of supplementary semester. **Supplementary semester is a special semester and the student cannot demand it as a matter of right** and will be offered based on availability of faculty and other institute resources.

4.5 The institute may use **supplementary semester** to arrange add-on courses for regular students and / or for deputing them for practical training / FSI model. A student can register for a maximum number of 15 credits during a supplementary semester.

4.5.1 The registration for the supplementary semester (during May – July, every year) provides an opportunity to students to clear their backlogs ('F' grade) or who are prevented from appearing for SEE examinations due to shortage of attendance less than 65% in each course ('SA' Grade) in the earlier semesters or the courses which he / she could not register (Drop / Withdraw) due to any reason.

Students will not be permitted to register for more than 15 credits (both I and II semester) in the supplementary semester. Students required to register for supplementary semester

courses are to pay a nominal fee within the stipulated time. A separate circular shall be issued at the time of supplementary semester.

It will be optional for a student to get registered in the course(s) of supplementary semester; otherwise, he / she can opt to appear directly in supplementary examination. However, if a student gets registered in a course of supplementary semester, then it will be compulsory for a student to fulfill attendance criterion (≥90%) of supplementary semester and he / she will lose option to appear in immediate supplementary examination.

The students who have earlier taken SEE examination and register afresh for the supplementary semester may revoke the CIA marks secured by them in their regular/earlier attempts in the same course. Once revoked, the students shall not seek restoration of the CIA marks.

Supplementary semester will be at an accelerated pace e.g. one credit of a course shall require two hours/week so that the total number of contact hours can be maintained same as in normal semester.

Instructions and guidelines for the supplementary semester course:

- A minimum of 36 to 40 hours will be taught by the faculty for every course.
- Only the students registered and having sufficient percentage of attendance for the course will be permitted to write the examination.
- The assessment procedure in a supplementary semester course will be similar to the procedure for a regular semester course.
- Student shall register for the supplementary semester as per the schedule given in academic calendar.
- Once registered, students will not be allowed to withdraw from supplementary semester.

4.5.2 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

FIRST SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation & Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Summer Vacation, Supplementary Semester and Remedial Exams			8 weeks

4.6 Students admitted on transfer from JNTUH affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned 'Board of Studies'.

5.0 REGISTRATION / DROPPING / WITHDRAWAL

5.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2. In ABSENTIA, registration will not be permitted under any circumstances.

5.3. At the time of registration, students should have cleared all the dues of Institute and Hostel for the previous semesters, paid the prescribed fees for the current semester and not been debarred from the institute for a specified period on disciplinary or any other ground.

5.4. The student has to normally register for a minimum of 17 credits and may register up to a maximum of 27 credits, in consultation with HOD/faculty mentor. On an average, a student is expected to register for 22 credits.

5.5. **Dropping of Courses:** Within one week after the last date of first internal assessment test or by the date notified in the academic calendar, the student may in consultation with his / her faculty mentor/adviser, drop one or more courses without prejudice to the minimum number of credits as specified in clause 5.4. The dropped courses are not recorded in the Grade Card. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits.

5.6. **Withdrawal from Courses:** A student is permitted to withdraw from a course by the date notified in the academic calendar. Such withdrawals will be permitted without prejudice to the minimum number of credits as specified in clause 5.4. A student cannot withdraw a course more than once and withdrawal of reregistered subjects is not permitted.

5.7 After **Dropping and / or Withdrawal** of courses, minimum credits registered shall be 20.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the seven groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1	Aeronautical Engineering	AE
2	Computer Science and Engineering	CS
3	Information Technology	IT
4	Electronics and Communication Engineering	EC
5	Electrical and Electronics Engineering	EE
6	Mechanical Engineering	ME
7	Civil Engineering	CE

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Theory Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Mini Project, Internship and Project work. The list of elective courses may also include subjects from allied discipline.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- **Contact classes (Theory):** 1 credit per lecture hour per week, 1 credit per tutorial hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours per week.
- **Project Work:** 1 credit for 2 hours of project work per week.
- **Mini Project:** 1 credit for 2 hours per week

7.1 TYPES OF COURSES

Courses in a program may be of three kinds: **Foundation / Skill, Core and Elective Courses.**

7.1.0 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

7.1.1 Professional Core Courses:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in the said discipline of study.

7.1.2 Elective Course:

Electives provide breadth of experience in respective branch and application areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline / domain
- Nurturing student's proficiency / skill.

An elective may be Professional Elective, is a discipline centric focusing on those courses which add generic proficiency to the students or may be Open Elective, chosen from unrelated disciplines.

There are six professional elective tracks; students can choose not more than two courses from each track. Overall, students can opt for six professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the four open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

7.1.3 Credit distribution for courses offered is given in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course	1 / 2 / 3 / 4	1 / 2 / 3 / 4
2	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	2 / 3 / 4	1 / 1.5 / 2
5	Audit Course / Mandatory Course	-	0
6	Project / Research based learning	-	4
7	Full Semester Internship (FSI) / Project Work	-	11

7.2 Course Structure

Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4.

Table 4: Category Wise Distribution of Credits

S. No	Category	Breakup of Credits
1	Humanities and Social Sciences (HSMC), including Management.	12
2	Basic Science Courses (BSC) including Mathematics, Physics and Chemistry.	25
3	Engineering Science Courses (ESC), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	24
4	Professional Core Courses (PCC), relevant to the chosen specialization / branch.	48
5	Professional Electives Courses (PEC), relevant to the chosen specialization / branch.	18
6	Open Elective Courses (OEC), from other technical and/or emerging subject areas.	18
7	Project Based Learning, Research Based Learning and Project Work (PROJ) / Full Semester Internship (FSI)	15
8	Mandatory Courses / Audit Courses.	Non-Credit
TOTAL		**160**

7.3 Semester wise course break-up

Following are the **TWO** models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

i. Full Semester Internship (FSI) Model and

ii. Non Full Semester Internship (NFSI) Model – Project work.

7.4 For Four year regular program (FSI Model):

In the FSI Model, out of the selected students - half of students shall undergo Full Semester

Internship in VII semester and the remaining students in VIII semester. In the Non FSI Model, all the selected students shall carry out the course work and Project work as specified in the course structure. A student who secures a minimum CGPA of 7.5 up to IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester shall be eligible to opt for FSI.

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two C I A examinations or the marks scored in the make-up examination.

8.1.1 Semester End Examination (SEE):

The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each modules carries equal weightage in terms of marks distribution. The question paper pattern is as follows.

Two full questions with 'either' 'or' choice will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
50 %	To test the analytical skill of the concept OR to test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty / teacher handling the course as given in Table 5. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 5: Assessment pattern for Theory Courses

COMPONENT	THEORY			TOTAL MARKS
Type of Assessment	CIE Exam	Quiz	AAT	
Max. CIA Marks	20	05	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

8.1.2.2 Quiz – Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students.

Marks shall be awarded considering the average of two quiz examinations for every course.

8.1.2.3 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, **METE** (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.

8.2 Laboratory Course:

8.2.1 Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by the Chairman, BOS.

8.2.2 All the drawing related courses are evaluated in line with laboratory courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test of 10 marks in each semester.

8.3 Mandatory Courses (MC):

These courses are among the compulsory courses but will not carry any credits. However, a pass in each such course during the program shall be necessary requirement for the student to qualify for the award of Degree. Its result shall be declared as “Satisfactory” or “Not Satisfactory” performance.

8.4 Value Added Courses:

The value added courses are audit courses offered through joint ventures with various organizations providing ample scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with “Satisfactory” or “Not Satisfactory” performance.

8.5 Project / Research Based Learning

This gives students a platform to experience a research driven career in engineering, while developing a device / systems and publishing in reputed SCI / SCOPUS indexed journals and/or filing an **Intellectual Property** (IPR-Patent/Copyright) to aid communities around the world. Students should work individually as per the guidelines issued by head of the department concerned. The benefits to students of this mode of learning include increased engagement, fostering of critical thinking and greater independence.

The topic should be so selected that the students are enabled to complete the work in the stipulated

time with the available resources in the respective laboratories. The scope of the work be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome.

Project report will be evaluated for 100 marks in total. Assessment will be done for 100 marks out of which, the supervisor / guide will evaluate for 30 marks based on the work and presentation / execution of the work. Subdivision for the remaining 70 marks is based on publication, report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the supervisor, Head of the department and an examiner nominated by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the department.

8.6 Project work

The project work shall be evaluated for 100 marks out of which 30 marks for internal evaluation and 70 marks for semester end evaluation. The project work shall be spread over in VII semester and in VIII semester. The project work shall be somewhat innovative in nature and explore the research bent of the mind of the student. A student shall carry out the project work under the supervision of a member of the faculty or may undertake to execute the project in collaboration with an Industry, R&D organization or another academic institution/University where sufficient facilities exist to carry out the project work.

At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The project is expected to be completed by the end of VIII semester. In VII semester, a first mid review is conducted by Project Review Committee (PRC) (on the progress) for 10 marks.

In VIII semester, a second mid review is conducted by PRC (on the progress) for 10 marks. On completion of the project, a third evaluation is conducted for award of internal marks of another 10 marks before the report is submitted, making the total internal marks 30.

The end semester examination shall be based on the report submitted and a viva-voce exam for 70 marks by a committee comprising the Head of the Department, the project supervisor and an external examiner nominated by the Principal. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

8.7 Full Semester Internship (FSI)

FSI is a full semester internship program carrying 11 credits. The FSI shall be opted in VII semester or in VIII semester. During the FSI, student has to spend one full semester in an identified industry / firm / R & D organization or another academic institution/University where sufficient facilities exist to carry out the project work.

Following are the evaluation guidelines:

- Quizzes: 2 times
- Quiz #1 - About the industry profile, weightage: 5%
- Quiz #2 - Technical-project related, weightage: 5%
- Seminars - 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Viva-voce: 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Project Report, weightage: 15%
- Internship Diary, weightage: 5 %
- Final Presentation, weightage: 40%

FSI shall be open to all the branches with a ceiling of maximum 10% distributed in both semesters. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) up to IV semester
- Competency Mapping / Allotment

9.0 MAKEUP EXAMINATION

The make-up examination facility shall be available to students who may have missed to attend CIE exams in one or more courses in a semester for valid genuine reasons. The make-up examination shall have comprehensive online objective type questions. The syllabus for the make-up examination shall be the whole syllabus covered till the end of the semester under consideration and will be conducted at the end of the semester.

10.0 SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Semester End Examinations held at the end of each semester, Supplementary Semester End Examinations will be conducted within three weeks of the commencement of the teaching of the next semester. Candidates taking the Regular / Supplementary examinations as Supplementary candidates may have to take more than one Semester End Examination per day. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period for the course shall not be relaxed under any circumstances.

11.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

11.1 It is desirable for a candidate to have 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

11.2 In case of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of the Head of the Department if the attendance is between 75% and 65% in every course, subjected to the submission of medical certificates, medical case file, and other needful documents to the concerned departments.

11.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program. However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

11.4 A candidate shall put in a minimum required attendance in atleast 60% of (rounded to the next highest integer) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

11.5 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

11.6 A prescribed fee shall be payable towards condonation of shortage of attendance.

11.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fails to fulfill the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

11.8 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

12.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

12.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

12.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

12.3 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

12.4 In case of difference of more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by this examiner shall be taken as final.

12.5 COE shall invite 3 - 9 external examiners to evaluate all the end-semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

12.6 Examinations Control Committee shall consolidate the marks awarded by internal and external examiners and award grades.

13.0 SCHEME FOR THE AWARD OF GRADE

13.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

i. Not less than 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

13.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Project based learning / Research based learning / Project work / FSI, if s/he secures

i. Not less than 40% marks for each Lab / Project based learning / Research based learning / Project work / FSI course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Project based learning / Research based learning / Project work / FSI course considering both internal and semester end examination.

13.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

14.0 LETTER GRADES AND GRADE POINTS

14.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Grade Point	Letter Grade
100 – 90	10	S (Superior)
89 – 80	9	A+ (Excellent)
79 – 70	8	A (Very Good)
69 – 60	7	B+ (Good)
59 – 50	6	B (Average)
49 – 40	5	C (Pass)
Below 40	0	F (Fail)
Absent	0	AB (Absent)
Authorized Break of Study	0	ABS

14.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: "S", "A+", "A", "B+", "B", "C".

14.3 A student obtaining Grade F shall be considered Failed and will be required to reappear in the examination.

14.4 For non credit courses, 'Satisfactory' or "Not Satisfactory" is indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

14.5 "SA" denotes shortage of attendance (as per item 11) and hence prevention from writing Semester End Examination.

14.6 "W" denotes **withdrawal** from the exam for the particular course.

14.7 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

15.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} \left(C_j S_j \right) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

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

16.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

16.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

16.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0 + 26x6.3 + 25x8.0}{144} = 6.73$$

17.0 PHOTOCOPY / REVALUATION

A student, who seeks the re-valuation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

18.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 11.

18.1 For students admitted into B.Tech (Regular) program

18.1.1 A student will not be promoted from II semester to III semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next lowest integer) from I and II semester examinations, whether the candidate takes the examination(s) or not.

18.1.2 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next lowest integer) upto III semester **or** 50% of the total credits (rounded to the next lowest integer) up to IV semester, from all the examinations, whether the candidate takes the examination(s) or not.

18.1.3 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 50% of the total credits (rounded to the next lowest integer) up to V semester **or** 50% of the total credits (rounded to the next lowest integer) up to VI semester from all the examinations, whether the candidate takes the examination(s) or not.

18.1.4 A student shall register for all the 160 credits and earn all the 160 credits. Marks obtained in all the 160 credits shall be considered for the award of the Grade.

18.2 For students admitted into B.Tech (lateral entry students)

18.2.1 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next lowest integer) up to IV semester, from all the examinations, whether the candidate takes the examination(s) or not.

18.2.2 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 50% of the total credits (rounded to the next lowest integer) up to V semester **or** 50% of the total credits (rounded to the next lowest integer) up to VI semester from all the examinations, whether the candidate takes the examination(s) or not.

18.2.3 A student shall register for all the 123 credits and earn all the 123 credits. Marks obtained in all the 123 credits shall be considered for the award of the Grade.

19.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

19.1 Student shall register and acquire minimum attendance in all courses and secure 160 credits for regular program and 123 credits for lateral entry program.

19.2 A student of a regular program, who fails to earn 160 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

19.3 A student of a lateral entry program who fails to earn 123 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

20.0 BETTERMENT OF MARKS IN THE COURSES ALREADY PASSED

Students who clear all the courses in their first attempt and wish to improve their CGPA shall register and appear for betterment of marks for one course of any theory courses within a period of subsequent two semesters. The improved marks shall be considered for classification / distinction but not for ranking. If there is no improvement, there shall not be any change in the original marks already awarded.

21.0 AWARD OF DEGREE

21.1 Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.0 and < 6.5	CGPA ≥ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

21.2 In order to extend the benefit to the students with one/two backlogs after either VI semester or VIII semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 7 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the 4 years program, either after VI semester (Option #1) or after VIII semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in V and / or VI semesters.

Option#2: Applicable to students who have maximum of TWO theory courses in VII and / or VIII semesters.

d. Eligibility for grafting:

i. Prior to the conduct of the supplementary examination after the declaration of VI or VIII semester results.

ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

21.3 Student, who clears all the courses upto VII semester, shall have a chance to appear for Quick Supplementary Examination to clear the failed courses of VIII semester.

21.4 By the end of VI semester, all the students (regular and lateral entry students) shall complete one of the audit course and mandatory course with acceptable performance.

21.5 In case, a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the grade sheet.

All the candidates who register for the semester end examination will be issued grade sheet by the institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

22 B.TECH WITH HONOURS OR ADDITIONAL MINORS IN ENGINEERING

Students acquiring 160 credits are eligible to get B.Tech degree in Engineering. A student will be eligible to get B.Tech degree with Honours or additional Minors in Engineering, if s/he completes an additional 20 credits (3/4 credits per course). These could be acquired through MOOCs from SWAYAM / NPTEL / edX / Coursera / Udacity /PurdueNext / Khan Academy / QEEE etc. The list for MOOCs will be a dynamic one, as new courses are added from time to time. Few essential skill sets required for employability are also identified year wise. Students interested in doing MOOC courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department. Any expense incurred for the MOOC course / summer program should be met by the students.

Only students having no credit arrears and a CGPA of 7.5 or above at the end of the fourth semester are eligible to register for B.Tech (Honours / Minor). After registering for the B.Tech (Honours / Minor) program, if a student fails in any course, s/he will not be eligible for B.Tech (Honours / Minor).

Every Department to develop and submit a Honours / Minors – courses list of 5 - 6 theory courses.

Honours Certificate for Vertical in his/her OWN Branch for Research orientation; Minor in any OTHER branch for Improving Employability.

For the MOOCs platforms, where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the institute prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that examinations Control Office (ECO) can conduct examination for the course. There shall be one Continuous Internal Examination (Quiz exam for 30 marks) after 8 weeks of the commencement of the course and semester end examination (Descriptive exam for 70 marks) shall be done along with the other regular courses.

A student can enroll for both Minor & Honours or for two Minors. The final grade sheet will only show the basic CGPA corresponding to the minimum requirement for the degree. The Minors/Honours will be indicated by a separate CGPA. The additional courses taken will also find separate mention in the grade sheet.

If a student drops (or terminated) from the Minor/Honours program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the grade sheet (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "Pass (P)" grade and also choose to omit the mention of the course as for the following:

- All the courses done under the dropped Minor/Honours will be shown in the grade sheet
- None of the courses done under the dropped Minor/Honours will be shown in the grade sheet.

Honours will be reflected in the degree certificate as "B.Tech (honours) in XYZ Engineering". Similarly, Minor as "B.Tech in XYZ Engineering with Minor in ABC". If a student has done both honours & minor, it will be acknowledged as "B.Tech (honours) in XYZ Engineering with Minor in ABC". And two minors will be reflected as "B.Tech in XYZ Engineering with Minor in ABC and Minor in DEF".

22.1. B.Tech with Honours

The total of 20 credits required to be attained for B.Tech Honours degree are distributed from V semester to VII semester in the following way:

For V semester	:	4 – 8 credits
For VI semester	:	4 – 8 credits
For VII semester	:	4 – 8 credits

Following are the details of such Honours which include some of the most interesting areas in the profession today:

S. No	Department	Honours scheme
1	Aeronautical Engineering	Aerospace Engineering / Space Science etc.
2	Computer Science and Engineering / Information Technology	Big data and Analytics / Cyber Physical Systems, Information Security / Cognitive Science / Internet of Things (IoT) etc.
3	Electronics and Communication Engineering	Digital Communication / Signal Processing / Communication Networks / VLSI Design / Embedded Systems etc.
4	Electrical and Electronics Engineering	Renewable Energy systems / Energy and Sustainability / IoT Applications in Green Energy Systems etc.
5	Mechanical Engineering	Industrial Automation and Robotics / Manufacturing Sciences and Computation Techniques etc.
6	Civil Engineering	Structural Engineering / Environmental Engineering etc.

22.2 B.Tech with additional Minor in Engineering

Every Department to develop and submit Minor Courses List of 5 - 6 Theory courses. Student from any department is eligible to apply for Minor from any other department. The total of 20 credits to complete the B.Tech (Minor) program by registering for MOOC courses each having a minimum of 3/4 credits offered by reputed institutions / organization with the approval of the department. Registration of the student for B.Tech (Minor), is from V Semester to VII Semester of the program in the following way:

For V semester : 4 – 8 credits
For VI semester : 4 – 8 credits
For VII semester : 4 – 8 credits

Only students having no credit arrears and a CGPA of 7.5 or above at the end of the fourth semester are eligible to register for B.Tech (Minor). After registering for the B.Tech (Minor) program, if a student fails in any course, s/he will not be eligible for B.Tech (Minor).

Every student shall also have the option to do a minor in engineering. A major is a primary focus of study and a minor is a secondary focus of study. The minor has to be a subject offered by a department other than the department that offers the major of the student or it can be a different major offered by the same department. For example, a student with the declared major in Computer Science and Engineering (CSE) may opt to do a minor in Physics; in which case, the student shall receive the degree B.Tech, Computer Science and Engineering with a minor in Physics. A student can do Majors in chosen filed as per the career goal, and a minor may be chosen to enhance the major thus adding the diversity, breadth and enhanced skills in the field.

Advantages of Minor in Engineering:

The minors mentioned above are having lots of advantages and a few are listed below:

1. To apply the inter-disciplinary knowledge gained through a Major (Stream) + Minor.
2. To enable students to pursue allied academic interest in contemporary areas.
3. To provide an academic mechanism for fulfilling multidisciplinary demands of industries.
4. To provide effective yet flexible options for students to achieve basic to intermediate level competence in the Minor area.

5. Provides an opportunity to students to become entrepreneurs and leaders by taking business/ management minor.
6. Combination in the diverse fields of engineering e.g., CSE (Major) + Electronics (Minor) combination increases placement prospects in chip designing companies.
7. Provides an opportunity to Applicants to pursue higher studies in an inter-disciplinary field of study.
8. Provides opportunity to the Applicants to pursue interdisciplinary research.
9. To increase the overall scope of the undergraduate degrees.

Following are the details of such Minor / Honours which include some of the most interesting areas in the profession today:

1. Space Science
2. Information Security
3. Data Analytics
4. Cyber Physical Systems
5. Electronic System Design
6. Renewable Energy Sources
7. Energy and Sustainability
8. Industrial Automation and Robotics
9. Aerospace Engineering
10. Manufacturing Sciences and Computation Techniques
11. Structural Engineering
12. Environmental Engineering
13. Internet of Things
14. Computer Science and Engineering
15. Technological Entrepreneurship
16. Materials Engineering
17. Physics (Materials / Nuclear / Optical / Medical)
18. Mathematics (Combinatorics / Logic / Number theory / Dynamical systems and differential equations./ Mathematical **physics /** Statistics and Probability).

23.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAM

23.1 A candidate is normally not permitted to take a break from the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program in a later respective semester, s/he shall seek the approval from the Principal in advance. Such application shall be submitted before the last date for payment of examination fee of the semester in question and forwarded through the Head of the Department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

23.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to temporarily withdraw from the program. Such permission is accorded only to those who do not have any outstanding dues / demand at the College / University level including tuition fees, any other fees, library materials etc.

23.3 The candidate has to rejoin the program after the break from the commencement of the respective semester as and when it is offered.

23.4 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 19. The maximum period includes the break period.

23.5 If any candidate is detained for any reason, the period of detention shall not be considered as 'Break of Study'.

24.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.
b. A student shall not be permitted to study any semester more than three times during the entire program of study.
c. The student fails to satisfy the norms of discipline specified by the institute from time to time.

25.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results and the degree of the candidate will be withheld.

26.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of degrees to the students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

27.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and are expected not to indulge in any activity which will tend to bring down the honour of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations, he/she shall be liable for punitive action as prescribed by the institute from time to time.

28.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

29.0 TRANSITORY REGULATIONS

A candidate, who is detained or has discontinued a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUH) curriculum and detained due to the shortage of attendance at the end of the first semester shall join the

autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUH curriculum and detained due to the shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, if detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) Transfer candidates (from non-autonomous college affiliated to JNTUH):

A student who is following JNTUH curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to the previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) Transfer candidates (from an autonomous college affiliated to JNTUH):

A student who has secured the required credits up to previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

e) Readmission from IARE-R16 to IARE-R18 regulations

A student took admission in IARE-R16 Regulations, detained due to lack of required number of credits or percentage of attendance at the end of any semester is permitted to take re-admission at appropriate level under any regulations prevailing in the institute subject to the following rules and regulations.

1. Student shall pass all the courses in the earlier scheme of regulations (IARE - R16). However, in case of having backlog courses, they shall be cleared by appearing for supplementary examinations conducted under IARE - R16 regulations from time to time.
2. After rejoining, the student is required to study the courses as prescribed in the new regulations for the re-admitted program at that level and thereafter.
3. If the student has already passed any course(s) of readmitted program in the earlier regulation / semester of study, such courses are exempted in the new scheme to appear for the course(s).
4. The courses that are not done in the earlier regulations / semester as compared with readmitted program need to be cleared after readmission by appearing for the examinations conducted time to time under the new regulations.
5. In general, after transition, course composition and number of credits / semester shall be balanced between earlier and new regulations on case to case basis.
6. In case, the students who do not have option of acquiring required credits with the existing courses offered as per the new curriculum, credit balance can be achieved by clearing the additional courses offered by the respective departments (approved in Academic Council meeting). The additional courses that are offered can be of theory or laboratory courses and shall be offered during semester.
7. Students re-joined in III semester shall be treated on par with “Lateral Entry” students for credits and graduation requirements. However, the student shall clear all the courses in B.Tech I Semester and B.Tech II Semester as per IARE-R16 regulations.

30.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

CIVIL ENGINEERING

COURSE STRUCTURE

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AHSB01	English	HSMC	Foundation	2	0	0	2	30	70	100
AHSB02	Linear Algebra and Calculus	BSC	Foundation	3	1	0	4	30	70	100
AEEB04	Basic Electrical and Electronics Engineering	ESC	Foundation	3	1	0	4	30	70	100
PRACTICAL										
AHSB08	English Language and Communication Skills Laboratory	HSMC	Foundation	0	0	2	1	30	70	100
AMEB02	Engineering Graphics and Design Laboratory	ESC	Foundation	1	0	4	3	30	70	100
AEEB08	Basic Electrical and Electronics Engineering Laboratory	ESC	Foundation	0	0	3	1.5	30	70	100
TOTAL				**09**	**02**	**09**	**15.5**	**180**	**420**	**600**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AHSB11	Mathematical Transform Techniques	BSC	Foundation	3	1	0	4	30	70	100
AHSB03	Engineering Chemistry	BSC	Foundation	3	1	0	4	30	70	100
AHSB04	Waves and Optics	BSC	Foundation	3	1	0	4	30	70	100
ACSB38	Programming for Problem Solving using Python	ESC	Foundation	3	0	0	3	30	70	100
PRACTICAL										
AHSB09	Engineering Chemistry Laboratory	BSC	Foundation	0	0	3	1.5	30	70	100
AHSB10	Engineering Physics Laboratory	BSC	Foundation	0	0	3	1.5	30	70	100
ACSB02	Programming for Problem Solving Laboratory	ESC	Foundation	0	0	4	2	30	70	100
AMEB01	Workshop / Manufacturing Practices Laboratory	ESC	Foundation	0	0	3	1.5	30	70	100
TOTAL				**12**	**03**	**13**	**21.5**	**240**	**560**	**800**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ACEB01	Surveying and Geomatics	PCC	Core	3	0	0	3	30	70	100
AMEB03	Engineering Mechanics	ESC	Foundation	3	1	0	4	30	70	100
ACEB02	Building Materials, Construction and Planning	PCC	Core	3	1	0	4	30	70	100
AECB01	Basic Electronics Engineering	ESC	Foundation	3	0	0	3	30	70	100
ACSB03	Data Structures	PCC	Core	3	0	0	3	30	70	100
PRACTICAL										
ACEB03	Surveying and Geomatics Laboratory	PCC	Core	0	0	3	1.5	30	70	100
ACEB04	Civil Engineering Drawing Laboratory	PCC	Core	1	0	2	2	30	70	100
ACSB05	Data Structures Laboratory	PCC	Core	0	0	3	1.5	30	70	100
TOTAL				**16**	**02**	**08**	**22**	**240**	**560**	**800**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ACEB05	Engineering Geology	PCC	Core	3	0	0	3	30	70	100
ACEB06	Fluid Mechanics	PCC	Core	3	1	0	4	30	70	100
ACEB07	Strength of Materials	PCC	Core	3	1	0	4	30	70	100
AHSB12	Probability and Statistics	BSC	Foundation	3	1	0	4	30	70	100
ACEB08	Materials, Testing and Evaluation	PCC	Core	3	1	0	4	30	70	100
AHSB07	Environmental Science	MC-II	---	0	0	0	0	30	70	100
PRACTICAL										
ACEB09	Engineering Geology Laboratory	PCC	Core	0	0	2	1	30	70	100
ACEB10	Fluid Mechanics Laboratory	PCC	Core	0	0	2	1	30	70	100
ACEB11	Strength of Materials Laboratory	PCC	Core	0	0	2	1	30	70	100
TOTAL				**15**	**04**	**06**	**22**	**270**	**630**	**900**

V SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ACEB12	Mechanics of Material	PCC	Core	2	1	0	3	30	70	100
ACEB13	Structural Engineering	PCC	Core	2	1	0	3	30	70	100
ACEB14	Hydraulic Engineering	PCC	Core	3	0	0	3	30	70	100
AHSB14	Business Economics and Financial Analysis	PCC	Core	3	0	0	3	30	70	100
	Professional Elective - I	PEC	Elective	3	0	0	3	30	70	100
	Open Elective - I	OEC	Elective	3	0	0	3	30	70	100
AHSB15	Project Based Learning (Prototype / Design Building)	PCC	Core	2	0	0	2	30	70	100
PRACTICAL										
ACEB15	Hydraulic Engineering Laboratory	PCC	Core	0	0	2	1	30	70	100
ACEB16	Concrete Technology Laboratory	PCC	Core	0	0	2	1	30	70	100
TOTAL				**18**	**02**	**04**	**22**	**270**	**630**	**900**

VI SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ACEB17	Engineering Economics, Estimation and Costing	PCC	Core	3	0	0	3	30	70	100
ACEB18	Hydrology and Water Resources Engineering	PCC	Core	2	1	0	3	30	70	100
ACEB19	Geotechnical Engineering	PCC	Core	2	1	0	3	30	70	100
	Professional Elective - II	PEC	Elective	3	0	0	3	30	70	100
	Professional Elective - III	PEC	Elective	3	0	0	3	30	70	100
	Open Elective - II	OEC	Elective	3	0	0	3	30	70	100
AHSB16	Research Based Learning (Fabrication / Model Development)	PCC	Core	2	0	0	2	30	70	100
PRACTICAL										
ACEB20	Geotechnical Engineering Laboratory	PCC	Core	0	0	2	1	30	70	100
ACEB21	Reinforced Concrete Structures Drawing Laboratory	PCC	Core	0	0	2	1	30	70	100
TOTAL				**18**	**02**	**04**	**22**	**270**	**630**	**900**

VII SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ACEB22	Environmental Engineering	PCC	Core	3	0	0	3	30	70	100
ACEB23	Transportation Engineering	PCC	Core	3	0	0	3	30	70	100
	Professional Elective - IV	PEC	Elective	3	0	0	3	30	70	100
	Professional Elective – V	PEC	Elective	3	0	0	3	30	70	100
	Open Elective – III	OEC	Elective	3	0	0	3	30	70	100
AHSB17	Constitution of India / Essence of Indian Traditional Knowledge	MCC	---	0	0	0	0	30	70	100
PRACTICAL										
ACEB24	Environmental Engineering Laboratory	PCC	Core	0	0	3	1.5	30	70	100
ACEB25	Transportation Engineering Laboratory	PCC	Core	0	0	3	1.5	30	70	100
ACEB54	Project Work-I	PROJ	Project	0	0	10	5	30	70	100
TOTAL				**15**	**00**	**16**	**23**	**270**	**630**	**900**

VIII SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
	Professional Elective – VI	PEC	Elective	3	0	0	3	30	70	100
	Open Elective IV	OEC	Elective	3	0	0	3	30	70	100
PRACTICAL										
ACEB55	Project Work-II / Full Semester Internship	PROJ	Project	0	0	12	6	30	70	200
TOTAL				**06**	**00**	**12**	**12**	**90**	**210**	**300**

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PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – I: Materials and Technology

Course Code	Course Code
ACEB26	Concrete Technology
ACEB27	Building Construction Practices
ACEB28	Construction Equipment Materials
ACEB29	Engineering Materials for Sustainability

PROFESSIONAL ELECTIVE – II: Structural Designing

Course Code	Course Title
ACEB30	Design of Steel Structures and Drawing
ACEB31	Structural Geology
ACEB32	Industrial structures
ACEB33	Bridge Engineering

PROFESSIONAL ELECTIVE – III: Concrete Structures

Course Code	Course Title
ACEB34	Design of Concrete Structures – I
ACEB35	Reinforced Concrete
ACEB36	Design of Structural Systems
ACEB37	Masonry Structures

PROFESSIONAL ELECTIVE – IV: Foundation Engineering

Course Code	Course Title
ACEB38	Foundation Engineering
ACEB39	Soil Dynamics and Machine Foundations
ACEB40	Ground Water Engineering
ACEB41	Advanced Foundation Engineering

PROFESSIONAL ELECTIVE – V: Structural detailing

Course Code	Course Title
ACEB42	Design of Concrete Structures – II
ACEB43	Structural Dynamics
ACEB44	Design of Hydraulic Structures
ACEB45	Earthquake Engineering

PROFESSIONAL ELECTIVE – VI: Advanced topics in Civil Engineering

Course Code	Course Title
ACEB46	Prestressed Concrete Structures
ACEB47	Advanced Structural Analysis
ACEB48	Structural Analysis by Matrix methods
ACEB49	Construction Engineering and Management

OPEN ELECTIVE - I

Course Code	Course Title
AAEB53	Flight Control Theory
AAEB54	Airframe Structural Design
AMEB54	Mechanical Properties of Materials
AMEB55	Automation in Manufacturing
ACEB50	Remote Sensing and GIS
ACEB51	Project Safety Management

OPEN ELECTIVES – II

Course Code	Course Title
ACSB32	Computer Architecture
ACSB33	Analysis of Algorithms and Design
ACSB34	Relational Database Management Systems
AITB30	Advanced Data Structures
AITB31	Data Communications and Networks
AITB32	Network Security

OPEN ELECTIVE - III

Course Code	Course Title
AHSB18	Soft Skills and Interpersonal Communication
AHSB19	Cyber Law and Ethics
AHSB20	Economic Policies in India
AHSB21	Global Warming and Climate Change
AHSB22	Intellectual Property Rights
AHSB23	Entrepreneurship

OPEN ELECTIVE - IV

Course Code	Course Title
AECB55	Microprocessors and Interfacing
AECB56	Principles of Communication
AECB57	Image Processing
AEEB55	Electrical Engineering Materials
AEEB56	Non Conventional Energy Sources
AEEB57	Nanotechnology

MANDATORY COURSES

Course Code	Course Title
AHSB07	Environmental Sciences
AHSB17	Essence of Indian Traditional Knowledge

SYLLABUS

ENGLISH

I Semester: ECE / EEE /CE | II Semester: AE / CSE / IT / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB01	Foundation	2	-	-	2	30	70	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 30		

OBJECTIVES:

The course should enable the students to:

I. Communicate in an intelligible English accent and pronunciation.
II. Use the four language skills i.e., Listening, Speaking, Reading and Writing effectively.
III. Develop the art of writing accurate English with correct spelling, grammar and punctuation.

MODULE - I	GENERAL INTRODUCTION AND LISTENIG SKILLS	Classes: 07

Introduction to communication skills; Communication process; Elements of communication; Soft skills vs hard skills; Importance of soft skills for engineering students; Listening skills; Significance; Stages of listening; Barriers to listening and effectiveness of listening; Listening comprehension.

MODULE - II	SPEAKING SKILLS	Classes: 09

Significance; Essentials; Barriers and effectiveness of speaking; Verbal and non-verbal communication; Generating talks based on visual prompts; Public speaking; Addressing a small group or a large formal gathering; Oral presentation; Power point presentation.

MODULE - III	VOCABULARY & GRAMMAR	Classes: 10

Vocabulary:

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; Standard abbreviations; Idioms and phrases; One word substitutes.

Grammar:

Sentence structure; Uses of phrases and clauses; Punctuation; Subject verb agreement; Modifiers; Articles; Prepositions.

MODULE - IV	READING SKILLS	Classes: 09

Significance; Techniques of reading; Skimming-Reading for the gist of a text; Scanning - Reading for specific information; Intensive; Extensive reading; Reading comprehension;; Reading for information transfer; Text to diagram; Diagram to text.

MODULE - V	WRITING SKILLS	Classes: 10

Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing introduction and conclusion; Techniques for writing precisely; Letter writing; Formal and Informal letter writing; E-mail writing , Report Writing.

Text Books:

Handbook of English for Communication (Prepared by Faculty of English, IARE)

Reference Books:

1. Sanjay Kumar and Pushp Lata. "Communications Skills". Oxford University Press. 2011.
2. Michael Swan. "Practical English Usage", Oxford University Press, 1995.
3. F.T. Wood. "Remedial English Grammar", Macmillan. 2007.
4. William Zinsser. "On Writing Well". Harper Resource Book, 2001.
5. Raymond Murphy, "Essential English Grammar with Answers", Cambridge University Press, 2nd Edition.

Web References:

1. www.edufind.com
2. www.myenglishpages.com
3. http://grammar.ccc.comment.edu
4. http://owl.english.prudue.edu

E-Text Books:

1. http://bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. https://americanenglish.state.gov/files/ae/resource_files/developing_writing.pdf
4. http://learningenglishvocabularygrammar.com/files/idiomsandphraseswithmeaningsandexamplespdf.pdf
5. http://www.robinwood.com/Democracy/General Essays/CriticalThinking.pdf

LINEAR ALGEBRA AND CALCULUS

I Semester: AE / CSE / IT / ECE / EEE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB02	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Determine rank of a matrix and solve linear differential equations of second order.
II. Determine the characteristic roots and apply double integrals to evaluate area.
III. Apply mean value theorems and apply triple integrals to evaluate volume.
IV. Determine the functional dependence and extremum value of a function.
V. Analyze gradient, divergence, curl and evaluate line, surface, volume integrals over a vector field.

Module-I	THEORY OF MATRICES AND HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS	Classes: 09

THEORY OF MATRICES: Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew-Hermitian and unitary matrices; Elementary row and column transformations; Rank of a matrix: Echelon form and normal form; Inverse by Gauss-Jordan method.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS: Linear differential equations of second and higher order with constant coefficients, non-homogeneous term of the type $f(x) = e^{ax}, \sin ax, \cos ax$ and $f(x) = x^n, e^{ax}v(x), xv(x)$; Method of variation of parameters.

Module-II	LINEAR TRANSFORMATIONS AND DOUBLE INTEGRALS	Classes: 09

LINEAR TRANSFORMATIONS: Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Eigen values and Eigen vectors of a matrix and Properties (without proof); Diagonalization of matrix by linear transformation.

DOUBLE INTEGRALS: Evaluation of double integrals in Cartesian coordinates and Polar coordinates; Change of order of integration; Area as a double integral; Transformation of coordinate system.

Module-III	FUNCTIONS OF SINGLE VARIABLES AND TRIPLE INTEGRALS	Classes: 09

FUNCTIONS OF SINGLE VARIABLES: Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof and geometrical interpretation.

TRIPLE INTEGRALS: Evaluation of triple integrals in Cartesian coordinates; volume of a region using triple integration.

Module-IV	FUNCTIONS OF SEVERAL VARIABLES AND EXTREMA OF A FUNCTION	Classes: 09

FUNCTIONS OF SEVERAL VARIABLES: Partial differentiation, functional dependence, Jacobian.

EXTREMA OF A FUNCTION: Maxima and minima of functions of two variables without constraints and with constraints; Method of Lagrange multipliers.

Module-V	VECTOR DIFFERENTIAL AND INTEGRAL CALCULUS	Classes: 09

VECTOR DIFFERENTIAL CALCULUS: Scalar and vector point functions; Definitions of Gradient, divergent and curl with examples; Solenoidal and irrotational vector point functions; Scalar potential function.

VECTOR INTEGRAL THEOREMS: Line integral, surface integral and volume integral, Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., "Engineering Mathematics" for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Dr. M Anita, "Engineering Mathematics-I", Everest Publishing House, Pune, First Edition, 2016.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

I Semester: CE | II Semester: ME | III Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB04	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand Kirchhoff laws and their application in series and parallel electric circuits.
II. Discuss principle and operation of measuring instruments.
III. Analyze the characteristics of alternating quantities, DC and AC machines.
IV. Illustrate the V-I characteristics of various diodes and bi-polar junction transistor.

MODULE -I	ELECTRIC CIRCUITS, ELECTROMAGNETISM AND INSTRUMENTS	Classes: 10

Electrical Circuits: Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; **Instruments:** Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments.

MODULE -II	DC MACHINES	Classes: 10

DC Machines: Principle of operation of DC generator, EMF equation, principle of operation of DC motors, torque equation, types of DC machines, applications, three point starter.

MODULE -III	ALTERNATING QUANTITIES AND AC MACHINES	Classes: 08

Alternating quantities: Sinusoidal AC voltage, average and RMS values, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, efficiency and regulation.

Three phase induction motor: Principle of operation, slip, slip torque characteristics, efficiency, applications; Alternator: Principle of operation, EMF Equation, efficiency, regulation by synchronous impedance method.

MODULE-IV	SEMICONDUCTOR DIODE AND APPLICATIONS	Classes: 09

Semiconductor diode: P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator.

MODULE-V	BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS	Classes: 08

Bipolar junction transistor: Working principle of transistors, DC characteristics, CE, CB, CC configurations, biasing, load line, applications.

Text Books:

1. A Chakrabarti, “Circuit Theory”, Dhanpat Rai Publications, 6th Edition, 2004.
2. K S Suresh Kumar, “Electric Circuit Analysis”, Pearson Education, 1st Edition, 2013.
3. Willianm Hayt, Jack E Kemmerly S M Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill, 7th Edition, 2010.
4. J P J Millman, C C Halkias, Satyabrata Jit, “Millman‟s Electronic Devices and Circuits”, Tata McGraw Hill, 2nd Edition, 1998. 5 R L Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI / PHI, 9th Edition, 2006.
5. R L Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI / PHI, 9th Edition, 2006.
6. V K Mehta, Rohit Mehta, “Principles of electrical engineering”, S CHAND, 1st Edition, 2003.

Reference Books:

1. David A Bell, “Electric Circuits”, Oxford University Press, 9th Edition, 2016.
2. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
3. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008.
4. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
5. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008.

Web References:

1. https://www.kuet.ac.bd/webportal/ppmv2/uploads/1364120248DC%20Machines2.pdftextofvideo.nptel.iitm.ac.in
2. https://www.eleccompengineering.files.wordpress.com/2014/08/a-textbook-of-electrical-technology-volume-ii-ac-and-dc-machines-b-l-thferaja.pdf
3. https://www.geosci.uchicago.edu/~moyer/GEOS24705/Readings/Klempner_Ch1.pdf
4. https://www.ibiblio.org/kuphaldt/electricCircuits/DC/DC.pdf
5. https://www.users.ece.cmu.edu/~dwg/personal/sample.pdf.
6. https://www.djm.cc/library/Principles_of_Alternating_Current_Machinery_Lawrence_edited.pdf

E-Text Books:

1. https://www.kisi.deu.edu.tr/aytac.goren/ELK2015/w10.pdfwww.bookboon.com.
2. https://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/lecture-notes/19_bjt_1.pdf.
3. https://www.google.co.in/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=half+and+full+wave+rectifier+pdf.
4. https://www.leka.lt/sites/default/files/vaizdai/concepts-in-electric-circuits.pdf.
5. https://www.ktustudents.in

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

I Semester: ECE / EEE /CE | II Semester: AE / CSE / IT / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB08	Foundation	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course enables the students to:

I. Improve their ability to listen and comprehend a given text.
II. Upgrade the fluency and acquire a functional knowledge of English Language.
III. Enrich thought process by viewing a problem through multiple angles.

LIST OF ACTIVITIES

Week-l	**LISTENING SKILL**

a. Listening to conversations and interviews of famous personalities in various fields; Listening practice related to the TV talk shows and news.
b. Listening for specific information; Listening for summarizing information – Testing.

Week-2	**LISTENING SKILL**

a. Listening to films of short duration and monologues for taking notes; Listening to answer multiple choice questions.
b. Listening to telephonic conversations; Listening to native Indian: Abdul Kalam, British: Helen Keller and American: Barrack Obama speakers to analyze intercultural differences – Testing.

Week-3	**SPEAKING SKILL**

a. Functions of English Language; Introduction to pronunciation; Vowels and Consonants
b. Tips on how to develop fluency, body language and communication; Introducing oneself: Talking about yourself, others, leave taking.

Week-4	**SPEAKING SKILL**

a. Sounds - Speaking exercises involving the use of Vowels and Consonant sounds in different contexts; Exercises on Homophones and Homographs
b. Just a minute (JAM) session.

Week-5	**SPEAKING SKILL**

a. Stress patterns.
b. Situational Conversations: common everyday situations; Acting as a compere and newsreader; Greetings for different occasions with feedback preferably through video recording.

Week-6	**READING SKILL**
a. Intonation. b. Reading newspaper and magazine articles; Reading selective autobiographies for critical commentary.	
Week-7	**READING SKILL**
a. Improving pronunciation through tongue twisters. b. Reading advertisements, pamphlets; Reading comprehension exercises with critical and analytical questions based on context.	
Week-8	**WRITING SKILL**
a. Listening to inspirational short stories. b. Writing messages, leaflets, Notice; Writing tasks; Flashcards – Exercises.	
Week-9	**WRITING SKILL**
a. Write the review on a video clipping of short duration (5 to 10minutes). b. Write a slogan related to the image; Write a short story of 6-10 lines based on the hints given.	
Week-10	**WRITING SKILL**
a. Minimizing Mother Tongue Influence to improve fluency through watching educational videos. b. Writing practices – précis writing; Essay writing.	
Week-11	**THINKING SKILL**
a. Correcting common errors in day to day conversations. b. Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms, proverbs.	
Week-12	**THINKING SKILL**
a. Correcting common errors in day to day conversations. b. Making pictures and improvising diagrams to form English words, phrases and proverbs.	
Reference Books:	
1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practices", Oxford University Press, New Delhi, 3rd Edition, 2015. 2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009.	
Web References:	
1. http://learnenglish.britishcouncil.org 2. http://www.esl-lab.com/ 3. http://www.elllo.org/	

EQUIPMENT REQUIRED FOR A BATCH OF 60 STUDENTS (ORAL AND MULTIMEDIA)

1. Career laboratory: 1 Room
2. Server computer for the laboratory with high configuration: 1 no
3. Computers: 30 nos
4. Software: K Van Solution
5. LCD Projector: 1 no
6. Speakers with amplifiers, one wireless mic and one collar mic
7. Podium: 1
8. Chairs: 30
9. Discussion Tables: 2
10. White board: 1

ENGINEERING GRAPHICS AND DESIGN LABORATORY

I Semester: ECE / EEE / CE | II Semester: AE / ME / CSE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB02	Foundation	1	-	4	3	30	70	100
Contact Classes: 15	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 63		

OBJECTIVES:

The course should enable the students to

I. Understand the basic principles of engineering drawing and construction of curves used in engineering field.
II. Apply the knowledge of interpretation of projection in different quadrants.
III. Understand the projections of solids, when it is inclined to both planes simultaneously.
IV. Convert the pictorial views into orthographic view and vice versa.
V. Create intricate details of components through sections and develop its surfaces.

LIST OF EXPERIMENTS

MODULE - I **INTRODUCTION TO ENGINEERING DRAWING**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales-Plain, Diagonal and Vernier Scales.

MODULE - II **OVERVIEW OF COMPUTER GRAPHICS, CUSTOMIZATION & CAD DRAWING, ANNOTATIONS, LAYERING & OTHER FUNCTIONS, DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT**

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids].

Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

MODULE - III	ORTHOGRAPHIC PROJECTIONS
Principles of Orthographic Projections-Conventions-Projections of Points and lines inclined to both planes. Projections of planes inclined Planes-Auxiliary Planes.	
MODULE - IV	**PROJECTIONS OF REGULAR SOLIDS AND SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS**
Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Draw the sectional orthographic views of geometrical solids ofPrism, Pyramid, Cylinder and Cone; Objects from industry and dwellings (foundation to slab only).	
MODULE - V	**DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS**
Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Principles of Isometric projection–Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT: Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	

Text Books

1. N. D. Bhatt (2012), "Engineering Drawing", Charotar Publications, New Delhi, 49th Edition, 2010.
2. C.M. Agarwal, Basant Agarwal, "Engineering Drawing", Tata McGrawHill, 2nd Edition, 2013.

Reference Books:

1. K. Venugopal, "Engineering Drawing and Graphics". New Age Publications, 2nd Edition, 2010.
2. Dhananjay. A. Johle, "Engineering Drawing", Tata McGraw Hill, 1st Edition, 2008.
3. S.Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishers, 3rd Edition, 2011.
4. A. K. Sarkar, A.P Rastogi, "Engineering graphics with Auto CAD", PHI Learning, 1st Edition, 2010.

Web References:

1. http://nptel.ac.in/courses/112103019
2. http://www.autocadtutorials.net/
3. http://gradcab.com/questions/tutorial-16-for -beginner-engineering-drawing-I

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: AUTOCAD 2016
HARDWARE: 30 numbers of Intel Desktop Computers with 2 GB RAM

BASIC ELECTRICAL AND ELCTRONICS ENGINEERING LABORATORY

I Semester: CE | II Semester: ME

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB08	Foundation	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Analysis the basic concepts of electric circuits.
II. Study the performance of DC machines and AC machines.
III. Understand the characteristics of electronic components.

LIST OF EXPERIMENTS

Expt - 1	**KIRCHOFF'S CURRENT LAW AND VOLTAGE LAW**

Verification of Kirchhoff's current and voltage laws.

Expt - 2	**OHM' S LAW**

Verification of Ohm's law.

Expt - 3	**OPEN CIRCUIT CHARACTERISTICS OF DC SHUNT GENERATOR**

Study the magnetization characteristics of DC shunt generator.

Expt - 4	**SWINBURNE'S TEST**

Predetermination of efficiency (Swinburne's test) of DC shunt machine.

Expt - 5	**OPEN CIRCUIT AND SHORT CIRCUIT TEST**

Determination of efficiency of single phase transformer by conducting open circuit and short circuit test.

Expt - 6	**BRAKE TEST ON THREE PHASE INDUCTION MOTOR**

Plot the performance characteristics of three phase induction motor by conducting brake test.

Expt - 7	**REGULATION OF ALTERNATOR**

Determine the regulation of alternator using synchronous impedance method.

Expt - 8	**PN JUNCTION DIODE**

Study the characteristics of PN junction diode.

Expt - 9	**ZENER DIODE**
Study the characteristics of Zener diode and breakdown mechanism.	
Expt - 10	**HALF WAVE RECTIFIER CIRCUIT**
Determine the efficiency of, regulation of half wave rectifier circuit.	
Expt - 11	**FULL WAVE RECTIFIER CIRCUIT**
Determine the efficiency of, regulation of full wave rectifier circuit.	
Expt - 12	**TRANSISTOR**
Study the characteristics of Transistor with common emitter (CE) configuration.	
Expt - 13	**TRANSISTOR**
Study the characteristics of Transistor with common base (CB) configuration.	
Expt - 14	**CATHODE RAY OSCILLOSCOPE (CRO)**
Check the features and limitations of cathode ray oscilloscope.	

Reference Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 2004.
2. J P J Millman, C C Halkias, Satyabrata Jit, "Millman's Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998.
3. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI/PHI, 9th Edition, 2006.

Web References:

1. https://www.nptel.ac.in/Courses/117106108
2. https://www.gnindia.dronacharya.info/EEEDept/labmanuals.html
3. https://www.textofvideo.nptel.iitm.ac.in
4. https://www.textofvideo.nptel.iitm.ac.in/

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Microsoft Windows 7 and MATLAB – V 8.5
HARDWARE: 01 numbers of Intel Desktop Computer with 2 GB RAM

MATHEMATICAL TRANSFORM TECHNIQUES

II Semester: AE / ECE / EEE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB11	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge solving algebra and transcendental equations and understanding Laplace transforms.
II. Determine the unknown values of a function by interpolation and applying inverse Laplace transforms.
III. Fitting of a curve and determining the Fourier transform of a function.
IV. Solving the ordinary differential equations by numerical techniques.
V. Formulate to solve partial differential equation.

Module-I	ROOT FINDING TECHNIQUES AND LAPLACE TRANSFORMS	Classes: 09

ROOT FINDING TECHNIQUES: Root finding techniques: Solving algebraic and transcendental equations by bisection method, method of false position, Newton-Raphson method.

LAPLACE TRANSFORMS: Definition of Laplace transform, linearity property, piecewise continuous function, existence of Laplace transform, function of exponential order, first and second shifting theorems, change of scale property, Laplace transforms of derivatives and integrals, multiplied by t, divided by t, Laplace transform of periodic functions.

Module-II	INTERPOLATION AND INVERSE LAPLACE TRANSFORMS	Classes: 09

INTERPOLATION: Interpolation: Finite differences, forward differences, backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange's interpolation.

INVERSE LAPLACE TRANSFORMS: Inverse Laplace transform: Definition of Inverse Laplace transform, linearity property, first and second shifting theorems, change of scale property, multiplied by s, divided by s; Convolution theorem and applications.

Module-III	CURVE FITTING AND FOURIER TRANSFORMS	Classes: 09

CURVE FITTING: Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares.

FOURIER TRANSFORMS: Fourier integral theorem, Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transform, properties, inverse transforms, finite Fourier transforms.

Module-IV	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	Classes: 09

STEP BY STEP METHOD: Taylor's series method; Euler's method, modified Euler's method for first order differential equations.

MULTI STEP METHOD: Runge-Kutta method for first order differential equations.

Module-V	PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS	Classes: 09

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method.

APPLICATIONS: Method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., "Engineering Mathematics" for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Dr. M Anita, "Engineering Mathematics-I", Everest Publishing House, Pune, First Edition, 2016.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

ENGINEERING CHEMISTRY

I Semester: CSE / IT/ EEE | II Semester: AE / ECE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB03	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Apply the electrochemical principles in batteries, understand the fundamentals of corrosion.
II. Analysis of water for its various parameters and its significance in industrial and domestic Applications.
III. Analyze microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces
IV. Analysis of major chemical reactions that are used in the synthesis of molecules.
V. Understand the chemistry of various fuels and their combustion.

MODULE-I	ELECTROCHEMISTRY AND CORROSION	Classes: 09

Electro chemical cells: Electrode potential, standard electrode potential, types of electrodes; Calomel, Quinhydrone and glass electrode; Nernst equation; Electrochemical series and its applications; Numerical problems; Batteries: Primary (Dry cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery).

Causes and effects of corrosion: Theories of chemical and electrochemical corrosion, mechanism of electrochemical corrosion; Types of corrosion: Galvanic, water-line and pitting corrosion; Factors affecting rate of corrosion; Corrosion control methods: Cathodic protection, sacrificial anode and impressed current; Surface coatings: Metallic coatings- Methods of coating- Hot dipping, cementation, electroplating and Electroless plating of copper.

MODULE -II	WATER AND ITS TREATMENT	Classes: 08

Introduction: Hardness of water, Causes of hardness; Types of hardness: temporary and permanent, expression and units of hardness; Estimation of hardness of water by complexometric method; Potable water and its specifications, Steps involved in treatment of water, Disinfection of water by chlorination and ozonization; Boiler feed water and its treatment, Calgon conditioning, Phosphate conditioning and Colloidal conditioning; External treatment of water; Ion-exchange process; Desalination of water: Reverse osmosis, numerical problems.

MODULE-III	MOLECULAR STRUCTURE AND THEORIES OF BONDING	Classes: 08

Shapes of Atomic orbitals, Linear Combination of Atomic orbitals (LCAO), molecular orbitals of diatomic molecules; Molecular orbital energy level diagrams of N_2, O_2,F_2 ,CO and NO molecules.

Crystal Field Theory (CFT): Salient Features of CFT-Crystal Fields; Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries; Band structure of solids and effect of doping on conductance.

MODULE -IV	STEREOCHEMISTRY, REACTION MECHANISM AND SYNTHESIS OF DRUG MOLECULES	Classes: 12
Introduction to representation of 3-dimensional structures: Structural and stereoisomers, configurations, symmetry and chirality; Enantiomers, diastereomers, optical activity and Absolute configuration; Confirmation analysis of n- butane. Substitution reactions: Nucleophilic substitution reactions, Mechanism of SN^1, SN^2 reactions; Electrophilic and nucleophilic addition reactions; Addition of HBr to propene; Markownikoff and anti Markownikoff's additions; Grignard additions on carbonyl compounds; Elimination reactions: Dehydro halogenation of alkylhalides; Saytzeff rule; Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromicacid; Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$ & $NaBH_4$; Hydroboration of olefins; Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.		
MODULE –V	**FUELS AND COMBUSTION**	**Classes: 08**
Fuels: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems.		

Text Books:

1. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017.
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 2017.
2. R.T. Morrison, RN Boyd and SK Bhattacharya "Organic Chemistry", Pearson, 7th Edition, 2011.
3. K.F. Purcell and J.C. Kotz, "Inorganic Chemistry", Cengage learning, 2017.

Reference Books:

1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry Structure and Functions", Oxford Publications, 7th Edition.
2. B. H. Mahan, "University Chemistry", Narosa Publishers, 4th Edition, 2009.

Web References:

1. Engineering Chemistry (NPTEL Web-book), by B.L.Tembe, Kamaluddin and M.S.Krishnan.

WAVES AND OPTICS

I Semester: AE / ECE / ME | II Semester: EEE / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB04	Foundation	3	1	-	4	30	70	100
Contact Classes:45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich knowledge in principals of quantum mechanics and semiconductors.
II. Correlate principles and applications of lasers and fiber optics.
III. Acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.
IV. Develop strong fundamentals of transverse, longitudinal waves and harmonic waves.

MODULE - I	QUANTUM MECHANICS	Classes: 08

Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger equation for one dimensional problems–particle in a box.

MODULE - II	INTRODUCTION TO SOLIDS AND SEMICONDUCTORS	Classes: 10

Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative treatment), Origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators; Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Hall effect.

MODULE - III	LASERS AND FIBER OPTICS	Classes: 10

Characteristics of lasers, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby laser, He-Ne laser and applications of lasers.

Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Attenuation in optical fibers, Optical fiber communication system with block diagram.

MODULE - IV	LIGHT AND OPTICS	Classes: 07

Huygens' principle, Superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer; Fraunhofer diffraction from a single slit, circular aperture and diffraction grating.

MODULE - V	HARMONIC OSCILLATIONS AND WAVES IN ONE DIMENSION	Classes: 10

Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillator, Forced mechanical and electrical oscillators, Impedance, Steady state motion of forced damped harmonic oscillator; Transverse wave on a string, the wave equation on a string, Harmonic waves, Reflection and transmission of waves at a boundary, Longitudinal waves and the wave equation for them, acoustics waves.

Text Books:

1. Dr. K Vijay Kumar and Dr. S Chandralingam, "Modern Engineering Physics" Volume-1&2, S Chand.Co, 2018.
2. I. G. Main, "Vibrations and Waves in Physics", Cambridge University Press, 1993.
3. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001.

Reference Books:

1. H.J. Pain, "The Physics of Vibrations and Waves", Wiley, 2006.
2. A. Ghatak, "Optics", McGraw Hill Education, 2012.
3. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

Web References:

1. http://link.springer.com/book
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

E-Text Books:

1. http://www.peaceone.net/basic/Feynman/
2. http://physicsdatabase.com/free-physics-books/
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html

PROGRAMMING FOR PROBLEM SOLVING USING PYTHON

II Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB38	Foundation	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamentals of Python programming concepts and its applications.
II. Improve problem solving skills using control structures and lists.
III. Understand the basics of object-oriented concepts using Python.
IV. Describe string handling to solve real-time problems.
V. Design and implement programs using functions.

MODULE - I	INTRODUCTION TO PYTHON	Classes: 10

Introduction to Python: Python Identifiers, Keywords, datatypes in python: built-in datatypes, bool datatype, sequences, sets. input and output statements, Operators: arithmetic operators, assignment operators, comparison operators, logical operators, identity operators, membership operators, bitwise operators.

MODULE - II	CONTROL STRUCTURES	Classes: 08

Conditional Control structures: Conditional blocks using if statement, if-else statement, if-elif statement, Range function. Loops: for loops, Nested for loop, while loop, pass, continue, break statements.

MODULE - III	LIST, TUPLES ,DICTIONARY AND ARRAYS	Classes: 10

Creating List, List manipulation – index(), append(), insert(), copy(), extend(), count(), remove(), pop(), reverse(), sort(),len(),nested list.Creating a tuple, accessing a tuple element, basic operations on tuples, tuples manipulations – len(),min(), max(), count(),index(), sorted().Creation of dictionary, operations on dictionaries, dictionaries methods

Array: creating an array, importing array module, indexing and slicing. processing the arrays, arrays using numpy, array creation using numpy, transpose, addition and multiplication of matrices.

MODULE - IV	STRINGS AND FUNCTIONS	Classes: 09

Creating a string, methods – length(), indexing(), slicing(), repeating(), concatenation(), comparing(), remove(), removing spaces, finding substring, inserting a sub string in to a string, finding number of characters and words.

Functions: Defining a function, Calling a function, returning multiple values from a function, functions are first class objects, formal and actual arguments, positional arguments, recursive functions, Powerful Lamda function in python

MODULE - V	INTRODUCTION TO OOPS	Classes: 08

Introduction to Object Oriented Concepts: Features of Object oriented programming system (OOPS) – Classes and Objects, Encapsulation, Abstraction, Inheritance, Polymorphism.

Classes and Objects: Concept of class, object and instances, Creating a class, The Self variable, constructor, Types of Variables, Types of Methods.

Text Books:

1. R Nageswara Rao, “Core Python Programming”, Dreamtech Press, 2nd Edition, 2017.
2. Dusty Philips, “Python 3 Object Oriented Programming”, PACKT Publishing, 2nd Edition, 2015.

Reference Books:

1. Michael H.Goldwasser, David Letscher, “Object Oriented Programming in Python”, Prentice Hall, 1st Edition, 2007.

Web References:

1. https://www.bfoit.org/itp/Programming.html
2. https://www.khanacademy.org/computing/computer-programming
3. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x-0
4. https://www.edx.org/course/introduction-computer-science-harvardx-cs50x

E-Text Books:

1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming/

ENGINEERING CHEMISTRY LABORATORY

I Semester: CSE / IT / EEE | II Semester: AE / ECE / ME / CE

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB09	Foundation	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Analyze, interpret, and draw conclusions from experimental data.
II. Describe the fluid property of surface tension and viscosity.
III. Perform a complexometric titration to determine the hardness of water from various sources.
IV. Comprehend the experimental results.

LIST OF EXPERIMENTS

Week-l	**INTRODUCTION TO CHEMISTRY LABORATORY**
Introduction to chemistry laboratory. Do's and Don'ts in chemistry laboratory.	
Week-2	**PREPARATION OF ORGANIC COMPOUNDS**
Synthesis of Aspirin.	
Week-3	**VOLUMETRIC ANALYSIS**
Estimation of Total hardness of water by complexometric method using EDTA.	
Week-5	**INSTRUMENTATION**
Estimation of an HCl by conductometric titrations.	
Week-6	**INSTRUMENTATION**
Estimation of HCl by potentiometric titrations.	
Week-7	**INSTRUMENTATION**
Estimation of Acetic acid by Conductometric titrations.	
Week-8	**INSTRUMENTATION**
Estimation of Fe^{2+} by Potentiometry using $KMnO_4$titrations.	

Week-9	VOLUMETRIC ANALYSIS
Determination of chloride content of water by Argentometry.	
Week-10	**PHYSICAL PROPERTIES**
Determination of surface tension of a given liquid using Stalagmometer.	
Week-11	**PHYSICAL PROPERTIES**
Determination of viscosity of a given liquid using Ostwald's viscometer.	
Week-12	**PHYSICAL PROPERTIES**
Verification of freundlich adsorption isotherm-adsorption of acetic and on charcoal.	
Week-13	**ANALYSIS OF ORGANIC COMPOUNDS**
Thin layer chromatography calculation of R_f values .Eg: ortho and para nitro phenols.	
Week-14	**REVISION**
Revision.	

Reference Books:

1. Vogel's, "Quantitative Chemical Analysis", Prentice Hall, 6th Edition, 2000.
2. Gary D. Christian, "Analytical Chemistry", Wiley India, 6th Edition, 2007.

Web References:

http://www.iare.ac.in

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S. No	Name of the Apparatus	Apparatus Required	Quantity
1	Analytical balance	04	100 gm
2	Beaker	30	100 ml
3	Burette	30	50 ml
4	Burette Stand	30	Metal
5	Clamps with Boss heads	30	Metal
6	Conical Flask	30	250 ml
7	Conductivity cell	10	K=1
8	Calomel electrode	10	Glass
9	Digital Potentiometer	10	EI
10	Digital Conductivity meter	10	EI
11	Digital electronic balance	01	RI
12	Distilled water bottle	30	500 ml

13	Funnel	30	Small
14	Glass rods	30	20 cm length
15	Measuring Cylinders	10	10 ml
16	Oswald Viscometer	30	Glass
17	Pipette	30	20 ml
18	Platinum Electrode	10	PP
19	Porcelain Tiles	30	White
20	Reagent bottle	30	250 ml
21	Standard Flask	30	100 ml
22	Stalagmo meter	30	Glass
23	TLC Plates	40	--
24	UV Chamber	02	--

ENGINEERING PHYSICS LABORATORY

I Semester: AE / ECE / ME | II Semester: CSE / IT / CE / EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB10	Foundation	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Upgrade practical knowledge in optics.
II. Analyze the behavior and characteristics of various materials for its optimum utilization.
III. Enrich the knowledge of electric and magnetic properties.

LIST OF EXPERIMENTS

Week-l	**INTRODUCTION TO PHYSICS LABORATORY**
Do's and Don'ts in physics laboratory. Precautions to be taken in laboratory.	
Week-2	**HALL EFFECT (LORENTZ FORCE)**
Determination of charge carrier density.	
Week-3	**MELDE'E EXPERIMENT**
Determination of frequency of a given tuning fork.	
Week-4	**STEWART GEE'S APPARATUS**
Magnetic field along the axis of current carrying coil-Stewart and Gee's method.	
Week-5	**B-H CURVE WITH CRO**
To determine the value of retentivity and coercivity of a given magnetic material.	
Week-6	**ENERGY GAP OF A SEMICONDUCTOR DIODE**
Determination of energy gap of a semiconductor diode.	
Week-7	**PIN AND AVALANCHE DIODE**
Studying V-I characteristics of PIN and Avalanche diode.	
Week-8	**OPTICAL FIBER**
Evaluation of numerical aperture of a given optical fiber.	
Week-9	**WAVE LENGTH OF LASER LIGHT**
Determination of wavelength of a given laser light using diffraction grating.	

Week-10	**PLANK'S CONSTANT**
Determination of Plank's constant using LED.	
Week-11	**LIGHT EMITTING DIODE**
Studying V-I characteristics of LED	
Week-12	**NEWTONS RINGS**
Determination of radius of curvature of a given plano-convex lens.	
Week-13	**SINGLE SLIT DIFFRACTION**
Determination of width of a given single slit.	
Manuals:	
1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012. 2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.	
Web Reference:	
http://www.iare.ac.in	

PROGRAMMING FOR PROBLEM SOLVING LABORATORY

I Semester: AE / ME | II Semester: CSE / IT / ECE / EEE / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB02	Foundation	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

OBJECTIVES:

The course should enable the students to:

I. Formulate problems and implement algorithms using C programming language.
II. Develop programs using decision structures, loops and functions.
III. Learn memory allocation techniques using pointers.
IV. Use structured programming approach for solving of computing problems in real world.

LIST OF EXPERIMENTS

Week-1 OPERATORS AND EVALUATION OF EXPRESSIONS

a. Write a C program to check whether a number is even or odd using ternary operator.
b. Write a C program to perform the addition of two numbers without using +operator.
c. Write a C program to evaluate the arithmetic expression ((a + b / c * d - e) * (f - g)). Read the values a, b, c, d, e, f, g from the standard input device.
d. Write a C program to find the sum of individual digits of a 3 digit number.
e. Write a C program to read the values of x and y and print the results of the following expressions in one line:
   i. (x + y) / (x -y)
   ii. (x + y)(x - y)

Week-2 CONTROL STRUCTURES

a. Write a C program to find the sum of individual digits of a positive integer.
b. A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of these sequences.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
d. A character is entered through keyboard. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if-else and switch case. The following table shows the range of ASCII values for various characters.

Characters	ASCII values
A–Z	65 –90
a – z	97 –122
0 – 9	48 – 57
Special symbols	0 – 47, 58 – 64, 91 – 96, 123 –127

e. If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Write a C program to determine how much profitor loss incurred in percentage.

Week-3	CONTROL STRUCTURES

a. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).
b. Write a C program to calculate the following sum:

$$sum = 1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$$

c. Write a C program to find the roots of a quadratic equation.
d. Write a C program to check whether a given 3 digit number is Armstrong number or not.
e. Write a C program to print the numbers in triangular form

```
1
1 2
1 2 3
1 2 3 4
```

Week-4	ARRAYS

a. Write a C program to find the second largest integer in a list of integers.
b. Write a C program to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices
c. Write a C program to count and display positive, negative, odd and even numbers in an array.
d. Write a C program to merge two sorted arrays into another array in a sorted order.
e. Write a C program to find the frequency of a particular number in a list of integers.

Week-5	STRINGS

a. Write a C program that uses functions to perform the following operations:
   i. To insert a sub string into a given main string from a given position.
   ii. To delete n characters from a given position in a given string.
b. Write a C program to determine if the given string is a palindrome or not.
c. Write a C program to find a string within a sentence and replace it with another string.
d. Write a C program that reads a line of text and counts all occurrence of a particular word.
e. Write a C program that displays the position or index in the string S where the string T begins, or 1if S doesn‘t contain T.

Week-6	FUNCTIONS

a. Write C programs that use both recursive and non-recursive functions
   i. To find the factorial of a given integer.
   ii. To find the greatest common divisor of two given integers.
b. Write C programs that use both recursive and non-recursive functions
   i. To print Fibonacci series.
   ii. To solve towers of Hanoi problem.
c. Write a C program to print the transpose of a given matrix using function.
d. Write a C program that uses a function to reverse a given string.

Week-7	POINTERS

a. Write a C program to concatenate two strings using pointers.
b. Write a C program to find the length of string using pointers.
c. Write a C program to compare two strings using pointers.
d. Write a C program to copy a string from source to destination using pointers.
e. Write a C program to reverse a string using pointers.

Week-8	STRUCTURES AND UNIONS

a. Write a C program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition and subtraction of two complex numbers
   iv. Multiplication of two complex numbers. Note: represent complex number using a structure.
b. Write a C program to compute the monthly pay of 100 employees using each employee‘s name, basic pay. The DA is computed as 52% of the basic pay. Gross-salary (basic pay + DA). Print the employees name and gross salary.
c. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
d. Create a union containing 6 strings: name, home_address, hostel_address, city, state and zip. Write a C program to display your present address.
e. Write a C program to define a structure named DOB, which contains name, day, month and year. Using the concept of nested structures display your name and date of birth.

Week-9	ADDITIONAL PROGRAMS

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$. For example: if n is 3 and x is 5, then the program computes 1+5+25+125. Print x, n, the sum. Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.
b. 2‘s complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2‘s complement of 11100 is 00100. Write a C program to find the 2‘s complement of a binary number.
c. Write a C program to convert a Roman numeral to its decimal equivalent. E.g. Roman number CD is equivalent to400.

Week-10	PREPROCESSOR DIRECTIVES

a. Define a macro with one parameter to compute the volume of a sphere. Write a C program using this macro to compute the volume for spheres of radius 5, 10 and 15meters.
b. Define a macro that receives an array and the number of elements in the array as arguments. Write a C program for using this macro to print the elements of the array.
c. Write symbolic constants for the binary arithmetic operators +, -, *, and /. Write a C program to illustrate the use of these symbolic constants.

Week-11	FILES

a. Write a C program to display the contents of a file.
b. Write a C program to copy the contents of one file to another.
c. Write a C program to reverse the first n characters in a file, where n is given by the user.
d. Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are put in the third file.
e. Write a C program to count the no. of characters present in the file.

Week-12	COMMAND LINE ARGUMENTS AND NUMERICAL METHODS

a. Write a C program to read two numbers at the command line and perform arithmetic operations on it.
b. Write a C program to read a file name at the command line and display its contents.
c. Write a C program to solve numerical methods problems (root finding, numerical differentiation and numerical integration)

Reference Books:

1. Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.
2. Oualline Steve, "Practical C Programming", O'Reilly Media, 3rd Edition, 1997.
3. King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
4. Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
5. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.

Web References:

1. http://www.sanfoundry.com/c-programming-examples
2. http://www.geeksforgeeks.org/c
3. http://www.cprogramming.com/tutorial/c
4. http://www.cs.princeton.edu

WORKSHOP / MANUFACTURING PRACTICES LABORATORY

I Semester: CSE / IT / ECE | II Semester: EEE / AE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB01	Foundation	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Identify and use of tools, types of joints in carpentry, fitting, tin smithy and plumbing operations.
II. Understand of electrical wiring and components.
III. Observation of the function of lathe, shaper, drilling, boring, milling, grinding machines.

LIST OF EXPERIMENTS

Week-1	**MACHINE SHOP-Turning and other machines**

Batch I: Working on central lathe and shaping machine.
Batch II: Working on drilling, grinding machines.

Week-2	**MACHINE SHOP-Milling and other machines**

Batch I: Working on milling machine.
Batch II: Working on milling and shaping machine.

Week-3	**ADVANCED MACHINE SHOP**

Batch I: Working on CNC Turning machines.
Batch II: Working on CNC Vertical Drill Tap Center.

Week-4	**FITTING**

Batch I: Make a straight fit and straight fit for given dimensions.
Batch II: Make a square fit for straight fit for given sizes.

Week-5	**CARPENTRY-I**

Batch I: Preparation of lap joint as per given dimensions.
Batch II: Preparation of dove tail joint as per given taper angle.

Week-6	**CARPENTRY-II**

Batch I: Preparation of dove tail joint as per given taper angle.
Batch II: Preparation of lap joint as per given dimensions.

Week-7	**ELECTRICAL AND ELECTRONICS**

Batch I & II: Make an electrical connection to demonstrate domestic voltage and current sharing.
Make an electrical connection to control one bulb with two switches-stair case connection.

Week-8	**WELDING**
Batch I: Arc welding & Gas Welding. Batch II: Gas welding & Arc Welding.	
Week-9	**MOULD PREPARATION**
Batch I: Prepare a wheel flange mould using a given wooden pattern. Batch II: Prepare a bearing housing using an aluminum pattern.	
Week-10	**MOULD PREPARATION**
Batch I: Prepare a bearing housing using an aluminum pattern. Batch II: Prepare a wheel flange mould using a given wooden pattern.	
Week-11	**BLACKSMITHY- I, TINSMITHY- I,**
Batch I: Prepare S-bend & J-bend for given MS rod using open hearth furnace. Batch II: Prepare the development of a surface and make a rectangular tray and a round tin.	
Week-12	**TINSMITHY- I, BLACKSMITHY- I**
Batch I: Prepare the development of a surface and make a rectangular tray and a round tin. Batch II: Prepare S-bend & J-bend of given MS rod using open hearth furnace.	
Week-13	**PLASTIC MOULDING, INJECTION MOULDING, GLASS CUTTING**
Batch I: Plastic Moulding and Glass cutting. Batch II: Plastic Moulding and Glass cutting.	
Week-14	**BLOW MOULDING**
Batch I& II: Blow Moulding.	
Reference Books:	
1. 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. 2. Kalpakjian S, Steven S. Schmid, "Manufacturing Engineering and Technology", Pearson Education India Edition, 4th Edition, 2002. 3. Gowri P. Hariharan, A. Suresh Babu," Manufacturing Technology – I", Pearson Education, 2008. 4. Roy A. Lindberg, "Processes and Materials of Manufacture", Prentice Hall India, 4th Edition, 1998. 5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw-Hill House, 2017.	
Web References:	
http://www.iare.ac.in	

SURVEYING & GEOMATICS

III Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Describe the function of surveying in civil engineering construction,
II. Work with survey observations, and perform calculations,
III. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,
IV. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements.

MODULE - I	INTRODUCTION TO SURVEYING	Classes: 09

Principles, Linear, angular and graphical methods, Survey stations, Survey lines ranging, bearing of survey lines, levelling: Plane table surveying, Principles of levelling booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. Triangulation and Trilateration Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control methods, triangulation network signals. Baseline choices instruments and accessories extension of base lines corrections Satellite station reduction to centre, Inter visibility of height and distances, Trigonometric levelling, Axis single corrections.

MODULE - II	CURVES	Classes: 07

Elements of simple and compound curves, Method of setting out, Elements of Reverse curve, Transition curve, length of curve, Elements of transition curve, Vertical curves.

MODULE - III	MODERN FIELD SURVEY SYSTEMS	Classes: 09

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station, Parts of a Total Station, Accessories, Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey.

Global Positioning Systems (GPS), Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

MODULE - IV	PHOTOGRAMMETRIC SURVEYING	Classes: 08

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping aerial triangulation, radial triangulation, methods; photographic mapping, mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

MODULE - V	REMOTE SENSING	Classes: 12
Introduction, Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.		

Text Books:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson India, 2nd Edition, 2006.
2. Manoj, K. Arora and Badjatia, "Geomatics Engineering", Nem Chand & Bros, 2011.
3. Bhavikatti, S.S., "Surveying and Levelling", I.K. International, Vol. I and II, 2010.

Reference Books:

1. Chandra, A.M., "Higher Surveying", New Age International (P) Limited, 3rd Edition, 2002.
2. Anji Reddy, M., "Remote sensing and Geographical information system", B. S. Publications, 2001.
3. Arora, K.R., "Surveying", Standard Book House, Vol-I, II and III, 2015.

Web References:

1. https://nptel.ac.in/courses/105104100/43
2. https://www.coloradomesa.edu/wccc/programs/land-surveying-geomatics.html.
3. https://books.google.co.in/books?id=FaCgAAQBAJ&printsec=frontcover&dq=surveying+and+geomatics+ONLINE+text+books&hl=en&sa=X&ved=0ahUKEwi1wP3x24HgAhUJ5o8KHS2EDzkQ6AEIMzAB#v=onepage&q&f=false

E-Text Books:

1. https://www.jntubook.com/surveying-textbook-free-download.
2. http://www.freeengineeringbooks.com/Civil/Surveying-Books.php
3. https://www2.unb.ca/gge/Study/Undergraduate/Handbook.pdf

ENGINEERING MECHANICS

II Semester: AE | III Semester: ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB03	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures.

II. Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free-body diagrams and accurate equilibrium equations.

III. Identify and model various types of loading and support conditions that act on structural systems, apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem.

IV. Understand the meaning of center of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments.

MODULE-I	INTRODUCTION TO ENGINEERING MECHANICS	Classes: 10

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

MODULE -II	FRICTION AND BASICS STRUCTURAL ANALYSIS	Classes: 09

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

MODULE -III	CENTROID AND CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD	Classes: 10

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

MODULE -IV	PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS	Classes: 08

Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

MODULE -V	**MECHANICAL VIBRATIONS**	**Classes: 08**

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;

Text Books:

1. Irving H. Shames (2006), "Engineering Mechanics", Prentice Hall, 4th Edition, 2013
2. F. P. Beer and E. R. Johnston (2011), "Vector Mechanics for Engineers", Vol I - Statics, Vol II, – Dynamics, Tata McGraw Hill , 9th Edition, 2013.
3. R. C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.

Reference Books:

1. S.Bhavikatti, "A Text Book of Engineering Mechanics", New Age International, 1st Edition, 2012.
2. A.K.Tayal, "Engineering Mechanics", Uma Publications, 14th Edition, 2013.
3. R. K. Bansal "Engineering Mechanics", Laxmi Publication, 8th Edition, 2013.
4. Basudeb Bhattacharya, "Engineering Mechanics", Oxford University Press, 2nd Edition, 2014.
5. K.Vijay Reddy, J. Suresh Kumar, "Singer's Engineering Mechanics Statics and Dynamics", B S Publishers, 1st Edition, 2013.

Web References:

1. https://en.wikipedia.org/wiki/Dynamics_(mechanics)
2. https://www.youtube.com/playlist?list=PLUl4u3cNGP62esZEwffjMAsEMW_YArxYC

E-Text Books:

1. http://www.freeengineeringbooks.com/Civil/Engineering-Mechanics-Books.php
2. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-2.pdf
3. http://www.faadooengineers.com/threads/17024-Engineering-mechanics-pdf-Free-Download

BUILDING MATERIALS, CONSTRUCTION AND PLANNING

III Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB02	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Develop knowledge of material science and behavior of various building materials used in construction.
II. Identify the construction materials required for the assigned work.
III. Provide procedural knowledge of the simple testing methods of cement, lime and concrete etc.
IV. List the requirements and different types of stairs.

MODULE - I	STONES, BRICKS AND AGGREGATES	Classes: 09

Properties of building stones, relation to their structural requirements. Classification of stones, stone quarrying, precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacture of bricks, Comparison between clamp burning and kiln burning; Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials; Coarse aggregate: Natural and manufactured: Importance of size, shape and texture.

MODULE – II	CEMENT AND ADMIXTURES	Classes: 09

Various types of cement and their properties; Various file and laboratory tests for cement; Various ingredients of cement concrete and their importance, various tests for concrete; Field and tests admixtures, mineral and chemical admixture.

MODULE – III	BUILDING COMPONENTS AND FOUNDATIONS	Classes: 09

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to-roof, coupled roofs, trussed roofs, king and queen post.

Trusses; RCC roofs, madras terrace/shell roofs; Foundations: Shallow foundations, spread, combined, strap and mat footings

MODULE – IV	WOOD, ALUMINUM AND GLASS	Classes: 09

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fiber-reinforced plastics, steel, aluminum; Types of masonry, English and Flemish bonds, rubble and ashlars masonry, cavity and partition walls.

MODULE - V	STAIRS AND BUILDING PLANNING	Classes: 09

Stairs: Definitions, technical terms and types of stairs, requirements of good stairs; Geometrical design of RCC doglegged and open-well stairs; Principles of building planning, classification building and planning and building by laws.

Text Books:
1. Sushil Kumar "Building Materials and construction", Standard Publishers, 20th edition, reprint, 2015. 2. Dr. B.C.Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi. 3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.
Reference Books:
1. S. K. Duggal, "Building Materials", New Age International (P) Limited, 4th Edition,2016 2. National Building Code (NBC) of India 3. P C Vergese, "Building Materials", PHI Learning Pvt. Ltd, 2nd Edition, 2015. 4. Building Materials and Components, CBRI, India, 1990. 5. Jagadish. K.S, "Alternative Building Materials Technology", New Age International, 2007. 6. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi, 2005.
Web References:
1. http://nptel.ac.in/courses/105102088/ 2. http://nptel.ac.in/courses/105101088/
E-Text Books:
1. http://www.freeengineeringbooks.com/civil-books-download/building-materials-construction.php 2. http://www.freeengineeringbooks.com/civil-books-download/building-materials.php

BASIC ELECTRONICS ENGINEERING

III SEMESTER: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB01	Foundation	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Introduce components such as diodes, BJTs and FETs.
II. Know the applications of components.
III. Understand common forms of number representation in logic circuits
IV. Be acquainted to principles and characteristics of op-amp and apply the techniques for the design of comparators, instrumentation amplifier, integrator, differentiator

MODULE - I	DIODE AND APPLICATIONS	Classes: 08

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications;

MODULE - II	BIPOLAR JUNCTION TRANSISTOR (BJT)	Classes: 10

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

MODULE - III	OPERATIONAL AMPLIFIERS AND APPLICATIONS	Classes: 08

Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground; 49 Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator;

MODULE - IV	TIMERS AND DATA CONVERTERS	Classes: 10

IC 555 Timer – Block Diagram, Astable and Mono stable Multi vibrator Configurations; Data Converters – Basic Principle of Analogue–to-Digital (ADC) and Digital-to-Analogue (DAC) Conversion, Flash type, Counter-ramp type and Successive Approximation type ADCs, Resistor Ladder Type DAC, Specifications of ADC and DAC;

MODULE - V	BASIC DIGITAL ELECTRONICS	Classes: 09

Binary Number Systems and Codes; Basic Logic Gates and Truth Tables, Boolean Algebra, De Morgan's Theorems, Logic Circuits, Flip-Flops – SR, JK, D type, Clocked and Master-Slave Configurations; Counters – Asynchronous, Synchronous, Ripple, Non-Binary, BCD Decade types; Shift Registers – Right-Shift, Left-Shift, Serial-In-Serial-Out and Serial-In-Parallel-Out Shift Registers; Applications;

Text Books:

1. R. L. Boylestad & Louis Nashlesky, “Electronic Devices &Circuit Theory”, Pearson Education, 2007
2. Santiram Kal, “Basic Electronics- Devices, Circuits and IT Fundamentals”, Prentice Hall, India, 2002

Reference Books:

1. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, 2008.
2. Thomas L. Floyd and R. P. Jain, “Digital Fundamentals”, Pearson Education, 2009
3. R. S. Sedha , “A Text Book of Electronic Devices and Circuits”, S. Chand & Co., 2010
4. R. T. Paynter, “Introductory Electronic Devices & Circuits – Conventional Flow Version”, Pearson Education, 2009.

Web References:

1. mcsbzu.blogspot.com
2. https://archive.org/details/ElectronicDevicesCircuits
3. https://www.smartzworld.com
4. https://www.crectirupati.com

E-Text Books:

1. https://books.google.co.in/books/about/Switching_Theory_and_Logic_Design
2. http://services.eng.uts.edu.au/pmcl/ec/Downloads/LectureNotes.pdf
3. http://nptel.ac.in/courses/122106025/
4. https://books.google.co.in/books?isbn=8122414702
5. https://books.google.co.in/books?isbn=013186389

DATA STRUCTURES

III Semester: CE / ME / CSE / IT / ECE / | IV Semester AE / EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB03	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic techniques of algorithm analysis.
II. Demonstrate searching and sorting algorithms and analyze their time complexities.
III. Implement linear data structures viz. stack, queue and linked list.
IV. Demonstrate non-linear data structures viz. tree and graph traversal algorithms.
V. Study and choose appropriate data structure to solve problems in real world.

MODULE – I	INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING	Classes: 09

Basic concepts: Introduction to data structures, classification of data structures, operations on data structures; Searching techniques: Linear search and Binary search; Sorting techniques: Bubble sort, selection sort, insertion sort and comparison of sorting algorithms.

MODULE - II	LINEAR DATA STRUCTURES	Classes: 09

Stacks: Primitive operations, implementation of stacks using arrays, applications of stacks arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue and double ended queue (deque).

MODULE - III	LINKED LISTS	Classes: 09

Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation.

Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack and Queue.

MODULE - IV	NONLINEAR DATA STRUCTURES	Classes: 09

Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, application of trees; Graphs: Basic concept, graph terminology, graph implementation, graph traversals, Application of graphs.

MODULE - V	BINARY TREES AND HASHING	Classes: 09

Binary search trees: Binary search trees, properties and operations; Balanced search trees: AVL trees; Introduction to M-Way search trees, B trees; Hashing and collision: Introduction, hash tables, hash functions, collisions, applications of hashing.

Text Books:
1. Rance D. Necaise, “Data Structures and Algorithms using Python”, Wiley, John Wiley & Sons, INC., 2011. 2. Benjamin Baka, David Julian, “Python Data Structures and Algorithms”, Packt Publishing Ltd., 2017.
Reference Books:
1. S. Lipschutz, “Data Structures”, Tata McGraw Hill Education, 1st Edition, 2008. 2. D. Samanta, “Classic Data Structures”, PHI Learning, 2nd Edition, 2004.
Web References:
1. https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm 2. https://www.codechef.com/certification/data-structures-and-algorithms/prepare 3. https://www.cs.auckland.ac.nz/software/AlgAnim/dsToC.html 4. https://online-learning.harvard.edu/course/data-structures-and-algorithms

SURVEYING AND GEOMATICS LABORATORY

III Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB03	Core	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Gain the practical knowledge on calculation of an area, volume of an irregular and regular land surface using chains and tapes.
II. Operate different types of instruments in surveying. Perform leveling and contouring of ground surfaces.
III. Apply knowledge of mathematics in surveying field to calculate areas and volumes for different projects.
IV. Utilize total station and other modern survey instruments.

LIST OF EXPERIMENTS

Week - l	**SURVEY OF AN AREA BY CHAIN SURVEY (CLOSED TRAVERSE) AND PLOTTING**

Batch I: Measurement of an area by chain survey
Batch II: Measurement of an area by chain survey

Week - 2	**CHAINING ACROSS OBSTACLES**

Batch I: Chaining across obstacles
Batch II: Chaining across obstacles

Week - 3	**DETERMINATION OF DISTANCE BETWEEN TWO INACCESSIBLE POINTS WITH COMPASS**

Batch I: Calculation of distance between two points with compass survey.
Batch II: Calculation of distance between two points with compass survey.

Week – 4	**CORRECTION FOR LOCAL ATTRACTION BY PRISMATIC COMPASS**

Batch I: Corrections for local attraction by prismatic compass
Batch II: Corrections for local attraction by prismatic compass

Week – 5	**RADIATION METHOD, INTERSECTION METHODS BY PLANE TABLE SURVEY**

Batch I: Radiation method and intersection methods by plane table survey.
Batch II: Radiation method and intersection methods by plane table survey.

Week – 6	**AN EXERCISE OF LONGITUDINAL SECTION AND CROSS SECTION AND PLOTTING**

Batch I: An exercise of longitudinal section and cross section and plotting.
Batch II: An exercise of longitudinal section and cross section and plotting

Week – 7	**MEASUREMENT OF HORIZONTAL ANGLES BY METHOD OF REPETITION AND REITERATION**
Batch I: Measurement of horizontal angles Batch II: Measurement of horizontal angles	
Week – 8	**TRIGONOMETRIC LEVELING- HEIGHTS AND DISTANCE PROBLEMS**
Batch I: Trigonometric leveling- heights and distance problems Batch II: Trigonometric leveling- heights and distance problems	
Week – 9	**HEIGHTS AND DISTANCES USING PRINCIPLES OF TACHEOMETRIC SURVEY**
Batch I: Heights and distances using principles of tacheometric survey. Batch II: Heights and distances using principles of tacheometric survey.	
Week - 10	**CURVE SETTING –DIFFERENT METHODS**
Batch I: Curve setting: different methods. Batch II: Curve setting: different methods.	
Week - 11	**DETERMINATION OF AN AREA USING TOTAL STATION**
Batch I: Determination of an area using total station. Batch II: Determination of an area using total station.	
Week - 12	**DETERMINATION OF REMOTE HEIGHT USING TOTAL STATION**
Batch I: Determination of remote height using total station. Batch II: Determination of remote height using total station.	
Week - 13	**CALCULATING DISTANCE, GRADIENT AND DIFFERENT HEIGHTS BETWEEN TWO INACCESSIBLE POINTS USING TOTAL STATION**
Batch I: Calculating distance, gradient and different heights between two inaccessible points using total station. Batch II: Calculating distance, gradient and different heights between two inaccessible points using total station.	
Manuals:	
1. H. S. Moondra, Rajiv Gupta, "Laboratory Manual for Civil Engineering", CBS Publishers Pvt .Ltd., New Delhi, 2nd Edition, 2013. 2. James M. Anderson, Edward M. Mikhail, "Surveying: Theory and Practice", Tata Mc Graw Hill Education, 2012. 3. S. S. Bhavikatti, "Surveying Theory and Practice", IK Books, New Delhi, 2010.	

CIVIL ENGINEERING DRAWING LABORATORY

III Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB04	Core	1	-	2	2	30	70	100
Contact Classes: 15	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 39		

OBJECTIVES:

The course should enable the students to:

I. Develop Parametric design and the conventions of formal engineering drawing
II. Produce and interpret 2D & 3D drawings
III. Communicate a design idea/concept graphically/ visually
IV. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
V. Get a Detailed study of an engineering artefact

LIST OF EXPERIMENTS

Week - l	**BUILDINGS**
Load bearing walls including details of doors and windows.	
Week - 2	**STANDARD DRAWINGS**
Typical two storied building including all MEP, joinery, rebars, finishing and other details.	
Week - 3	**RCC FRAMED STRUCTURES - 1**
Floor plans, Elevations.	
Week - 4	**RCC FRAMED STRUCTURES - 2**
Sectional views.	
Week – 5	**REINFORCEMENT DRAWINGS - 1**
Typical beams.	
Week – 6	**REINFORCEMENT DRAWINGS - 2**
Typical Columns.	
Week – 7	**REINFORCEMENT DRAWINGS - 3**
Typical Slabs.	
Week – 8	**REINFORCEMENT DRAWINGS - 4**
Typical Spread footings	

Week – 9	**INDUSTRIAL BUILDINGS - 1**
North light roof structures	
Week – 10	**INDUSTRIAL BUILDINGS - 2**
Trusses	
Week - 11	**PERSPECTIVE VIEW - 1**
One storey buildings.	
Week - 12	**PERSPECTIVE VIEW - 2**
Two storey buildings.	

Manuals:

1. Subhash C Sharma & Gurucharan Singh, "Civil Engineering Drawing", Standard Publishers, 2005.
2. Ajeet Singh, "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi, 2002.
3. Sham Tickoo Swapna D, "AUTOCAD for Engineers and Designers", Pearson Education, 2009.
4. Venugopal, "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd., 2007.
5. Balagopal and Prabhu , "Building Drawing and Detailing", Spades publishing KDR building, Calicut, 1987.
6. Malik R.S., Meo, G.S., "Civil Engineering Drawing", Computech Publication Ltd New Asian, 2009.
7. Sikka, V.B., "A Course in Civil Engineering Drawing", S. K. Kataria & Sons, 2013.

Web Reference:

1. http://www.aust.edu/civil/lab_manual/ce_100.pdf
2. https://www.wiziq.com/tutorials/civil-engineering-drawing
3. http://civilengineering-notes.weebly.com/building-drawing.html
4. https://www.pdfdrive.com/civil-engineering-drawing-books.html

DATA STRUCTURES LABORATORY

III Semester: ME / CSE / IT / ECE / CE | IV Semester AE / EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB05	Core	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

COURSE OBJECTIVES:

The course should enable the students to:

I. Understand various data representation techniques in the real world.
II. Implement linear and non-linear data structures.
III. Analyze various algorithms based on their time and space complexity.
IV. Develop real-time applications using suitable data structure.
V. Identify suitable data structure to solve various computing problems.

LIST OF EXPERIMENTS

WEEK - 1 BASICS OF PYTHON

Write Python programs for the following:

a. To find the biggest of given n numbers using control statements and lists
b. To print the Fibonacci series using functions
c. To find GCD of two numbers

WEEK - 2 SEARCHING TECHNIQUES

Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Linear search
b. Binary search

WEEK - 3 SORTING TECHNIQUES

Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Bubble sort
b. Insertion sort
c. Selection sort

WEEK - 4 IMPLEMENTATION OF STACK AND QUEUE

Write Python programs to for the following:

a. Design and implement Stack and its operations using List.
b. Design and implement Queue and its operations using List.

WEEK - 5 APPLICATIONS OF STACK

Write Python programs for the following:

a. Uses Stack operations to convert infix expression into postfix expression.
b. Uses Stack operations for evaluating the postfix expression.

WEEK - 6	**IMPLEMENTATION OF SINGLE LINKED LIST**
Write Python programs for the following operations on Single Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal	
WEEK - 7	**IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST**
Write Python programs for the following operations on Circular Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal	
WEEK - 8	**IMPLEMENTATION OF DOUBLE LINKED LIST**
Write Python programs for the following operations on Double Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.	
WEEK - 9	**IMPLEMENTATION OF STACK USING LINKED LIST**
Write a Python program to implement Stack using linked list.	
WEEK - 10	**IMPLEMENTATION OF QUEUE USING LINKED LIST**
Write a Python program to implement Linear Queue using linked list.	
WEEK - 11	**GRAPH TRAVERSAL TECHNIQUES**
Write Python programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.	
WEEK - 12	**IMPLEMENTATION OF BINARY SEARCH TREE**
Write a Python program to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order. c. Count the number of nodes in the binary search tree.	
LIST OF REFERENCE BOOKS:	
1. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley, John Wiley & Sons, INC., 2011. 2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishing Ltd., 2017.	
WEB REFERENCES:	
1. https://docs.python.org/3/tutorial/datastructures.html 2. http://interactivepython.org/runestone/static/pythonds/index.html 3. http://www.tutorialspoint.com/data_structures_algorithms 4. http://www.geeksforgeeks.org/data-structures/ 5. http://www.studytonight.com/data-structures/ 6. http://www.coursera.org/specializations/data-structures-algorithms	

ENGINEERING GEOLOGY

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB05	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Asses engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.

II. Involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works.

III. Assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation.

MODULE – I	INTRODUCTION	Classes: 12

Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

MODULE – II	PETROLOGY	Classes:14

Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

MODULE – III	PHYSICAL GEOLOGY AND ROCK MECHANICS	Classes: 10

Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints.

Solifluction deposits, mudflows, Coastal deposits. Sub surface investigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

MODULE – IV	GEOLOGICAL HAZARDS	Classes: 12
Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.		
MODULE – V	**GEOLOGY OF DAM AND RESERVOIR SITE**	**Classes: 12**
Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.		

Text Books:

1. Parbin Singh, "Engineering and General Geology, , 8th Edition,2010, S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition 2009, Macmillan Publishers India.

Reference Books:

1. J. C. Harvey, "Geology for Geotechnical Engineers", Cambridge University Press 1982.

Web References:

1. http://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-001-introduction-to-geology-fall-2013/
2. http://nptel.ac.in/courses/105105106/
3. http://www.journals.elsevier.com/engineering-geology
4. http://www.springer.com/earth+sciences+and+geography/engineering+geology/journal/10706
5. http://www.springer.com/earth+sciences+and+geography/engineering+geology/journal/10064
6. http://www.sciencedirect.com/science/journal/00137952

E-Text Books:

1. http://cepdf.blogspot.in/2012/07/geology-for-civil-engineers-pdf-book.html
2. http://nptel.ac.in/courses/105105106/
3. https://www.studynama.com/community/threads/187-Engineering-Geology-Ebook-Lecture-Notes-PDF-download-for-Civil-Engineers.
4. http://www.civilenggforall.com/p/engineering-geology-list-of-books.html

FLUID MECHANICS

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB06	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the broad principles of fluid statics, kinematics and dynamics
II. Understand definitions of the basic terms used in fluid mechanics
III. Understand classifications of fluid flow
IV. Be able to apply the continuity, momentum and energy principles
V. Be able to apply dimensional analysis

MODULE – I	BASIC CONCEPTS AND DEFINITIONS	Classes: 09

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, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

MODULE – II	FLUID STATICS	Classes: 09

Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U -Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

MODULE – III	FLUID KINEMATICS	Classes: 10

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;

Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two and three - dimensional continuity equations in Cartesian coordinates.

MODULE – IV	FLUID DYNAMICS	Classes: 09

Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced;

MODULE – V	DIMENSIONAL ANALYSIS	Classes: 08

Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

Text Books:

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010.
2. P M Modi and S M Seth, "Hydraulics and Fluid Mechanics", Standard Book House, 2014.

Reference Books:

1. K. Subramanya, “Theory and Applications of Fluid Mechanics”, Tata McGraw Hill.
2. R.L. Daugherty, J.B. Franzini and E.J. Finnemore, “Fluid Mechanics with Engineering Applications”, International Student Edition, Tata Mc Graw Hill.

Web References:

1. http://nptel.ac.in/courses/112105171/1
2. http://nptel.ac.in/courses/105101082/
3. http://nptel.ac.in/courses/112104118/ui/TOC.htm

E-Text Books:

1. http://engineeringstudymaterial.net/tag/fluid-mechanics-books/
2. http://www.allexamresults.net/2015/10/Download-Pdf-Fluid-Mechanics-and-Hydraulic-Machines-by-rk-Bansal.html
3. http://varunkamboj.typepad.com/files/engineering-fluid-mechanics-1.pdf

STRENGTH OF MATERIALS

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB07	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;

II. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyse solid mechanics problems using classical methods and energy methods;

III. Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams; and

IV. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members;

MODULE – I	STRESSES AND STRAINS	Classes: 12

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity, types of stresses and strains, Hooke's law stress – strain diagram for mild steel working stress, factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them; Bars of varying section, composite bars, temperature stresses. Strain Energy – Resilience, Gradual, sudden, impact and shock loadings, simple applications, two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

MODULE – II	BENDING MOMENT AND SHEAR FORCE DIAGRAMS	Classes : 08

Bending Moment (BM) and Shear Force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments. Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

MODULE – III	FLEXURAL STRESSES AND SHEAR STRESSES OF BEAMS	Classes: 08

Derivation of bending equation, Neutral axis, determination of bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections.

Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

MODULE – IV	TORSION	Classes: 08
Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.		
MODULE – V	**THIN CYLINDERS AND SPHERES**	**Classes: 09**
Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.		

Text Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004.
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979.

Reference Books:

1. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
2. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

Web References:

1. http://www.nptelvideos.in/2012/11/strength-of-materials- prof.html
2. http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanics-fall-2004/lecture-notes/
3. https://www.youtube.com/watch?v=coRgpxG2pyY&list=PLLbvVfERDon3oDfCYxkwRct1Q6YeOzi9g

E-Text Books:

1. http://www.freeengineeringbooks.com/Civil/Strength-of-Material-Books.php
2. http://royalmechanicalbuzz.blogspot.in/2015/04/strength-of-materials-book-by-r-k-bansal.html
3. https://books.google.co.in/books?id=I8gg0Q4OQ4C&printsec=frontcover&dq=STRENGTH+OF+MATERIALS&hl=en&sa=X&ved=0ahUKEwjpveCD44HgAhWBad4KHacUAgYQ6AEIMDAB#v=onepage&q=STRENGTH%20OF%20MATERIALS&f=false

PROBABILITY AND STATISTICS

IV Semester: AE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB12	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of probability on single random variables and probability distributions.
II. Apply the concept of correlation and regression to find covariance.
III. Analyze the given data for appropriate test of hypothesis.

MODULE – I	PROBABILITY AND RANDOM VARIABLES	Classes: 09

Probability, Conditional Probability, Baye's Theorem; Random variables: Basic definitions, discrete and continuous random variables; Probability distribution: Probability mass function and probability density functions; Mathematical expectation.

MODULE – II	PROBABILITY DISTRIBUTION	Classes: 09

Binomial distribution; Mean and variances of Binomial distribution, Recurrence formula for the Binomial distribution; Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, mean and variance of Poisson distribution, Recurrence formula for the Poisson distribution; Normal distribution; Mean, Variance, Mode, Median, Characteristics of normal distribution.

MODULE – III	CORRELATIONS AND REGRESSION	Classes: 09

Correlation: Karle Pearson's Coefficient of correlation, Computation of correlation coefficient, Rank correlation, Repeated Ranks; Properties of correlation.

Regression: Lines of regression, Regression coefficient, Properties of Regression coefficient, Angle between two lines of regression; Multiple correlation and Regression.

MODULE – IV	TEST OF HYPOTHESIS - I	Classes: 09

Sampling: Definitions of population, Sampling, Parameter of statistics, standard error; Test of significance: Null hypothesis, alternate hypothesis, type I and type II errors, critical region, confidence interval, level of significance. One sided test, two sided test.

Large sample test: Test of significance for single mean, Test of significance for difference between two sample means, Tests of significance single proportion and Test of difference between proportions

MODULE – V	TEST OF HYPOTHESIS - II	Classes: 09

Small sample tests: Student t-distribution, its properties: Test of significance difference between sample mean and population mean; difference between means of two small samples. Snedecor's F-distribution and its properties; Test of equality of two population variances Chi-square distribution and it's properties; Test of equality of two population variances Chi-square distribution, it's properties, Chi-square test of goodness of fit.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand & Co., 10th Edition, 2000.
2. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016.
3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resourcs/#Mathematics
3. http://www.sosmath.com
4. http://www.mathworld.wolfram.com

E-Text Books:

1. http://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks

MATERIALS, TESTING AND EVALUATION

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB08	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Make measurements of behavior of various materials used in Civil Engineering
II. Provide physical observations to complement concepts learnt
III. Introduce experimental procedures and common measurement instruments, equipment, devices.
IV. Exposure to a variety of established material testing procedures and techniques
V. Different methods of evaluation and inferences drawn from observations

MODULE – I	INTRODUCTION TO ENGINEERING MATERIALS	Classes: 08

Cements, Sand, Concrete (plain, reinforced and steel fiber / glass fiber reinforced, light weight concrete, high Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses.

MODULE – II	INTRODUCTION TO MATERIAL TESTING	Classes: 09

Introduction to material Engineering; Mechanical behavior and mechanical characteristics; Elasticity principle and characteristics; plastic deformation of metals; tensile test-standards for different material (brittle, quasi-brittle, elastic) True stress-strain interpretation of tensile test; hardness tests; bending and torsion test; strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel-temperature transition approach; Background of fracture mechanics; fracture toughness testing for different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics.

MODULE – III	STANDARD TESTING & EVALUATION PROCEDURES	Classes: 10

Mechanical testing of various metals; naming systems for various irons, steels and nonferrous metals; elastic deformation; plastic deformation.

Impact test and transition temperatures; fracture mechanics background; fracture toughness-different materials; Fatigue of material; Creep.

MODULE – IV	STANDARD TESTING PROCEDURES	Classes: 09

Tests & testing of bricks, Tests & testing of sand, Tests & testing of concrete, Tests & testing of soils, Tests & testing of bitumen & bituminous mixes.

MODULE –V	TESTING PROCEDURES OF SPECIAL MATERIALS	Classes: 09

Testing of polymers and polymer based materials, tests and testing of metals, special materials, composites and cementitious materials. Explanation of mechanical behavior of these materials.

Text Books:

1. Chudley, R., Greeno, "Building Construction Handbook", R. Butterworth Heinemann, 6th edition, 2006.
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, "Highway Materials and Pavement Testing", Nem Chand & Bros, 5th Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications

Reference Books:

1. Kyriakos Komvopoulos, "Mechanical Testing of Engineering Materials", Cognella, 2011
2. E.N. Dowling, "Mechanical Behaviour of Materials", Prentice Hall International, 1993
3. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

Web References:

1. https://nptel.ac.in/courses/113106070/
2. http://www.studynotes.ie/wiki/material-testing-engineering-notes/.
3. https://www.youtube.com/watch?v=tpGhqQvftAo&list=PL1XvQlloG76jRFOxUiWAcmYrMUf4BsnSX

E-Text Books:

1. http://www.cognella.com/pdf/Mechanical-Testing-of-Engineering Materials_sneak_preview.pdf.
2. https://books.google.co.in/books?id=2QxVlNDlKvwC&printsec=frontcover#v=onepage&q&f=false
3. .https://books.google.co.in/books?id=M1jg8oJxRGsC&printsec=frontcover&dq=material+testing&hl=en&sa=X&ved=0ahUKEwjM9P45YHgAhVbfd4KHewOCLYQ6AEIRTAF#v=onepage&q=material%20testing&f=false.

ENGINEERING GEOLOGY LABORATORY

IV Semester: CE

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB09	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Study the physical properties of minerals and rocks.
II. Identify rocks and mineral by megascopic and microscopic techniques.
III. Interpret and draw profiles and sections of different geological features.
IV. Solve simple structure geology problems.

LIST OF EXPERIMENTS

Week - l	**PHYSICAL PROPERTIES OF MINERALS**
Study of physical properties of minerals.	
Week - 2	**GROUP OF MINERALS**
Study of different group of minerals.	
Week - 3	**IDENTIFICATION OF SILICA GROUP MINERALS**
Identification of Quartz, Amethyst, Opal	
Week - 4	**IDENTIFICATION OF FELDSPAR GROUP MINERALS**
Identification of Orthoclase, Plagioclase Feldspar	
Week - 5	**IDENTIFICATION OF MINERALS**
Identification of Jasper, Calcite, Graphite; Talc; Muscovite Mica,	
Week - 6	**IDENTIFICATION OF AMPHIBOLE GROUP MINERALS**
Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.	
Week - 7	**IDENTIFICATION OF IGNEOUS ROCKS**
Identification of Granite, Pegmatite, Dolerite and Basalt rocks	
Week - 8	**IDENTIFICATION OF SEDIMENTARY ROCKS**
Identification of Conglomerate, Sandstone, Limestone and Shale rocks	
Week - 9	**IDENTIFICATION OF METAMORPHIC ROCKS**
Identification of Marble, Slate, Gneiss and Schist rocks	
Week - 10	**TOPOGRAPHICAL FEATURES**
Study of topographical features from Geological maps.	
Week - 11	**GEOLOGICAL PROBLEMS**
Dip, Strike direction	

Week - 12	GEOLOGICAL MAPS
Identification of symbols in maps.	

Reference Books:

1. Fred G. Bell, “Engineering Geology and Construction” Spon Press, London, 2004.
2. Robert B. Johnson, Jerome V. Degraff , “Engineering Geology: A Lab Manual”, Macmillan Publishing Company, 1st Edition, 1994

Web References:

1. https://www.youtube.com/results?search_query=engineering+geology+lab
2. http://www.wctmgurgaon.com/pdf/EG%20Lab%20Manual.pdf 3.
3. http://civil.gecgudlavalleru.ac.in/pdf/manuals/EngineeringGeologyLabManual.pdf

FLUID MECHANICS LABORATORY

IV Semester: CE

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB10	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Enrich the concept of fluid mechanics and hydraulic machines.
II. Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.
III. Correlate various flow measuring devices such as venturimeter, orifice meter and notches etc.
IV. Discuss the performance characteristics of turbines and pumps

LIST OF EXPERIMENTS

Week - 1	**INTRODUCTION TO FLUID MECHANICS**
Introduction to Fluid Mechanics, Do's and Don'ts in Fluid Mechnaics Laboratory	
Week - 2	**CALIBRATION OF VENTURIMETER & ORIFICEMETER**
Batch I: Calibration of Venturimeter Batch II: Orificemeter	
Week - 3	**CALIBRATION OF VENTURIMETER & ORIFICEMETER**
Batch I: Orificemeter Batch II: Calibration of Venturimeter	
Week - 4	**DETERMINATION OF COEFFICIENT OF DISCHARGE FOR A SMALL ORIFICE / MOUTH PIECE BY CONSTANT HEAD METHOD**
Batch I: Determination of coefficient of discharge for a small orifice Batch II: Determination of coefficient of discharge by constant head method	
Week - 5	**DETERMINATION OF COEFFICIENT OF DISCHARGE FOR A SMALL ORIFICE / MOUTH PIECE BY CONSTANT HEAD METHOD**
Batch I: Determination of coefficient of discharge by constant head method Batch II: Determination of coefficient of discharge for a small orifice	
Week - 6	**CALIBRATION OF CONTRACTED RECTANGULAR NOTCH / TRIANGULAR NOTCH AND DETERMINATION OF FRICTION FACTOR OF PIPE**
Batch I: Calibration of contracted rectangular notch/ triangular notch Batch II: Determination of friction factor of pipe	
Week - 7	**CALIBRATION OF CONTRACTED RECTANGULAR NOTCH / TRIANGULAR NOTCH AND DETERMINATION OF FRICTION FACTOR OF PIPE**
Batch I: Determination of friction factor of pipe Batch II: Calibration of contracted rectangular notch/ triangular notch	
Week - 8	**DETERMINATION OF COEFFICIENT FOR MINOR LOSSES AND VERIFICATION OF BERNOULLI'S EQUATION**
Batch I: Determination of coefficient for minor losses Batch II: Verification of Bernoulli's equation	

Week - 9	**DETERMINATION OF COEFFICIENT FOR MINOR LOSSES AND VERIFICATION OF BERNOULLI"S EQUATION**
Batch I: Verification of Bernoulli 's equation Batch II: Determination of coefficient for minor losses	
Week - 10	**IMPACT OF JET ON VANES AND STUDY OF HYDRAULIC JUMP**
Batch I: Impact of jet on vanes Batch II: Study of hydraulic jump	
Week - 11	**IMPACT OF JET ON VANES AND STUDY OF HYDRAULIC JUMP**
Batch I: Study of hydraulic jump Batch II: Impact of jet on vanes	
Week - 12	**PERFORMANCE TEST ON PELTON WHEEL TURBINE AND PERFORMANCE TEST ON FRANCIS TURBINE**
Batch I: Performance test on Pelton wheel turbine Batch II: Performance test on Francis wheel turbine	
Week - 13	**PERFORMANCE CHARACTERISTICS OF A SINGLE/ MULTI- STAGE CENTRIFUGAL PUMP AND PERFORMANCE CHARACTERISTICS OF A RECIPROCATING PUMP**
Batch I: Performance characteristics of a single/ multi-stage centrifugal pump Batch II: Performance characteristics of a reciprocating pump	
Week - 14	**PERFORMANCE CHARACTERISTICS OF A SINGLE/ MULTI- STAGE CENTRIFUGAL PUMP AND PERFORMANCE CHARACTERISTICS OF A RECIPROCATING PUMP**
Batch I: Performance characteristics of a reciprocating pump Batch II: Performance characteristics of a single/ multi-stage centrifugal pump	
Week - 15	**REVISION**
Revision	

Reference Books:

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010 .
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House .
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill .
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Web References:

1. http://site.iugaza.edu.ps/mymousa/files/Fluid-Mechanics-and-Hydraulics-Lab-Manual-2015-.pdf
2. http://www.public.asu.edu/~lwmays/classes/cee341/manual.pdf
3. https://issuu.com/loisburchette4023/docs/fluid-mechanics-lab-manual-for-mech

STRENGTH OF MATERIALS LABORATORY

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB11	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Examine the mechanical properties of different solid engineering materials.
II. Identify the behavior of various material samples under different loads and equilibrium conditions.
III. Experiment with materials subjected to tension, compression, shear, torsion, bending and impact.
IV. Extract and analyze material testing data and its interpretation.

LIST OF EXPERIMENTS

Week – 1	**DIRECT TENSION TEST**

Direct Tension test: To evaluate the tensile strength, the elastic limits and the young ‘s modulus of a mild steel bar in tension using the universal testing machine.

Week – 2	**BENDING TEST ON CANTILEVER BEAM**

(a) To evaluate the deflections of the beam made of wood.
(b) To evaluate the deflections of the beam made of steel.

Week – 3	**BENDING TEST ON SIMPLY SUPPORTED BEAM**

(a) To evaluate the deflections of the beam made of wood.
(b) To evaluate the deflections of the beam made of steel.

Week – 4	**TORSION TEST**

To conduct torsion test on mild steel or cast iron specimen to determine modulus of rigidity.

Week – 5	**HARDNESS TEST**

To conduct hardness test on mild steel, carbon steel, brass and aluminum specimens using
(a) Brinell‘s Hardness Test.
(b) Rockwell‘s Hardness Test.

Week - 6	**SPRING TEST**

To determine the stiffness and modulus of rigidity of a spring wire.

Week - 7	**COMPRESSION TEST**

To perform compression test on UTM for
(a) Wooden block.
(b) Concrete block.

Week - 8	**IMPACT TEST**

To evaluate the impact strength of steel specimen using
(a) Izod test.
(b) Charpy Test.

Week - 9	**SHEAR TEST**
To evaluate the shear strength of the given specimens using universal testing machine.	
Week - 10	**BEAM DEFLECTIONS**
To verify the Maxwell's reciprocal theorem for beam deflections.	
Week - 11	**STRAIN MEASUREMENT**
Use of electrical resistance strain gauges	
Week - 12	**DEFLECTION OF CONTINUOUS BEAM**
To evaluate deflections on a continuous beam.	

Reference Books:

1. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
2. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
3. Laboratory Manual of Testing Materials - William Kendrick Hall

Web References:

1. https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf
2. http://www.atri.edu.in/images/pdf/departments/SOM%20LAB%20MANUAL.pdf
3. https://www.iitg.ac.in/mech/lab_sml.php

MECHANICS OF MATERIALS

V Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB12	CORE	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Relate mechanical properties of a material with its behavior under various loadtypes.
II. Apply the concepts of mechanics to find the stresses at a point in a material of a structural member.
III. Analyze a loaded structural member for deflections failure strength.
IV. Evaluate the stresses and strains in materials and deflections in beam members.

MODULE – I	COLUMNS AND STRUTS: BUCKLING	Classes: 09

Introduction: Types of columns, short, medium and long columns, axially loaded compression members, crushing load, Euler's theorem for long columns, assumptions, derivation of Euler's critical load formulae for various end conditions. Equivalent length of a column, slenderness ratio, Euler's critical stress, limitations of Euler's theory, Rankine's formula. Laterallyloaded struts, subjected to uniformly distributed and concentrated loads, maximum bending moment and stress due to transverse and lateral loading.

MODULE – II	DEFLECTIONS OF BEAMS	Classes: 09

Bending into a circular arc, slope, deflection and radius of curvature, differential equation for the elastic line of a beam, double integration and Macaulay's methods, determination of slope and deflection forcantilever and simply supported beams subjected to various loads, Mohr's theorems, moment area method, application to simple cases including overhanging beams; Conjugate beam method, concept of conjugate beam method, difference between a real beam and a conjugate beam, deflections of determinate beams with constant and different moments of inertia.

MODULE – III	DEFLECTIONS BY ENERGY METHODS	Classes: 09

Energy Methods: Work energy method, principal of virtual work, unit load method, Castigliano's theorem for displacements of cantilever beam with concentrated load and uniformly distributed load.

Deflections of simple beams like cantilever beams,simply supported beams with concentrated loads and uniformly distributed loads.Deflections of pin jointed trusses; Maxwell's theorem of reciprocal; Betti's Law.

MODULE – IV	INDETERMINATE BEAMS: PROPPED CANTILEVER AND FIXED BEAMS	Classes: 09

Analysis of propped cantilever and fixed beams using the method of consistent deformation, including the beams with varying moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load and combination of loads, shear force and bending moment diagrams for propped cantilever and fixed beams, deflection of propped cantilever and fixed beams; Effect of rotation of a support.

MODULE – V	INDETERMINATE BEAMS: CONTINUOUS BEAMS	Classes: 09

Continuous beams, Clapeyron's theorem of three moments, analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed, continuous beams with overhang; Effects of sinking of supports.

Text Books:

1. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, 2nd Edition, 2007.

2. F. Beer, E. R. Johnston, J. DeWolf, “Mechanics of Materials”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India, 1st Edition, 2008.
3. S. S. Bhavikatti, “Strength of Materials”, Vikas Publishing House Pvt. Ltd., New Delhi, 5th Edition, 2013.

Reference Books:

1. B. C. Punmia, Ashok K Jain and Arun K Jain, “Mechanics of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 12th Edition, 2007.
2. R. Subramanian, “Strength of Materials”, Oxford University Press, 2nd Edition, 2010.
3. D. S. Prakash Rao, “Strength of Materials A Practical Approach Vol.1”, Universities Press (India) Pvt. Ltd., India, 3rd Edition, 2007.
4. J. M. Gere, S.P. Timoshenko, “Mechanics of Materials, SI units edition”, CL Engineering, USA, 5th Edition, 2000.

Web References:

1. http://www.nptelvideos.in/2012/11/strength-of-materials-prof.html
2. http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanicsfall-2004/lecture-notes/
3. https://www.youtube.com/watch?v=coRgpxG2pyY&list=PLLbvVfERDon3oDfCYxkwRct1Q6Ye Ozi9g

E-Text Books:

1. http://www.freeengineeringbooks.com/Civil/Strength-of-Material-Books.php
2. http://royalmechanicalbuzz.blogspot.in/2015/04/strength-of-materials-book-by-r-k-bansal.html

STRUCTURAL ENGINEERING

V Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB13	CORE	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of arch action and three-hinged and two hinged arches.
II. Understand the behavior of indeterminate structures and their analysis.
III. Analyse continuous beams and frames by slope-deflection, moment distribution, and Kani's method.
IV. Understand the concept of moving loads and influence diagrams.

MODULE – I	ARCHES	Classes: 09

Introduction, types of arches, comparison between three-hinged and two hinged arches; Normal thrust and radial shear in an arch; Geometrical properties of parabolic and circular arch; Three hinged circular arch at different levels; Absolute maximum bending moment diagram for a three-hinged arch; Two hinged arches: Introduction, classification of two hinged arches, analysis of two hinged parabolic arches, secondary stresses in two hinged arches due to temperature and elastic shortening of rib.

MODULE – II	ANALYSIS OF INDETERMINATE STRUCTURES	Classes: 09

Indeterminate Structural Analysis –Determination of static and kinematic indeterminacies – Analysis of trusses with up to two degrees of internal and external indeterminacies using Castiglione's theorem.

MODULE – III	SLOPE-DEFLECTION AND MOMENT DISTRIBUTION METHOD	Classes: 09

Introduction- Derivation of slope deflection equation-Application to continuous beams with and without settlement of supports - Analysis of single-bay, single-story, portal frame including side sway.

Introduction to moment distribution method - Application to continuous beams with and without settlement of supports - Analysis of single-bay, single-story, portal frame including side sway.

MODULE – IV	KANI'S METHOD	Classes: 09

Introduction to Kani's method – Rotation factor- Application to continuous beams with and without settlement of supports.

MODULE – V	MOVING LOADS AND INFLUENCE LINES	Classes: 09

Introduction maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load U.D load longer than the span, UDL load shorter than the span, two-point loads with fixed distance between them and several point loads – Equivalent uniformly distributed load – Focal length. Definition of influence line for SF, Influence line for BM – load position for maximum SF at a section – Load position for maximum BM at a section Point loads, UDL longer than the span, UDL shorter than the span.

Text Books:

1. B.C. Punmia, A.K Jain &A.K.Jain, "Theory of Structures", Laxmi Publications 12th Edition, 2004.
2. C.S.Reddy, "Basic Structural Analysis", Tata Mc. Graw Hill, 3rd Edition, 2010.

Reference Books:

1. Bhavikatti, "Analysis of Structures - Vol. 1&2",Vikas Publications.
2. VaziraniandRatwani, "Analysis of Structures–Vol.II", Khanna Publishers, 16th Edition, 2015.
3. Ramamrutham, "Theory of Structures", Dhanpat Rai Publications, 9thEdition, 2014.
4. C.K.Wang, "Intermediate Structural Analysis", Standard Publication, 1stEdition, 2010.

Web References:
1. https://nptel.ac.in/courses/105105166/ 2. https://www.youtube.com/watch?v=qhEton-EEOw&list=PL83821B43A558F579
E-Text Books:
1. https://www.kopykitab.com/Structural-Analysis-I-by-S-S-Bhavikatti 2. https://www.pdfdrive.com/fundamental-structural-analysis-e25550099.html

HYDRAULIC ENGINEERING

V Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB14	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Estimation of head losses on pipes and design of a typical pipe networks.
II. Measurement of Viscosity, knowing different types of flows in closed pipes and their determination.
III. Concept of Boundary layer theory over the flat and parallel plates in a pipe flow.
IV. Designing of most economical sections of an Open channel.
V. Studying the problems associated through Non – Uniform flow in open channels.

MODULE – I	FLOW THROUGH PIPES	Classes: 10

Loss of head through pipes, Darcy – Wiesbatch equation, minorlosses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes inparallel, flow through laterals, flows in dead end pipes, siphon. Analysis of pipe networks: Hardy Cross method.

MODULE – II	LAMINAR AND TURBULENT FLOWS IN CLOSED PIPES	Classes: 08

Laminar flow throughcircular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.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. Resistance toflow of fluid in smooth and rough pipes, Moody's diagram.

MODULE – III	BOUNDARY LAYER THEORY	Classes: 08

Assumption and concept of boundary layer theory, Boundary layer thickness, displacement, momentum and energy thickness – problems. Laminar and Turbulent boundary layers on a flat plate.

Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Boundary layer separation and control.

MODULE – IV	OPEN CHANNEL FLOW: UNIFORM FLOW	Classes: 09

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 - Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient. Most economical section of channel. Computation of Uniform flow,Normal depth.

MODULE – V	OPEN CHANNEL FLOW: NON - UNIFORM FLOW	Classes: 10

Non – Uniform Flow: Specific energy, specific energy curve, critical flow, discharge curve specific force, specific depth, and critical depth. Gradually Varied Flow –Dynamic Equation of Gradually Varied Flow, Classification of channel bottoms lopes, Classification of surface profile, Computation of water surface profile by Direct Step 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.

Text Books:

1. P. M. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House, 22nd Edition, 2019.
2. Subramanya K. "Open Channel Flow", Tata McGraw Hill Publications, 3rd Edition, 2009.
3. Narayana and C. R. Ramakrishnan Pillai, "Principles of Fluid Mechanics and Fluid Machines", Sangam Books Ltd, 1st Edition, 2003.

Reference Books:
1. Ojha CSP, Chandramouli P. N., Berndtsson R., "Fluid Mechanics and Machinery, Oxford University Press, 2010. 2. Chow V.T., "Open Channel Hydraulics", Blackburn Press, 2009. 3. Rajput R.K., "A text book of Fluid Mechanics, S.Chand Publications, 1998. 4. Franck N. White, ―Fluid Mechanics‖, Tata McGraw Hill Publications, 8th Edition, 2015.
Web References:
1. http://nptel.ac.in/courses/112104117/ 2. http://nptel.ac.in/courses/105103096/ 3. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/TOC.htm
E-Text Books:
1. https://drive.google.com/file/d/0B9_2yANiGJ12aWJrSGJZVjlxbHM/view 2. https://books.google.co.in/books?id=mLpf6YjHM5AC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

III Semester: CSE / IT | V Semester: EEE / CE / MECH | VI Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB14	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the market dynamics namely demand elasticity of demand and pricing in different market structures.
II. Analyze how capital budgeting decisions are carried out for selecting the best investment proposal.
III. Learn how organizations make important investment and financing decisions.
IV. Analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.
V. Acquire the basics of how to analyze and interpret the financial statements through ratio analysis.

MODULE – I	INTRODUCTION AND DEMAND ANALYSIS	Classes: 07

Definition, nature and scope of business economics; Demand analysis; Demand determinants, law of demand and its exceptions; Elasticity of demand: Definition, types, measurement and significance of elasticity of demand, demand forecasting, factors governing demand forecasting.

MODULE – II	PRODUCTION AND COST ANALYSIS	Classes: 10

Production function; Isoquants and isocosts, MRTS, least cost combination of inputs, Cobb-Dougles production function, internal and external economies of scale, cost analysis; Cost concepts: Break even analysis (BEA), determination of break-even point (simple problems), managerial significance.

MODULE – III	MARKETS AND NEW ECONOMIC ENVIRONMENT	Classes: 08

Types of competition and markets, features of perfect competition, monopoly and monopolistic competition, price-output determination in case of perfect competition and monopoly business.

Features and evaluation of different forms of business organizations: Sole proprietorship, partnership, joint stock company, public enterprises and their types.

MODULE – IV	CAPITAL BUDGETING	Classes: 10

Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital, capital budgeting: features of capital budgeting proposals; Methods of capital budgeting: Payback period, accounting rate of return(ARR), net present value method and internal rate of return method (simple problems).

MODULE – V	INTRODUCTION TO FINANCIAL ACCOUNTING AND FINANCIAL ANALYSIS	Classes : 10

Financial accounting objectives, functions, importance; Accounting concepts and accounting conventions - double-entry book keeping, journal, ledger, trial balance; Final accounts: Trading account, profit and loss account and balance sheet with simple adjustments; Financial analysis: Analysis and interpretation of liquidity ratios, activity ratios, capital structure ratios and profitability ratios (simple problems), Du Pont chart.

Textbooks:

1. Aryasri, "Managerial Economics and Financial Analysis", TMH publications, 4th Edition, 2012.
2. M. Kasi Reddy, Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 2nd Edition, 2012.
3. Varshney, Maheswari, "Managerial Economics", Sultan Chand Publications, 11th Edition, 2009.

Reference Books:

1. S. A. Siddiqual, A. S. Siddiqual, "Managerial Economics and Financial Analysis", New Age International Publishers, Hyderabad, Revised 1st Edition, 2013.
2. S. N. Maheswari, S. K. Maheswari, "Financial Accounting", Vikas publications, 3rd Edition, 2012.
3. J. V. Prabhakar Rao, P. V. Rao, "Managerial Economics and Financial Analysis", Maruthi Publishers, Reprinted Edition, 2011.
4. Vijay Kumar, Appa Rao, "Managerial Economics and Financial Analysis", Cengage Publications, 1st Edition, Paperback, 2011.

Web References:

1. https:// www.slideshare.net/glory1988/managerial-economics-and- financial analysis
2. https:// thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis
3. https:// bookshallcold.link/pdfread/managerial-economics-and-financial analysis
4. https:// www.gvpce.ac.in/syllabi/Managerial Economics and financial analysis

E-Text Book:

1. https:// books.google.co.in/books/about/Managerial economics and financial analysis
2. http://www. ebooktake.in/pdf/title/managerial-economics-and-financial analysis
3. http://all4ryou.blogspot.in/2012/06/mefa-managerial-economics and financial analysis
4. http://books.google.com/books/about/Managerial economics and financial analysis
5. http://www.scribd.com/doc/37684926

HYDRAULIC ENGINEERING LABORATORY

V Semester: CE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACEB15	**Core**	-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 24**				**Total Classes: 24**		

OBJECTIVES:

The course should enable the students to:

I. Identify the properties and behavior of fluid flow patterns.
II. Understand the flow of liquid particles in closed pipes.
III. Demonstrate the concept of hydraulic jump.
IV. Understand the properties and importance of hydraulic turbines.

LIST OF EXPERIMENTS

Week – 1	**INTRODUCTION TO HYDRAULIC ENGINEEIRNG LABORATORY**
Introduction to Hydraulic Engineering laboratory.	
Week – 2	**FRICTION FACTOR FOR A SQUARE PIPE**
Measurement of Friction factor for a given square pipe	
Week – 3	**MINOR LOSSES IN CLOSED PIPES – I**
Determination of minor losses due to sudden expansion in a closed pipe	
Week – 4	**MINOR LOSSES IN CLOSED PIPES – II**
Determination of minor losses due to sudden contraction in a closed pipe	
Week – 5	**COEFFICIENT OF DISCHARGE FOR CONVERGENT MOUTH PIECE**
Measuring the co-efficient of discharge for convergent type of mouth pieces.	
Week – 6	**COEFFICIENT OF DISCHARGE FOR DIVERGENT MOUTH PIECE**
Measuring the co-efficient of discharge for divergent type of mouth pieces.	
Week – 7	**COEFFICIENT OF DISCHARGE FOR TRAPEZOIDAL NOTCH**
Determination of co-efficient of discharge for the given trapezoidal notch	
Week – 8	**COEFFICIENT OF DISCHARGE FOR STEPPED NOTCH**
Determination of co-efficient of discharge for the given stepped notch	
Week – 9	**PERFORMANCE TEST OF KAPLAN TURBINE**
Determination of maximum efficiency of Kaplan turbine	
Week – 10	**IMPACT OF JET ON AN INCLINED PLATE**
To find the coefficient of impact by the jet of water on an inclined plate.	
Week – 11	**HYDRAULIC JUMP**
To perform test on hydraulic jump to find the length and height of jump.	
Week – 12	**DISCHARGE THROUGH A WEIR**
To find the discharge through a weir in an open channel	
Week – 13	**BERNOULLI'S EXPERIMENT**
To determine the total head at all the duct points for an inclined pipe using Bernoulli's experiment.	
Week – 14	**TIME OF EMPTYING A TANK USING MOUTHPIECE**
To estimate the time taken to empty the tank using mouthpiece.	

Textbooks:

1.Majumdar Bireswar, "Fluid Mechanics with Laboratory Manual", PHI Learning Pvt Ltd; 2nd revised edition, 2015.

Reference Books:
1. Subramanya, “Fluid Mechanics and Hydraulic Machines”, Mc Graw Hill India, 2nd edition, 2018. 2. John. M. Cimbala Yunus A. Cengel, “Fluid Mechanics; Fundamentals and Applications, Mc Graw Hill Education (India) Private Limited, Special Indian Edition, 2019.

CONCRETE TECHNOLOGY LABORATORY

V Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB16	CORE	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

COURSE OBJECTIVES:

The course should enable the students to:

I. Achieve the practical knowledge regarding concrete testing equipment and their operation.
II. Demonstrate tests on cement, aggregates and concrete.
III. Observe the behavior of concrete materials and their properties.
IV. Emphasize the knowledge and application of safety regulations.

Week – 1	**INTRODUCTION TO CONCRETE TECHNOLOGY**
Introduction to concrete technology laboratory. Do's and Don'ts in concrete lab	
Week – 2	**FINENESS OF CEMENT**
Fineness of cement	
Week – 3	**NORMAL CONSISTENCY OF CEMENT**
Normal consistency of cement	
Week – 4	**INITIAL AND FINAL SETTING TIMES OF CEMENT**
Initial and final setting times of cement	
Week – 5	**SPECIFIC GRAVITY OF CEMENT**
Specific gravity of cement	
Week – 6	**COMPRESSIVE STRENGTH OF CEMENT**
Compressive strength of cement	
Week – 7	**SOUNDNESS OF CEMENT**
Soundness of cement	
Week – 8	**FINENESS MODULUS OF FINE AND COARSE AGGREGATE**
Fineness modulus of fine and Coarse Aggregate	
Week – 9	**BULKING OF SAND**
Bulking of sand	
Week – 10	**WORKABILITY TESTS ON FRESH CONCRETE**
Workability tests on fresh concrete	
Week – 11	**TEST FOR COMPRESSIVE STRENGTH OF CEMENT CONCRETE**
Test for compressive strength of cement concrete.	
Week – 12	**REVISION**
Revision	

Reference Books

1. Hemanthsood and LN Mittal, "Laboratory Manual on Concrete Technology", CBS Publishers Pvt. Ltd., New Delhi, 2nd Edition, 2013.
2. Khanna S.K and Justo C.E.G., "Pavement Materials and Testing" Tata McGraw Hill Education, 2012s.

Web References:

2. https://nptel.ac.in/courses/105102012/

E-Text Books:
1. https://www.emiliaecarlo.it/2018/20/03/concrete-technology-textbook-free-down/ 2. https://www.pdfdrive.com/concrete-technology-2nd-edition-book-d18823000.html

ENGINEERING ECONOMICS, ESTIMATION AND COSTING

VI Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB17	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Summarize the basic principal and standard methods for working out quantities in estimating.
II. Demonstrate the detailed estimate of buildings and workout rate analysis of the various items of work.
III. Understand the material requirements as per specified norms and standards.
IV. Evaluate the quantity of steel and details of contracts.
V. Assess the valuation of buildings and provide practical knowledge of standard specifications of items of buildings construction.

MODULE - I	GENERAL ITEMS OF WORK IN BUILDING	Classes: 09

General items of work in building, Standard units', principles of working out quantities for detailed andabstract estimates, Approximate method of estimating. Detailed estimates of buildings.

MODULE - II	EARTHWORKS	Classes: 09

Introduction to earth works, Earthwork calculations for roads and canals.

MODULE - III	RATE ANALYSISAND CONTRACTS	Classes: 09

Rate analysis - Working out data for various items of work over head and other contingent charges.

Contracts – Types of contracts, contract documents, conditions of contract.

MODULE - IV	REINFORCEMENT BAR BENDING	Classes: 09

Reinforcement bar bending and bar requirement schedules.

MODULE - V	VALUATION OF BUILDINGS AND ECONOMICS	Classes: 09

Valuation of buildings, standard specifications for different items of building construction.Basic principles and methodology of economics.

Text Books:

1. B. N. Dutta, "Estimating and Costing", UBS publishers, 2000.
2. G. S. Birdie., "Estimating and Costing", Dhanpat Rai publications, 1988.
3. M. Chakraborthi, "Estimation, Costing and Specifications", Laxmi publications, 1982.

Reference Books:

1. Standard schedule of rates and standard data book by public works department, 2015.
2. I.S. 1200 (Parts I to XXV – 1974/method of measurement of building and Civil Engineering works – B.I.S)
3. National Building Code book, 2015.

Web References:
1. https://en.wikipedia.org/wiki/Estimation 2. https://theconstructor.org/practical-guide/quality-control/
E-Text Books:
1. https://drive.google.com/file/d/0B-1pQnD2tCRIOWtWTURWRjR2WHM/view

HYDROLOGY AND WATER RESOURCES ENGINEERING

VI Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB18	Core	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of hydrology that deals with the occurrence, distribution and movement of water on and below the Earth surface.
II. Understand the occurrence of precipitation - its movement and estimation.
III. Application of water to crops and design of distribution channels.
IV. Develop the knowledge about various types of dams and spillways.

MODULE - I	HYDROLOGICAL CYCLE AND PRECIPITATION	Classes: 09

Introduction to hydrologic cycle, Water – budgetequation. Precipitation - forms of precipitation, characteristics of precipitation in India,measurement of precipitation, rain gauge network, mean precipitation over an area, Depth-Area-Duration (DAD) relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

MODULE -II	ABSTRACTIONS FROM PRECIPITATION	Classes: 09

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotran spiration, evapotranspiration equations, Potential evapotranspiration, actual evapotranspiration, infiltration, infiltration capacity, measurement of infiltration.

MODULE -III	SURFACE AND SUB – SURFACE RUNOFF	Classes: 08

Surface Runoff - Runoff volume, SCS – CN method of estimating runoff volume, flow – durationcurve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph.

Sub – surface runoff - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

MODULE- IV	WATER WITHDRAWLS AND DISTRIBUTION SYSTEMS	Classes: 09

Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation. Canal systems – Design of channels – Kennedy's and Lacey's theory of regime channels.

MODULE -V	DAMS AND SPILLWAYS	Classes: 10

Dams - Gravity dams - forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Embankment dams - Classification, design considerations. Arch and buttress dams. Spillways - components of spillways, types of gates for spillway crests. Reservoirs - Types, capacity of reservoirs, yield of reservoir, selection of suitable site for reservoirs.

Text Books:

1. Jayarami Reddy, "Engineering hydrology", McGraw Hill Education, 4th Edition, 2017.
2. B.C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Pande Brij Basi Lal, "Irrigation and Water Power Engineering", Laxmi publications Pvt. Ltd., New Delhi, 16th Edition, 2016.

Reference Books:

1. V.P.Singh, "Elementary hydrology", PH1 publications, 1st Edition, 1991.
2. Dr.G.Venkata Ramana, "Water Resources Engineering-I", Acadamic Publishing Company, 1st Edition, 2012.
3. D.K.Majundar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India, 2nd Edition, 2014.

Web References:

1. guides.lib.vt.edu/subject,guides/cee/environmental,water,engineering
2. https://en.wikipedia.org/wiki/Water_resources
3. https://www.nae.edu/.../ExpansionofFrontiersofEngineering/Water,ResourceE
4. https://books.google.co.in/books?isbn=0470460644
5. https://www.elsevier.com/journals/advances,in,water,resources/0309,1708

E-Text Books:

1. https://www.civilenggforall.com/p/water,resources,engineering.html
2. https://books.askvenkat.com/water,resources,engineering,1,textbook,pdf
3. https://www.amazon.in/Water,Resources,Engineering,Larry,Mays/dp/047
4. https://www.respwritunac.hatenablog.com/entry/2016/05/20/044146

GEOTECHNICAL ENGINEERING

VI Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB19	CORE	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Identify the type of soil based on index properties of soils, soil formation & its structure
II. Recognize the importance of permeability for calculating the seepage through soils. Find out the coefficient of permeability using various laboratory & field tests.
III. Analyze the stress at any point below the ground surface due to self-weight and externally applied load. Interpret the importance of consolidation and compaction on the settlement of footing.
IV. Recognize the importance of shear strength in load carrying capacity of soil. Calculate the shear strength of soil using various laboratory tests.

MODULE - I	INTRODUCTION AND INDEX PROPERTIES OF SOILS	Classes: 08

Soil formation, clay mineralogy and soil structure, moisture content, weight-volume relationships, relative density. Grain size analysis, sieve analysis, principle of hydrometer method, consistency limits and indices, I.S. classification of soils.

MODULE - II	PERMEABILITY, EFFECTIVE STRESS AND SEEPAGE THROUGH SOILS	Classes: 10

Capillary rise, flow of water through soils, Darcy's Law, permeability, factors affecting permeability, laboratory & field tests for determination of coefficient of permeability, permeability of layered soils; Total, neutral and effective stress, upward and downward seepage through soils, quick sand condition, flow nets: characteristics and uses.

MODULE - III	STRESS DISTRIBUTION IN SOILS AND COMPACTION	Classes: 09

Boussinesq's and Westergard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along vertical and horizontal plane, Newmark's influence chart for irregular areas.

Mechanism of compaction, factors affecting compaction, effects of compaction on soil properties, field compaction equipment and compaction quality control.

MODULE - IV	CONSOLIDATION	Classes: 10

Types of compressibility, immediate settlement, primary consolidation and secondary consolidation, stress history of clay, e-p and e-log p curves, normally consolidated soil , over and under consolidated soil, pre-consolidation pressure and its determination, Terzaghi's 1-D consolidation theory, coefficient of consolidation square root time and logarithm of time fitting methods, computation of total settlement and time rate of settlement.

MODULE - V	SHEAR STRENGTH OF SOILS	Classes: 08

Importance of shear strength, Mohr and coulomb failure theories, types of laboratory tests for strength parameters, strength tests based on drainage conditions, strength envelops, shear strength of sands, dilatancy, critical void ratio, liquefaction, shear strength of clays.

Text Books:
1. Braja M. Das, “Principles of geotechnical engineering” Cengage learning publishers, 2002. 2. VNS Murthy, “Soil mechanics and foundation engineering”, CBS publishers and distributors, 2003. 3. Gopal Ranjan and ASR Rao, “Basic and Applied Soil Mechanics”, New age international Pvt. Ltd, New Delhi, 2000.
Reference Books:
1. C. Venkataramiah, “Geotechnical engineering”, New Age International Pvt. Ltd, 2002. 2. Manoj dutta and Gulati, “Geotechnical engineering”, Tata Mc Graw hill publishers New Delhi, 2005. 3. K.R .Arora, “Soil mechanics and foundation engineering”, standard publishers and distributors, New Delhi, 2005. 4. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Soil mechanics and foundation”, Laxmi publications Pvt. Ltd, New Delhi, 2005.
Web References:
1. http://nptel.ac.in/courses/105107120/1# 2. http://www.nptel.ac.in/courses/105105105/ 3. http://www.nptel.ac.in/courses/105105104

GEOTECHNICAL ENGINEERING LABORATORY

VI Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB20	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The **course should enable the students to:**

I. Classify the soil based on index properties of soil.
II. Find the field bulk and dry density of cohesion-less and cohesive soils.
III. Find the coefficient of permeability of coarse grained and fine-grained soils & compressibility characteristics of soil.
IV. Evaluate the shear strength parameters of soil.

LIST OF EXPERIMENTS

Week – 1	**MOISTURE CONTENT**
To determine the natural moisture content of the given soil sample.	
Week – 2	**SPECIFIC GRAVITY**
Determine the specific gravity of soil fraction passing 4.75 mm I.S sieve by density bottle.	
Week – 3	**ATTERBERG'S LIMITS**
To determine liquid limit, plastic limit, shrinkage limit, classify the soil and to find flow index and toughness index	
Week – 4	**FIELD DENSITY- CORE CUTTER AND SAND REPLACEMENT METHOD**
To determine the mass density of soils by core cutter method and replacement method	
Week – 5	**GRAIN SIZE ANALYSIS**
To classify the Coarse Grained soils based on sieve analysis	
Week – 6	**PERMEABILITY OF SOIL: CONSTANT AND VARIABLE HEAD TEST**
To determine coefficient of permeability of given soil sample at desired density by a suitable method.	
Week – 7	**COMPACTION TEST**
To determine the optimum moisture content and maximum dry density of a soil by proctor test.	
Week - 8	**CBR TEST**
To determine the California bearing ratio by conducting a load penetration test in the laboratory.	
Week – 9	**CONSOLIDATION TEST**
To determine the settlements due to primary consolidation of soil by conducting one dimensional test.	
Week – 10	**UNCONFINED COMPRESSION TEST**
To determine the unconfined compressive strength of cohesive soil sample and its sensitivity	
Week – 11	**TRIAXIAL COMPRESSION TEST**
To determine shear strength parameter i.e. angle of shearing resistance and cohesion of a given soil Sample	
Week – 12	**DIRECT SHEAR TEST**
To determine shear strength parameters of the given soil sample at known density and moisture content by direct shear test.	
Week – 13	**VANE SHEAR TEST**

To determine the shear strength of clay specimen.
Text Books:
1. Braja M. Das, “Soil Mechanics Laboratory Manual”, Engineering Press at OUP, 2001. 2. Michael E. Kalinski, “Soil Mechanics Lab Manual”, John Wiley & Sons,2006.
Reference Books:
1. Head, “Manual of Soil Lab Testing: Effect. Stress Tests”, CBS Publishers, 1997.
Web References:
1. http://home.iitk.ac.in/~madhav/geolab.html 2. http://www.ammini.edu.in/Uploads/Lab_Manuals/CE09%20607(P)_%20Geotechnical%20Engineering%20Lab.pdf

REINFORCED CONCRETE STRUCTURES DRAWING LABORATORY

VI Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB21	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The **course should enable the students to:**

I. Understand reinforcement details of various concrete members.
II. Produce and interpret reinforcement details of various beams.
III. Develop reinforcement design of columns with lateral ties and spiral reinforcement.
IV. Interpret and produce reinforcement details of slabs, footings and staircase.

LIST OF EXPERIMENTS

Week-1	**INTRODUCTION**
Introduction to reinforced concrete structures.	
Week-2	**SIMPLY SUPPORTED BEAM**
Detailing of simply supported beam.	
Week-3	**CONTINUOUS BEAM**
Detailing of continuous beam.	
Week-4	**T-BEAM/ L-BEAM**
Reinforcement details of T- Beam	
Week-5	**COLUMN WITH LATERAL TIES**
Rectangular tied reinforcement details.	
Week-6	**COLUMN WITH SPIRAL REINFORCEMENT**
Round spiral reinforcement details.	
Week-7	**BEAM COLUMN JOINT**
Reinforcement details of exterior beam-column joint .	
Week-8	**SLAB WITH TORSIONAL REINFORCEMENT**
Slab with torsional reinforcement.	
Week-9	**FOOTINGS**
Combined trapezoidal footing	

Week-10	**STAIRCASE**
Plan of R.C.C staircase.	
Week-11	**STAIRCASE**
Sectional elevation of R.C.C staircase.	
Week-12	**DUCTILE REINFORCEMENT**
Ductile reinforcement details	

Text Books:

1. Bhash C Sharma & Gurucharan Singh, "Civil Engineering Drawing", Standard Publishers, 2005.
2. Ajeet Singh, "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi, 2002.
3. Sham Tickoo Swapna D, "AUTOCAD for Engineers and Designers", Pearson Education, 2009.
5. Balagopal and Prabhu, "Building Drawing and Detailing", Spades publishing KDR building, Calicut, 1987.

Reference Books:

1. Malik R.S., Meo, G.S., "Civil Engineering Drawing", Computech Publication Ltd New Asian, 2009.
2. Sikka, V.B., "A Course in Civil Engineering Drawing", S. K. Kataria & Sons, 2013.

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ENVIRONMENTAL ENGINEERING

VII Semester: CE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACEB22	**CORE**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Outline the different sources of water and its per capita demand.
II. Describe the basic characteristics of waste water and study the procedure for disposal
III. Outline for collection, transport, treatment and disposal of Solid Waste
IV. Describe the characteristics of sewage and design of sewers.
V. Construct and design waste water treatment units.

MODULE - I	**WATER QUALITY, DEMAND AND SUPPLY**	**Classes: 09**

Protected water supply, population forecasts, design period, water demand, types of demand, factors affecting fluctuations, fire demand, storage capacity, water quality and testing. Drinking water standards. Sources of water supply - intakes, infiltration galleries.

MODULE - II	**WATER TREATMENT AND DISTRIBUTION**	**Classes: 09**

Types of layouts of distribution systems, design of distribution systems using Hardy Cross and equivalent pipe methods. Components of Water Supply System - Service reservoirs, joints, valves - sluice valves, air valves, scour valves and check valves, water meters, laying and testing of pipe lines, pump house.

MODULE - III	**SOLID WASTE MANAGEMENT**	**Classes: 09**

Solid Waste Management - Municipal Solid Waste (MSW), Composition and various chemical and physical parameters of MSW. Types of MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes. MSW management: Collection, transport, treatment and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards.

Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

MODULE - IV	**SEWAGE TREATMENT AND DISPOSAL**	**Classes: 09**

Characteristics of sewage, cycles of decay, decomposition of sewage, examination of sewage, B.O.D. and C.O.D. equations. Sewage and Storm water estimation - shapes and materials, design of sewers. Sewer appurtenances - manhole, inverted siphon, catch basins, flushing tanks, ejectors, pumps and pump houses. House drainage components requirements - sanitary fittings, traps, one pipe and two pipe systems of plumbing, ultimate disposal of sewage.

MODULE - V	**OVERVIEW OF WASTEWATER TREATMENT**	**Classes: 09**

Lay out and general outline of various units in a Waste Water Treatment Plant – Steps involved in Primary Secondary, and Tertiary treatment of waste water. Sludge digestion tanks, factors effecting design of sludge digestion tank, sludge disposal by drying, septic tanks working principles and design - soak pits.

Text Books:

1. S.K. Garg, "Environmental Engineering", Vol. I:, Khanna Publishers, 20th Edition, 2011.
2. Birdie, G.S. and Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai& Sons, 1992.
3. Duggal, K.N. "Elements of Environmental Engineering", S.Chand & Co, 2002.
4. Punmia B.C, Ashok Jain &Arun Jain, "Water Supply Engineering", Laxmi Publications, Pvt. Ltd., New Delhi, 2004.
5. Solid waste management shabana Yasmin, Global research publications, 1st Edition,2013.
6. Solid and Liquid waste management, Vasudevan Rajaram, Faisal Zia siddiqui, PHI Learing ,2013

Reference Books:

1. Metcalf and Eddy, "Waste Water Engineering, Collection, Treatment and Disposal", Tata McGraw Hill, Inc., New York,
2. H.S. Peavy and D.R.Rowe, "Environmental Engineering", 2nd Edition, Mc.Graw Hill Publishing

Web References:

1. https://www.youtube.com/watch?v=pl8Isc7XIv8
2. https://www.youtube.com/watch?v=8MJ4qd9A9T0
3. https://www.youtube.com/watch?v=I1E0RdHw9gU
4. https://www.youtube.com/watch?v=gxgpK1EUZns

E-Text Books:

1. https://easyengineering.net/sewage-waste-disposal-and-air-pollution-engineering-by-santosh-kumar-garg/
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

TRANSPORTATION ENGINEERING

VII Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB23	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the highway planning process and carry out surveys involved in planning and highway alignment.
II. Remember various geometric elements involved in design of highways and expressway.
III. Understand the various traffic studies and to implement traffic regulation and control measures
IV. Understand the engineering properties of pavement materials used in highway construction.
V. Understand the factors affecting design and performance of flexible and rigid pavements as per IRC.

MODULE - I	HIGHWAY DEVELOPMENT AND PLANNING	Classes: 09

Classification of roads, road development in India, Current road projects in India, highway alignment, factors affecting alignment, Engineering surveys, drawing and reports, highway project.

MODULE - II	GEOMETRIC DESIGN OF HIGHWAYS	Classes: 09

Introduction, highway cross section elements,sight distance elements, stopping sight distance, overtaking sight distance and intermediate sight distance, design of horizontal alignment; design of vertical alignment; design of intersections.

MODULE - III	TRAFFIC ENGINEERING AND CONTROL	Classes: 09

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control.

Design of parking facilities; highway lighting and Accident studies: causes and measures.

MODULE - IV	PAVEMENT MATERIALS	Classes: 09

Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements,

MODULE - V	DESIGN OF PAVEMENTS	Classes: 09

Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

Text Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017.
2. Kadiyalai, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers, 2013.
3. Partha Chakraborty, 'Principles Of Transportation Engineering', PHI Learning, 2017.

Reference Books:

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", John Wiley, 4th Edition, 2007.
2. Srinivasa Kumar, R, "Textbook of Highway Engineering", Universities Press, 2011.
3. Paul H. Wright and Karen K. Dixon, "Highway Engineering", Wiley Student Edition, 7th Edition, 2009.

Web References:
1. http://www.nptelvideos.in/2012/11/introduction-to-transportation.html 2. http://www.nptelvideos.com/civil_engineering/transportation_engineering_video_lectures.php 3. https://nptel.ac.in/courses/105105107/ 4. https://nptel.ac.in/courses/105101087/
E-Text Books:
1. http://e-booksdirectory.com/details.php?ebook=5616

ENVIRONMENTAL ENGINEERING LABORATORY

VII Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB24	CORE	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

COURSE OBJECTIVES:

The course should enable the students to:

I. Investigate the different characteristics of water & wastewater Understand the shift from 2D representation to 3Dsimulation.
II. Outline the procedure for preparations of stock and standard solutions, their handling, storage,etc.
III. Assess the suitability of water for drinking, irrigation purpose and concretingworks.
IV. Determine the BOD, COD and bacterial density of portablewater.

Week – 1	**INTRODUCTION TO ENVIRONMENTAL ENGINEERING LABORATORY. DETERMINATION OF PH AND TURBIDITY**

Introduction to environmental engineering. Do's and Don'ts in the lab.
To determine the pH of given samples using universal indicator, pH paper and digital pH meter
Determination of turbidity of the given sample using nephelometer in NTU.

Week – 2	**DETERMINATION OF PH AND TURBIDITY**

Determination of turbidity of the given sample using nephelometer in NTU.
To determine the pH of given samples using universal indicator, pH paper and digital pH meter.

Week – 3	**DETERMINATION OF TURBIDITY AND TOTAL DISSOLVED SOLIDS**

Determining the electrical conductivity of the given water sample.
Determination of total dissolved solids of the sample.

Week – 4	**DETERMINATION OF CONDUCTIVITY AND TOTAL DISSOLVED SOLIDS**

Determination of total dissolved solids of the sample.
Determining the electrical conductivity of the given water sample.

Week – 5	**DETERMINATION OF ALKALINITY, ACIDITY OF WATER AND CHLORIDE IN WATER.**

Determining the amount of alkalinity present in the given samples & determine the acidity of the given sample of water.
Determine the amount of chloride present in the given water sample by Mohr‘s method.

Week – 6	**DETERMINATION OF CHLORIDE AND ALKALINITY, ACIDITY IN WATER**

Determine the amount of chloride present in the given water sample by Mohr‘s method.
Determining the amount of alkalinity present in the given samples & determine the acidity of the given sample of water

Week – 7	**DETERMINATION OF DISSOLVED OXYGEN AND IRON IN WATER**

Determine the nitrate nitrogen of the given sample of water.
Determine the quantity of dissolved oxygen present in the given sample(s) by using modified Winkler‘s (Azide modification) method.

Week – 8	**DETERMINATION OF IRON AND DISSOLVED OXYGEN IN WATER**
Determine the quantity of dissolved oxygen present in the given sample(s) by using modified Winkler's (azide modification) method Determine the nitrate nitrogen of the given sample of water.	
Week – 9	**DETERMINATION OF OPTIMUM DOSE OF COAGULANT IN WATER AND DETERMINATION OF RESIDULE CHLORINE IN WATER**
Determining the optimum coagulant dosage for clarifying the given sample of water by using alum as the coagulant and performing the jar test experiment. Determining the residual chlorine content in water	
Week – 10	**DETERMINATION OF RESIDULE CHLORINE IN WATER AND DETERMINATION OF OPTIMUM DOSE OF COAGULANT IN WATER**
Determining the residual chlorine content in water Determining the optimum coagulant dosage for clarifying the given sample of water by using alum as the coagulant and performing the jar test experiment.	
Week – 11	**DETERMINATION OF BOD AND COD**
Determining the amount of B.O.D. and C.O.D. exerted by the given sample Determining the amount of C.O.D. and B.O.D. exerted by the given Sample	
Week – 12	**REVISION**
Revision	
Reference Books:	
3. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston , "BIM HANDBOOK", Wiley, 2nd Edition, 2011	
E-Text Books:	
1. http://auvsp.edu.in/datastore/auwebsite/documents/libraryebookspdf/building-information-modeling.pdf	

TRANSPORTATION ENGINEERING LABORATORY

VII Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB25	Core	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Identify the properties and behavior of highway material for different loading patterns.
II. Demonstrate tests on transportation materials like aggregate, bitumen, sand etc. and check their suitability.
III. Understand the properties of cement by conducting setting time, specific gravity and compressive strength tests.
IV. Understand techniques to characterize various pavement materials through relevant tests.

LIST OF EXPERIMENTS

Week – I	**INTRODUCTION TO TRANSPORTATION LABORATORY – I**
Introduction to transportation material laboratory. Do's and Don'ts in materials lab.	
Week – 2	**AGGREGATE CRUSHING STRENGTH TEST**
Measurement of Aggregate crushing test.	
Week – 3	**AGGREGATE IMPACT TEST**
Measurement of Aggregate Impact test	
Week – 4	**SPECIFIC GRAVITY AND WATER ABSORPTION TEST**
Calculation of specific gravity and water absorption test.	
Week – 5	**ABRASION AND ATTRITION TEST OF COARSE AGGREGATES**
To perform Abrasion and Attrition test of coarse aggregates.	
Week – 6	**SHAPE TESTS OF COARSE AGGREGATES**
Measurement of percentage of Flakiness in coarse aggregates. Measurement of percentage of Elongation in coarse aggregates	
Week – 7	**PENETRATION AND DUCTILITY TEST OF BITUMINOUS MATERIALS**
To find the Penetration and ductility value of bitumen sample.	
Week – 8	**SOFTENING POINT OF BITUMEN MATERIALS**
To find the softening point value of bituminous materials.	
Week – 9	**FLASH AND FIRE POINT TEST OF BITUMEN MATERIALS**
To find the flash point value of bitumen sample.	
Week – 10	**NORMAL CONSISTENCY OF FINENESS OF CEMENT**
To perform test and find the normal consistency of fineness of cement.	
Week – 11	**INITIAL SETTING TIME AND FINAL SETTING TIME OF CEMENT**
To find the initial and final setting time of cement.	
Week – 12	**SPECIFIC GRAVITY AND SOUNDNESS OF CEMENT**
To find the specific gravity and soundness of cement.	
Week – 13	**COMPRESSIVE STRENGTH OF CEMENT**
To find the compressive strength of cement.	
Week – 14	**BULKING OF FINE AGGREGATES**

To find the bulking of fine aggregates of sand .	
Week – 15	**STRUCTURAL EVALUATION OF PAVEMENT USING BENKELMAN BEAM DEFECTION METHOD**
Structural evaluation of pavement surface by Benkelman beam deflection method	
Text Books:	
1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, "Highway Engineering", Nem Chand & Bros, Revised 10th Edition, 2017. 2. Kadiyalai, L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2013. 3. Partha Chakraborty, "Principles Of Transportation Engineering", PHI Learning, 2017.	
Reference Books:	
1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", John Wiley, 4th Edition, 2007. 2. Srinivasa Kumar, R, "Textbook of Highway Engineering", Universities Press, 2011. 3. Paul H. Wright and Karen K. Dixon, 'Highway Engineering', Wiley Student Edition, 7th Edition, 2009.	

PROJECT WORK - I

VII Semester: Common for all branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB54	Core	-	-	10	5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 150				Total Classes: 150		

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis / Modelling / Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

PROJECT WORK - II

VIII Semester: Common for all branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB55	Core	-	-	12	6	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 180				Total Classes: 180		

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EEP1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis / Modelling / Simulation / Design / Problem Solving / Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

CONCRETE TECHNOLOGY

PE – I : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB26	Elective	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Discuss the physical and chemical properties of cement and admixtures.
II. Understand the workability of concrete, manufacturing processes of concrete and the behavior of the hardened concrete.
III. Identify, formulate and solve problems in concrete mix design.
IV. Enrich the practical knowledge on mix design principles, concepts and methods.

MODULE – I	CEMENTS ADMIXTURES AND AGGREGATES	Classes: 09

Portland cement: Chemical composition, hydration, setting of cement, structure of hydrate cement, test on physical properties, different grades of cement. Admixtures: Mineral and chemical admixtures, properties, dosage, effects usage; Aggregates: Classification of aggregate, particle shape & texture bond, strength & other mechanical properties of aggregate, specific gravity, bulk density, porosity, adsorption & moisture content of aggregate, bulking of sand, deleterious substance in aggregate, soundness of aggregate, alkali-aggregate reaction, thermal properties, sieve analysis, fineness modulus, grading curves, grading of fine & coarse aggregates, gap graded aggregate, maximum aggregatesize.

MODULE – II	FRESH CONCRETE	Classes: 09

Workability: Factors affecting workability, measurement of workability by different tests, setting times of concrete, the effect of time and temperature on workability, segregation & bleeding, mixing and vibration of concrete, steps in manufacture of concrete, quality of mixing water.

MODULE – III	HARDENED CONCRETE AND IT'S TESTING	Classes: 09

Water / Cement ratio: Abram's Law, Gel space ratio, Nature of strength of concrete, maturity concept, strength in tension and compression, factors affecting strength, relation between compression and tensile strength curing.

Testing of hardened concrete: compression tests, tension tests, factors affecting strength, flexure tests, split tests, nondestructive testing methods, code provisions for NDT; Elasticity: Creep & shrinkage, modulus of elasticity, dynamic modulus of elasticity, Poisson's ratio, creep of concrete, factors influencing creep, relation between creep &time, nature of creep, effects of creep, shrinkage, types of shrinkage.

MODULE – IV	MIX DESIGN	Classes: 09

Factors in the choice of mix proportions, durability of concrete, quality control of concrete, Statistical methods, acceptance criteria, proportioning of concrete mixes by various methods, BIS method of mix design.

MODULE – V	SPECIAL CONCRETES	Classes: 09

Lightweight aggregates, lightweight aggregate concrete, cellular concrete, No fines concrete, high-density concrete, fiber reinforced concrete, different types of fibers, factors affecting properties of F.R.C, applications, polymer concrete, types of polymer concrete, properties of polymer concrete applications, high-Performance concrete, self-consolidating concrete, SIFCON.

Text Books:

1. Shetty,M.S., “ConcreteTechnology – Theory and Practical”, S. Chand and Co, 2004. 2. Gambhir,M.L., “ConcreteTechnology”,Tata McGraw Hill,2004. 3. Nevile, “Properties of Concrete”, Longman Publishers, 2004.
Reference Books:
1. Santa kumarA.R., “ConcreteTechnology”,Oxford University Press, New Delhi, 2007.
Web References:
1. https://nptel.ac.in/courses/105102012/ 2. https://nptel.ac.in/courses/105106176/
E-Text Books:
1. https://www.schandpublishing.com/author-details/-m-s-shetty/561 2. http://www.e-booksdirectory.com/googlesearch.php?q=CONCRETE%20TECHNOGY%20

BUILDING CONSTRUCTION PRACTICES

PE – I : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB27	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Analyze the Environmental impacts of building materials.
II. Describe concepts of sustainability in the context of building and conventional engineered building materials.
III. Understand the materials which optimize the performance.
IV. Identify the concepts of green buildings.
V. Explain the future scope of green building technology in India.

MODULE – I	EARTHWORK – MASONRY	Classes: 09

Earthworkmasonry – stonemasonry, Bond in masonry, concrete hollow block masonry, flooring damp proof courses.

MODULE – II	FLOORS AND CONSTRUCTION JOINTS	Classes: 09

Types of floors Mosaic, Marble, Granite, Tile flooring, Cladding of tiles, damp proof courses, movement, and expansion joints

MODULE – III	FORMWORK AND STEEL STRUSS	Classes: 09

Centering and shuttering: Slip forms, de – shuttering forms – Scaffoldings, shoring, underpinning.

Fabrication and erection of steel trusses, frames, braced domes.

MODULE – IV	SUB STRUCTURE CONSTRUCTIONTECHNIQUES	Classes: 09

Box jacking – Pipe Jacking, underwater construction of diaphragm walls and basement, Tunnelling techniques – Piling techniques, well and caisson, sinking cofferdam, cable anchoring, and grouting, driving diaphragm walls, sheet piles - shoring for deep cutting well points, Dewatering and stand by Plant equipment for underground open excavation.

MODULE – V	SUPERSTRUCTURE CONSTRUCTION AND MATERIAL HANDLING	Classes: 09

Launching girders, bridge decks, offshore platforms – special forms for shells, techniques for heavy decks – in-situ, Pre-stressing in high rise structures, erecting lightweight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and spacious decks.

Text Books:

1. S.K.Duggal, “Building Materials”, New Age International (P) Limited, 4th Edition, 2016.
2. Dr.S.K Sharma, “A textbook of Building Construction”, S.Chand Publication, 2013.

Reference Books:

1. S.C Rangwala, “Building Construction,” Charotar Publishing House, Anand, 1993.
2. R. Chudley, “Construction Technology – Volumes 1 and 2,” 2nd Edition, Longman, UK, 1987.
3. W. B. McKay, “Building Construction – Volumes 1, 2, 3, and 4,” Orient Longman, UK, 5th Edition,1993.

Web References:

1. https://nptel.ac.in/courses/105102195/ 2. https://nptel.ac.in/courses/105102088/ 3. https://nptel.ac.in/courses/105106053/
E-Text Books:
1. https://docs.google.com/viewer?a=v&pid=sites&srcid=bWl0ci5paXRtLmFjLmlufGlpdG1jaXZpbHxneDo1MWYxNGZiODVkYWQ3NTNj 2. https://books.google.co.in/books?id=_kAvTMzKGhAC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

CONSTRUCTION EQUIPMENT AND MATERIALS

PE – I : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB28	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Know various types of equipments to be used in the constructions projects.
II. Learn basic principles of Construction Management & Various networking techniques of project controlling in the context of various construction aspects.
III. Study Scheduling of the project & resource allocating in terms of site management.
IV. Finalize quantities of items, Equipment and resource requirement of civil engineering Work.

MODULE - I	CONSTRUCTION EQUIPMENTS AND MANAGEMENT	Classes: 09

Identification, planning of equipment, selection of equipment, equipment management in projects, maintenance management, equipment cost, operating cost, cost control of equipment. Depreciation analysis, replacement of equipment, replacement analysis, safety management.

MODULE -II	EQUIPMENT FOR EARTHWORK	Classes: 09

Fundamentals of earth work operations, earth moving operations, types of earth work equipment tractors, motor graders, scrapers, front end waders, dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment.

MODULE - III	OTHER CONSTRUCTION EQUIPMENT	Classes: 09

Equipment for dredging, trenching, drag line and clamshells, tunneling, equipment for drilling and blasting, pile driving equipment, erection equipment – Crane, mobile crane, types of pumps used in construction, equipment for dewatering and grouting, equipment for demolition.

MODULE - IV	CONCRETE PLANTS	Classes: 09

Aggregate production, different crushers – Feeders, screening equipment, handling equipment,batching and mixing equipment, pumping equipment, Ready Mix Concrete (RMC) equipment, concrete pouring equipment.

MODULE - V	MATERIALS HANDLING EQUIPMENT	Classes: 09

Forklifts and related equipment, portable material bins, material handling conveyors, material handling cranes.

Text Books:

1. Peurifoy, L., Schexnayder, C.J. and Shapira, A., "Construction Planning, Equipment and Methods", 8th Edition, McGraw Hill,New Delhi, 2010.
2. Sharma, S.C., "Construction Equipment & Management", Khanna Publications, New Delhi, 1988.

Reference Books:

1. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
2. Dr.Mahesh Varma, "Construction Equipment and its planning and Application", Metropolitan Book Company, New Delhi. 1983.

Web References:

1. https://www.academia.edu/35195975/Construction_Equipment_Management
2. https://www.slideshare.net/abhijitpawar9406/construction-book

E-Text Books:
1. https://www.slideshare.net/abhijitpawar9406/construction-book 2. http://www.e-booksdirectory.com/details.php?ebook=7400re

ENGINEERING MATERIALS FOR SUSTAINABILITY

PE – I : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB29	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Analyze the Environmental impacts of building materials.
II. Describe concepts of sustainability in the context of building and conventional engineered building materials.
III. Understand the materials which optimize the performance.
IV. Identify the concepts of green buildings.
V. Explain the future scope of green building technology in India.

MODULE - I	ENVIRONMENTAL IMPACT OF MATERIALS	Classes: 09

Environmental Impacts and Embodied Energies, Operational energy in Building, Ecological foot Print, low energy materials, alternative materials Concept of carbon emission and its reduction, carbon foot print– Carbon capture and storage (CCS).

MODULE - II	LIFE-CYCLE ASSESSMENT	Classes: 09

Life Cycle Assessment Approaches, Four Main phases of LCA, Operational and Life Cycle Energy, Assessment methods Global assessment and certification, Local assessment,Life Cycle Analysis (LCA).

MODULE - III	MATERIAL SELECTION TO OPTIMIZE PERFORMANCE	Classes: 09

Role of Material: Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete.

Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete, Reduction in water consumption in concrete.

MODULE - IV	DESIGN, EVALUATION OF GREEN ENERGY	Classes: 09

Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Rainwater harvesting.

MODULE - V	PRODUCTION OF GREEN CONSTRUCTION MATERIALS	Classes: 09

Green Engineering concepts, Use of Building Integrated Photo Voltaic (BIPV), renewable energy in buildings and efficiency, Energy codes ECBC requirement, Concepts of OTTV, Green Performance rating, requirements of LEED, GRIHA (Green Rating for Integrated Habitat Assessment), IGBC Certification for buildings

Text Books:

1. Jimmy C.M. Kao, Wen-Pei Sung, Ran Chen, "Green Building, Materials and Civil Engineering", CRC Press, 1st Edition, 2014.
2. Jamal M. Khatib, "Sustainability of Construction Materials", Woodhead publishing, 2nd Edition.
3. H, Ravindranath, K Usha Rao, "Renewable Energy and Environment" -A Policy Analysis for India, Tata McGraw Hill, 2000.
4. Ross Spiegel and Dru Meadows, "Green Building Materials": A Guide to Product Selection and Specification, 3rd Edition, 2009.
5. Charles.J.Kibert, John Wiley & Sons, New Jersey, "Sustainable Construction: Green Building Design and Delivery", 2008.

Reference Books:
1. Sustainable Engineering Practice ASCE Publication 2010. 2. LEED for India: Reference Guide, 2011. 3. Krishnakedar. S. Gumaste,, "Embodied Energy Computations in Buildings" Journal of Advances in Energy Research.
Web References:
1. https://nptel.ac.in/courses/105102195/ 2. https://unacademy.com/search/green%20building%20in%20india/
E-Text Books:
1. https://www.crcpress.com/Green-Building-Materials-and-Civil-Engineering/Kao-SungChen/p/book/9781138026698?source=igodigital#googlePreviewContainer. 2.https://books.google.co.in/books?id=5_9JCgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

DESIGN OF STEEL STRUCTURES AND DRAWING

PE – II : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB30	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Discuss the concepts of structural steel design conforming to the IS 800 design code.
II. Identify various types of structural steel and its properties also define concepts of Limit State Design.
III. Analyze structures using plastic method of analysis and evaluate collapse load and plastic moment capacity.
IV. Design compression members, beams, connections and girders.

MODULE - I	INTRODUCTION ON MECHANICAL BEHAVIOUR OF STEEL	Classes: 09

Materials, making of iron and steel, types of structural steel, mechanical properties of steel, concepts of plasticity yield strength, loads and combinations, behavior of steel, local buckling. Concept of limit state design – different limit states as per IS 800:2007. Design strengths deflection limits, serviceability, bolted connections, efficiency of joint, prying action, design of tension members, design strength of members.

MODULE - II	COMPRESSION MEMBERS	Classes: 09

Design of compression members, buckling class, slenderness ratio, strength design, laced columns, battened columns, slab base.

MODULE - III	BEAMS	Classes: 09

Design of beams, bending and shear strength laterally supported beams.

Design, built up sections, large plates web buckling, crippling and deflection of beams, design of purlin.

MODULE - IV	ECCENTRIC CONNECTIONS	Classes: 09

Design of eccentric connections with brackets, beam end connections, web angles, design of truss joints.

MODULE - V	PLATE GIRDERS	Classes: 09

Design of plate girders, optimum depth, design of main section, design of end bearing stiffeners and intermediate stiffeners. Connection between web and flange.

Text Books:

1. S. K. Duggal, “Limit state design of steel structures”, 3rd Edition, Tata McGraw-Hill, 2019.
2. N. Subramanian, “Design of steel structures”, 2nd Edition, Oxford University Press, 2016.
3. S.S. Bhavikatti, “Design of steel structures”, 4th Edition, IK International Publication House, New Delhi, 2014.

Reference Books:

1. K. S. Sai Ram, “Design of steel structures”, Pearson Education, 2nd Edition, 2015.
2. Dr. Ramachandra and Virendra Gehlot, “Design of steel structures Volumes 1 and 2”, Standard Publications, 2nd Edition, 2010.
3. Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer, “Design of Steel Structures”, Tata McGraw-Hill Education private Limited, 3rd Edition, 2010.

Web References:
1. http://www.nptel.ac.in/downloads/105106112/ 2. http://iitmweb.iitm.ac.in/phase2/courses/105103094/12 3. http://freevideolectures.com/Course/2679/Design-Of-Steel-Structures
E-Text Books:
1. http://www.freeengineeringbooks.com/Civil/Steel-Structure-Design-Books.php 2. https://books.google.co.in/books/about/Comprehensive_Design_of_Steel_Structures.html?id=pXekq3F

STRUCTURAL GEOLOGY

PE – II : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB31	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Discuss the process of formation of rocks, their classifications and properties of minerals.
II. Identify different geological structures encountered in nature.
III. Recognize different hazards such as earthquakes, landslides etc causes and their effects.
IV. Explain the importance of geophysical and geological studies of site for dams and reservoirs.

MODULE -I	INTRODUCTION	Classes: 09

Importance of geology from Civil Engineering point of view. Brief study of case histories of failures of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology. Weathering of Rocks: Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like "Granite"

MODULE – II	STRUCTURAL GEOLOGY	Classes: 09

Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults, unconformities, and joints – their important types. Their importance In-situ and drift soils, common types of soils, their origin and occurrence in India.

MODULE - III	MINERALOGY AND PETROLOGY	Classes: 09

MINERALOGY: Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldspar , Quartiz , Flint , Jasper, Olivine, Augite , Hornblende , Muscovite , Biotite , Asbestos, Chlorite , Kyanite , Garnet, Talc, Calcite.

PETROLOGY: Definition of rock, geological classification of rocks into igneous, sedimentary and metamorphic. Dykes and Sills, common structures and textures of igneous, sedimentary and metamorphic rocks. Megascopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate. Rock excavation, stone aggregates.

MODULE -IV	GEOLOGICAL HAZARDS	Classes: 09

EARTH QUAKES: Terminology, Causes, Classification, Earthquake waves, Seismograph, Locating Epicenter, Determination of depth of focus, Intensity, Magnitude, Prediction, Effects, Seismic belts, Shield areas – Seismic zones of India – Civil Engineering considerations in seismic areas – Safety measures for buildings and dams – Reservoir induced seismicity. Landslides: Causes, effects, preventive measures.

MODULE -V	GEOLOGY OF DAMS AND RESERVOIRS	Classes: 09

Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factors Contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs – case studies.

Text Books:
1. N. Chennkesavulu, “Engineering Geology”, Mc Milan India Private Limited, 12th Edition, 2009. 2. D.Venkat Reddy, “Engineering Geology”, Vikas Publications, 2nd Edition, 2011. 3. Vasudev Kanithi, “Engineering Geology”, University Press, 1st Edition, 2013.
Reference Books:
1. F.G. Bell, “Fundamentals of Engineering Geology”, B S Publications, 1st Edition, 2005. 2. K. V. G. K. Gokhale, “Principles of Engineering Geology”, B S Publications, 5th Edition, 2008. 3. S.K Duggal, “Engineering Geology”, Mc Graw Hill Publications, 1st Edition, 2017.
Web References:
1. http://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-001-introduction-togeology-fall-2013/ 2. http://nptel.ac.in/courses/105105106/
E-Text Books:
1. http://cepdf.blogspot.in/2012/07/geology-for-civil-engineers-pdf-book.html 2. https://www.studynama.com/community/threads/187-Engineering-Geology-Ebook-Lecture-NotesPDF-download- for-Civil-Engineers

INDUSTRIAL STRUCTURES

PE - II: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB32	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Discuss the planning and functional requirements of Industrial structures.
II. Discover the need to learn about the design concepts, and constructional aspects of Industrial Structures.
III. Evaluate the importance of various construction materials for Industrial constructions.
IV. Design portal frames, tower cranes and bracing system in Industrial buildings.

MODULE– I	PLANNING OF INDUSTRIES	Classes: 09

Classification of Industries and Industrial structures – General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components.

MODULE – II	DESIGN OF FRAMES	Classes: 09

Types of roof trusses, components of roof trusses, economical spacing of trusses, spacing of purlins, Types of Frames, Design of Frame with seated moment resisting connections.

MODULE – III	DESIGN OF GIRDERS	Classes: 09

Introduction to girders, loads acting on the girders, types of girders, analysis of gantry girders.

Design of gantry girders,types of brackets, different components of bracket, steel bracket design.

MODULE – IV	TRANSMISSION TOWERS	Classes: 09

Towers, lattice tower configurations and bracings, Principles of Analysis and Design of Lattice towers, Transmission towers. Design ofLattice towers andtransmission towers.

MODULE – V	DESIGN OF CHIMNEY, BUNKER AND SILOS	Classes: 09

Introduction to chimneys, dimensions of steel stacks, loads acting on the chimneys, design of chimneys, Design of bunkers and silos; Design concepts and IS code provisions.

Text Books:

1. P. Purushothaman, “Reinforced Concrete Structural Elements”, Tata McGraw-Hill Publishing,3 rd Edition, 2004
2. P.C Varghese, “Advanced reinforced concrete structures”, Prentice Hall of India Pvt. Ltd, 3rd Edition, 2009.
3. P.Dayaratnam, “Design of Steel Structure” S. Chand and Company, 1st Edition, 2008.
4. N.Subramanian, “Design of Steel Structures Limit State Method”, Oxford Publications, 2nd Edition, 2016.

Reference Books:

1. M. Raghupati, “Design of Steel Structures”, McGraw Hill Education Pvt. Ltd, New Delhi, India.2000.
2. B C Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Reinforced Concrete Structures”, Laxmi

Publications, 2nd Edition, 2012. 3. S Unnikrishna Pillai and DevdasMenon, "Reinforced Concrete Design", McGraw Hill Publications, 3rd Edition, 2017. 4. A.S Arya and J.L Ajmani, "Design of Steel Structures", Nem Chand & Bros Publishers, 6th Edition, 2014.
Web References:
1. https://nptel.ac.in/courses/105106113/ 2. https://www.ijariit.com/manuscripts/v3i4/V3I4-1232.pdf
E-Text Books:
https://www.amazon.in/Advanced-Reinforced-Concrete-Design ebook/dp/B00K7YFUBI?tag=googinhydr18418-21

BRIDGE ENGINEERING

PE – II : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB33	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Know the different types of Bridges based on materials used and shapes.
II. Different forces acting on the bridge structures as per codal provisions.
III. Analyze and design of reinforced cement concrete and steel bridges.
IV. Understand the different bridge foundations and design criteria for foundations.

MODULE -I	INTRODUCTION	Classes: 09

Definition, components of bridge, classification of bridges and selection of site, economical span, aesthetics consideration and necessary shapes investigation, essential design data.

Standard Considerations for roads and railway bridges: General, Indian road Congress, Bridge Code, Width of carriage way, clearance, Various loads to be considered for the design of roads and railway bridges, explanation of IRC Standard live loads.

MODULE -II	DESIGN CONSIDERATIONS FOR RCC BRIDGES	Classes: 09

Various types of Reinforced Cement Concrete Bridges (Brief Description of each type), Design of Reinforced Cement Concrete Culvert and T-Beam Bridge.

MODULE -III	DESIGN CONSIDERATIONS FOR STEEL BRIDGES	Classes: 09

Various types of steel bridges - Brief description of each

Design of truss and plate girder bridges.

MODULE -IV	HYDRAULIC AND STRUCTURAL DESIGN	Classes: 09

Piers, Abutments, wing-wall and approaches. Brief Description: Bearings, joints, articulation and other details.

MODULE -V	BRIDGE FOUNDATION	Classes: 09

Various types, Necessary investigations, and design criteria of well foundation.

Text Books:

1. D. Johnson Victor, "Essentials of Bridge Engineering", Oxford Publishers, 6th Edition,2017.
2. T.R.Jagadeesh & M.A Jairam, "Design of Bridge Structures", Prentice Hall India Learning Private Limited, 2nd Edition, 2009.
3. N.Krishna Raju, "Design of Bridges", Oxford & IBHPublishing Co Pvt.Ltd, 5th Edition, 2017.
4. S. Ponnuswamy, "Bridge Engineering", McGraw Hill Education, 3rd Edition,2017.

Reference Books:

1. Rangwala, "Bridge Engineering", Charotar Publishing House Pvt. Ltd, 16th Edition,2015.
2. S.P.Bindra, "Principles and Practice of Bridge Engineering", Dhanpat Rai Publications, 1st Edition,2012.
3. N.Krishna Raju, "Prestressed Concrete Bridges", CBS publishers, 1st Edition, 2010.
4. M.K. Pant, "Elements of Bridge Engineering", S.K. Kataria & Sons, 1st Edition,2014.

Web References:

https://nptel.ac.in/courses/105105165/

E-Text Books:

https://books.google.co.in/books?id=FNl04EyZ7iEC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

DESIGN OF CONCRETE STRUCTURES - I

PE – III : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB34	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Identify, formulate and solve engineering problems of RC elements.
II. Differentiate between working stress design and limit state design.
III. Understand the importance of limit state design in reinforced concrete beams and slabs.
IV. Design of different structural members like beam, slab, column and footing.

MODULE - I	**DESIGN OF BEAMS**	**Classes: 09**

Concepts of RC Design –Limit state method, Material Stress–Strain curves, Safety factors, Characteristic values, Stress block parameter, IS-456:2000 - Working Stress Method. BEAMS: Limit state analysis and design of singly reinforced, doubly reinforced, T, and L beam sections.

MODULE - II	**SHEAR TORSION AND BOND**	**Classes: 09**

Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing Limit state design for serviceability for deflection, cracking and codal provision.

MODULE - III	**DESIGN OF SLABS**	**Classes: 09**

Design of One-way Slabs and Two-way slabs.

Continuous slabs using I.S. coefficients, Cantilever slab or Canopy slab.

MODULE - IV	**DESIGN OF COLUMNS**	**Classes: 09**

Design of short columns for axial loads, uni-axial and bi-axial bending. I.S. Code provisions

MODULE - V	**DESIGN OF FOOTINGS**	**Classes: 09**

Design of isolated square and rectangular footings for axially and eccentrically loaded columns, Design of combined footing.

Text Books:

1. Dr. B. C. Punmia, "Limit state design of reinforced concrete", Laxmi Publications, NewDelhi.
2. S. Unnikrishna Pillai and Devdas Menon, "Reinforced concrete design", Tata Mc. Graw Hill, New Delhi.
3. N. Krishna Raju and R. N. Pranesh, "Reinforced Concrete Design", New Age International Publishers, New Delhi.
4. P. C. Varghese, "Limit state design of reinforced concrete", Prentice Hall of India, New Delhi.

Reference Books:

1. M. L. Gambhir, "Fundamentals of reinforced concrete design", Prince Hall of India Pvt. Ltd, New Delhi.
2. P. Purushotham, "Reinforced concrete structural elements – behavior, Analysis and design", Tata McGraw Hill, 1994.

Web References:

3. https://nptel.ac.in/courses/105105105/
4. https://www.youtube.com/watch?v=pIdaC_I6H_M&list=PL51300B0778FB5784

E-Text Books:

1. https://civildatas.com/download/advanced-reinforced-concrete-design-by-varghese
2. https://easyengineering.net/reinforced-concrete-design-books/

REINFORCED CONCRETE

PE – III : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB35	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the design philosophies of various methods of design.
II. Design the Reinforced Concrete beams using limit state and working stress methods.
III. Design Reinforced Concrete slabs.
IV. Design the Reinforced Concrete Columns and footings.
V. Design structures for serviceability

MODULE - I	CONCEPTS OF REINFORCED CONCRETE	Classes: 09

Introduction, Design loads, Materials for reinforced concrete and code requirements. Design Philosophy- Limit state design principles. Philosophy of limit state design, Principle of limit states, Factor of safety, Characteristics and design loads, Characteristics and design strength.

MODULE - II	PRINCIPLES OF LIMIT STATE DESIGN AND ULTIMATE STRENGTH OF RC SECTION	Classes: 09

General aspects of Ultimate strength, Stress block parameters for limit state of collapse, flexural strength of singly reinforced rectangular sections, Ultimate flexural strength of doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate strength of RC sections, Ultimate torsional strength of RC sections, Concept of development length and anchorage, Analysis examples of singly reinforced, double reinforced, flanged sections, shear strength and development length.

MODULE - III	FLEXURE AND SERVICEABILITY LIMIT STATES	Classes: 09

General specifications for flexure design of beams-practical requirements, size of beam, cover to reinforcement-spacing of bars. Design for Serviceability

Concept of Serviceability- Deflection- Span to depth ratio- Short term-Long term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.

MODULE - IV	BEAMS AND COLUMNS	Classes: 09

Analysis of shear and axial forces of beams, Design of Singly Reinforced Beams, doubly reinforced beams, continuous beams and T and L beams.

Design of RC Columns- Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum eccentricity-Use of Interaction diagrams for Axial load and Moment.

MODULE - V	SLABS AND FOOTINGS	Classes: 09

Design of RCC Slabs- Design of One Way, Two way slabs and Continuous Slabs- Effect of edge conditions- Moment of resistance-Torsion reinforcement at corners.

Design of Rectangular Footing, Square Footing and Combined Footing.

Text Books:

1. P.C.Varghese, “Limit state designed of reinforced concrete”, Printice Hall of India, New Delhi
2. S.Unnikrishna Pillai & Devdas Menon, “Reinforced Concrete Design” Tata McGraw Hill, New Delhi.
3. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Limit State Design”, Laxmi, publications Pvt. Ltd., New Delhi

Reference Books:

1. P. C. Varghese, “Limit State Designed of Reinforced Concrete”, Prentice Hall of India, New Delhi
2. Nilson, A. H., “Design of Concrete Structures”, McGraw Hill, 13th Edition, 2004.

Web References:

1. https://nptel.ac.in/courses/105105105/
2. https://swayam.gov.in/nd1_noc19_ce22/preview
3. https://nptel.ac.in/courses/105105104/
4. https://nptel.ac.in/courses/105105165/

E-Text Books:

1. https://www.e-booksdirectory.com/details.php?ebook=9205
2. https://www.e-booksdirectory.com/details.php?ebook=7193

DESIGN OF STRUCTURAL SYSTEMS

PE – III : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB36	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Introduce the structural system concepts and design processes methodology in relation to architectural and services systems peculiarities of building projects.
II. Understands the selection of the appropriate structural systems.
III. Understands broader understanding of the design process and structural detailing aspects which are essential for the design management and construction management responsibilities
IV. Understands the sustainability issues
V. Planning, design emphasis would consider life cycle cost economics

MODULE - I	**STRUCTURAL DESIGN PROCESS**	**Classes: 09**

Principles of structural analysis, design and detailing, static and dynamic loading concepts, concept of prescriptive versus performance based design.

MODULE - II	**SELECTION OF STRUCTURAL SCHEME AND FORMAULATION OF DESIGN CRITERIA**	**Classes: 09**

Study of structural requirements of buildings, Basis of Design; Various structural systems for low-rise (including confined masonry), multi-storyed, tall and super tall buildings and their planning and design considerations including cost economics.

MODULE - III	**DESIGN CRITERIA**	**Classes: 09**

Durability of structures, service life of structure; Structural fire safety;

Special structure systems including large span structures, blast resistance.

MODULE - IV	**ASSESSMENT OF DISTRESSED STRUCTURES AND FORENSICS**	**Classes: 09**

Constructability review and construction method statement; Assessment of distressed structures and forensics; Sustainable structure system design.

MODULE - V	**PERFORMANCE BASED DESIGN OF STRUCTURES**	**Classes: 09**

Analysis of special buildings (including tall and super tall); Co-ordination between structural systems and architectural and building services system

Text Books:

1. Nilson, A. H. "Design of Concrete Structures", . McGraw Hill, 13th Edition, 2004.
2. McCormac, J.C., Nelson, J.K. Jr., "Structural Steel Design", Prentice Hall, N.J., 3rd Edition, 2003.
3. Galambos, T.V., Lin, F.J., Johnston, B.G., "Basic Steel Design with LRFD", Prentice Hall, 1996.

Reference Books:

1. Segui, W. T., LRFD Steel Design, PWS Publishing, Boston, 2nd Edition. 1998.
2. Salmon, C.G. and Johnson, J.E., "Steel Structures: Design and Behavior", , Harper & Row, Publishers, New York, 3rd Edition, 1990.
3. MacGregor, J. G., "Reinforced Concrete: Mechanics and Design", Prentice Hall, New Jersey, 3rd Edition, 1997.
4. SAP2000 Analysis Reference and Tutorials, Computers and Structures.

Web References:

1. https://nptel.ac.in/courses/105105105/

2. https://nptel.ac.in/courses/105105166/
E-Text Books:
1. https://books.google.co.in/books?id=8J_4QwAACAAJ&dq=1 2. https://books.google.co.in/books?id=WggfCgAAQBAJ&pg=PA135&dq

MASONRY STRUCTURES

PE – III : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB37	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
II. Understand the permissible stresses and the design considerations that will come for masonry structures.
III. Analyze the masonry structures subjected to axial loads.
IV. Analyze the walls subjected to concentrated axial loads.
V. Analyze laterally and transversely loaded walls.

MODULE - I	MASONRY UNITS, MATERIALS, TYPES AND MASONRY CONSTRUCTION	Classes: 09

Masonry Units, Materials, types and masonry construction:Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability:Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

MODULE - II	PERMISSIBLE STRESSES	Classes: 09

Permissible stresses:Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations:Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

MODULE - III	LOAD CONSIDERATIONS AND DESIGN OF MASONRY SUBJECTED TO AXIAL LOADS	Classes: 09

Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Load considerations and design of Masonry subjected to axial loads. Design criteria, design examples of walls under UDL.

MODULE - IV	DESIGN OF WALLS SUBJECTED TO CONCENTRATED AXIAL LOADS	Classes: 09

Design of walls subjected to concentrated axial loads:Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Design of walls subjected to eccentric loads:Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

MODULE - V	DESIGN OF LATERALLY AND TRANSVERSELY LOADED WALLS	Classes: 09

Design of Laterally and transversely loaded walls. Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs. In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

Text Books:
1. Henry, A.W., “Structural Masonry”, Macmillan Education Ltd., 1990. 2. Dayaratnam P, “Brick and Reinforced Brick Structures”, Oxford & IBH, 1987. 3. M. L. Gambhir, “Building and Construction Materials”, Mc Graw Hill education Pvt. Ltd.
Reference Books:
1. IS 1905–1987 “Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi. 2. SP 20 (S&T) – 1991, “Hand book on masonry design and construction (1st revision) BIS, New Delhi.
Web References:
1. https://nptel.ac.in/courses/105106197/# 2. https://www.youtube.com/watch?v=btajjXi0q9s
E-Text Books:
1. https://www.uop.edu.jo/download/Research/members/%5BArchitecture_Ebook%5D_Design_of_Masonry_Structures.pdf 2. http://www.egyptarch.gov.eg/sites/default/files/pdf/Books/Book%20-%20Structural%20masonry%20designers%20manual.pdf

FOUNDATION ENGINEERING

PE – IV : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB38	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand various methods of soil exploration and field tests on soil, planning and preparation of soil investigation programme.
II. Analyze the stability of infinite and finite slopes
III. Calculate At rest, Active and Passive earth pressures of soil & analyze the stability of retaining wall against sliding, overturning and bearing capacity failures.
IV. Calculate the bearing capacity of shallow and deep foundation from theoretical & field tests.

MODULE – I	SOIL EXPLORATION	Classes: 09

Need and methods of soil exploration, boring and sampling methods, pits and trenches, drifts and shafts, methods of boring, auger borings, wash borings, rotary drilling, percussion drilling, core drilling, types of soil samples, disturbed samples, undisturbed samples, design features affecting the sample disturbance, split spoon samplers, scraper bucket samplers, shell by tubes and thin walled samplers, piston samplers, preservation and handling of samples. penetration tests, monotonic and cyclic, field permeability tests, insitu tests using pressure meter, observation of ground water table, instrumentation in soil engineering, strain gauges, resistance and inductance type plate load test, pressure meter, geophysical methods, planning of programme and preparation of soil investigation report.

MODULE –II	SLOPE STABILITY	Classes: 09

Infinite and finite earth slopes, types of failures, factor of safety of infinites lopes, stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method, Taylor's Stability number, and stability f slopes of earth dams under different conditions.

MODULE – III	EARTH PRESSURE THEORIES AND RETAINING WALLS	Classes: 09

Rankine's theory of earth pressure, earth pressures in layered soils, Coulomb's earth pressure theory, Culmann's graphical method.

Types of retaining walls, stability of retaining walls against overturning, sliding, bearing capacity and drainage from backfill.

MODULE –IV	SHALLOW AND DEEP FOUNDATIONS	Classes: 09

Types, choice of foundation, location of depth, safe bearing capacity, Terzaghi, Meyerhof, Skempton and IS Methods. Safe bearing pressure based on N value, allowable bearing pressure, safe bearing capacity, plate load test, allowable settlements of structures, Analysis of foundation, individual, strip, combined footings and mat foundations conventional, elastic approach, soil structure interaction principles. Types of piles, load carrying capacity of piles based on static pile formulae in dynamic pile formulae, pile load tests, load carrying capacity of pile groups in sands and clays, settlement of pile groups. Introduction to foundations on expansive soils and marine foundations.

MODULE - V	WELL FOUNDATIONS	Classes: 09
Different shapes of wells, components of well, sinking of well, tilts and shifts, principles of analysis and design, seismic influences, IRC guidelines		

Text Books:

1. Braja M. Das, "Principles of geotechnical engineering" Cengage learning publishers, 2002
2. V.N.S Murthy,"Geotechnical Engineering: Principles and practices of soils mechanics and foundation engineering", Taylor & Francis Group, 2002.
3. Gopal Ranjan and ASR Rao, "Basic and Applied Soil Mechanics", New age international Pvt. Ltd, New Delhi, 2000.

Reference Books:

1. C. Venkataramiah, "Geotechnical engineering", New Age International Pvt. Ltd, 2002.
2. Manoj dutta and Gulati, "Geotechnical engineering", Tata Mc Grawhill publishers New Delhi, 2005.
3. K.R .Arora, "Soil mechanics and foundation engineering", standard publishers and distributors, New Delhi, 2005.

Web References:

1. http://nptel.ac.in/courses/105107120/1#
2. 2.https://ocw.mit.edu/courses/civil,and,environmental,engineering/1,364,advanced,geotechnical,engineering,fall,2003/index.html

SOIL DYNAMICS AND MACHINE FOUNDATIONS

PE – IV : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB39	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the wave propagation in soils,
II. Determine dynamic properties of soil for analyzing.
III. Designing foundations subjected to vibratory loading

MODULE – I	FUNDAMENTALS OF VIBRATION	Classes: 09

Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

MODULE – II	WAVE PROPAGATION AND DYNAMIC SOIL PROPERTIES	Classes: 09

Propagation of seismic waves in soil deposits – Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties – Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.

MODULE – III	VIBRATION ANALYSES	Classes: 09

Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, Elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

MODULE – IV	DESIGN OF MACHINE FOUNDATIONS	Classes: 09

Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

MODULE – V	MACHINE FOUNDATIONS ON PILES	Classes: 09

Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

Text Books:

1. Swami Saran, "Soil Dynamics and Machine Foundation", Galgotia Publications Pvt. Ltd., 2010
2. Prakash, S., "Soil Dynamics", McGraw Hill Book Company, 1981.

Reference Books:

1. Prakash, S. and Puri, V. K., "Foundation for Machines: Analysis and Design", John Wiley & Sons, 1998.
2. Kameswara Rao, N. S. V., "Vibration Analysis and Foundation Dynamics", Wheeler Publication Ltd., 1998.

3. Das, B. M. & Ramana, G.V., "Principles of Soil Dynamics", 2nd Edition, CL Engineering Publishers, 2010.

Web References:

1. http://nptel.ac.in/courses/105107120/1#
2. https://ocw.mit.edu/courses/civil,and,environmental,engineering/1,364,advanced,geotechnical,engineering,fall,2003/index.html

GROUND WATER ENGINEERING

PE – IV : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB40	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers

II. Understand the techniques of development and management of groundwater.

MODULE - I	**GROUNDWATER IN INDIA**	**Classes: 09**
Problems and perspectives regarding groundwater in India		
MODULE - II	**HYDROGEOLOGY**	**Classes: 09**
Darcy's Equation; flow characteristics; general flow equations; unsaturated flow		
MODULE - III	**WELL HYDRAULICS**	**Classes: 09**
Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; characteristic well losses;specific capacity. Surface and Subsurface investigations (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction)		
MODULE - IV	**WATER WELLS**	**Classes: 09**
Construction; completion, development, protection and rehabilitation of wells; Groundwater quality		
MODULE - V	**GROUNDWATER MANAGEMENT:**	**Classes: 09**
Basin management, investigations, conjunctive use, modeling, artificial recharge; Saline water intrusion		

Text Books:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

Reference Books:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

Web References:

1.http://nptel.ac.in/courses/105107120/1#
2.https://ocw.mit.edu/courses/civil,and,environmental,engineering/1,364,advanced,geotechnical, engineering,fall,2003/index.html

ADVANCED FOUNDATION ENGINEERING

PE – IV : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB41	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Design a shallow foundation subjected to eccentric & inclined loads.
II. Design of deep foundation i.e., piles based on settlement & bearing capacity criteria.
III. Impart knowledge on earth pressure theories in design of gravity and cantilever retaining wall.
IV. Narrate the importance of apparent earth pressure diagrams in design of sheet piles & braced cuts.
V. Design of foundations in Expansive soils.

MODULE - I	INTRODUCTION	Classes: 09

Introducing Bearing capacity of Footings subjected to Eccentric and inclined loading – Meyerhoff's, Hansen's, Vesic theories – Foundations on layered soil – Elastic settlement of Footings embedded in sands and clays of infinite thickness – Footings on soil of Finite thickness – Schmertamaunn's method, Janbu method.

MODULE - II	PILE FOUNDATIONS	Classes: 09

Pile Foundations – pile groups- settlement of pile groups resting in sands and clays – negative skin friction- under reamed piles-laterally loaded piles - ultimate lateral capacity – Broms Method- Reese and Matlock Approach.

MODULE - III	LATERAL EARTH PRESSURES	Classes: 09

Lateral earth pressures theories – Rankine's and Coulomb's theories .

Graphical Methods, Culmann's, Trial Wedge methods – Stability checks of cantilever and gravity retaining walls.

MODULE - IV	CANTILEVER AND ANCHORED SHEET PILES	Classes: 09

Cantilever and anchored sheet piles-earth pressure diagram – determination of depth of embedment in sands and clays – braced cuts – earth pressure diagrams – forces in struts.

MODULE - V	FOUNDATION IN EXPANSIVE SOILS	Classes: 09

Foundation in Expansive soils – problems in expansive soils – mechanism of swelling – swell pressure and swelling potential – heave – foundation practices – sand cushion – CNS technique – under reamed pile foundations – granular pile anchor technique, stabilization of expansive soils.

Text Books:

1. Das, B. M. and Ramana, G.V., "Principles of Soil Dynamics", CL Engineering Publishers, 2nd Edition 2010.
2. Bowles, J.E., "Foundation Analysis and Design" 4th Edition, Mc GRaw-Hill International, 1998.

Reference Books:

1. Cuduto, "Geotechnical Engineering Principles and Practices", PHI International
2. C. Venkataramiah, "Geotechnical Engineering", New-Age International Pvt. Ltd., Publishers, 2002.
3. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Publishing Company Pvt. Ltd., 1998
4. Gopal Ranjan and ASR Rao, "Basics and Applied Soil Mechanics", New Age International Pvt. Ltd.,

Publishers, 2002.
Web References:
1.http://nptel.ac.in/courses/105107120/1# 2.https://ocw.mit.edu/courses/civil,and,environmental,engineering/1,364,advanced,geotechnical,engineering,fall,2003/index.html

DESIGN OF CONCRETE STRUCTURES-II

PE – V: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB42	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the design of flat slab.
II. Understand the design of concrete bunkers.
III. Understand the design of chimneys
IV. Understand the design of circular and rectangular water tanks
V. Understand the design of cantilever and counter fort retaining walls

MODULE - I	**FLAT SLAB**	**Classes: 09**

Introduction- Components of flat slab – Direct Design method – Shear in flat slabs – Slab reinforcement - Openings in flat slabs - Design of a flat slab (Interior panel only).

MODULE - II	**BUNKERS**	**Classes: 09**

Introduction – Components of bunker – Loads on Bunkers - Design of concrete bunkers of circular shape – (excluding staging) – Introduction to silos.

MODULE - III	**CHIMNEYS**	**Classes: 09**

Introduction – Types of concrete chimneys – Components of chimneys .
Loads on Chimneys - Design of concrete chimneys.

MODULE - IV	**WATER TANKS**	**Classes: 09**

Introduction- Types of water tanks – Loads on water tanks -Design of circular and rectangular water tank resting on the ground, Design of Intz water tank (excluding staging)

MODULE - V	**DESIGN OF FOOTINGS**	**Classes: 09**

Introduction – Types of retaining walls – Stability of cantilever retaining wall- Loads on retaining walls - Design of cantilever and counterfort retaining wall with horizontal back fill.

Text Books:

1. Krishna Raju., *Structural Design and drawing (RCC and steel)*, UniversitiesPress , NewDelhi
2. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain. *R.C.C Structures*,Laxmi publications, New Delhi
3. Varghese. *Advanced RCC*, PHI Publications, New Delhi.

Reference Books:

1. Sushil kumar. *R.C.C Designs*, standard publishing house.
2. N.C.Sinha and S.K.Roy.*Fundamentals of RCC*, S.Chand Publications, New Delhi.

Web References:
1. https://nptel.ac.in/courses/105105105/ 2. https://www.youtube.com/watch?v=pIdaC_I6H_M&list=PL51300B0778FB5784
E-Text Books:
1. https://civildatas.com/download/advanced-reinforced-concrete-design-by-varghese 2. https://easyengineering.net/reinforced-concrete-design-books/

STRUCTURAL DYNAMICS

PE – V : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB43	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental concepts and theory of dynamic analysis.
II. Understand the natural frequency of a system and harmonically excited vibrations
III. Understand forced vibrations and freedom systems
IV. Understand methods of interpolation of excitation

MODULE - I	THEORY OF VIBRATIONS	Classes: 09

Introduction - Elements of vibratory system - Degrees of Freedom – Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion – Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems – Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth

MODULE - II	INTRODUCTION TO STRUCTURAL DYNAMICS:	Classes: 09

Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle

MODULE - III	SINGLE DEGREE OF FREEDOM SYSTEMS AND MULTIDEGREE OF FREEDOM SYSTEMS	Classes: 09

Formulation and solution of the equation of motion – Freevibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.Free vibration - Determination of Natural frequencies and mode shapes - Vanello Stodola.

Matrix iteration methods - Energy methods - Forced vibrations - Lagrange's equation - Simple applications- Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

MODULE - IV	CONTINUOUS SYSTEMS	Classes: 09

Free and forced vibrations of beams - Approximate solutions - Rayleigh and Rayleigh - Ritz Methods - Vibrations of building frames - Model Analysis

MODULE - V	INTRODUCTION TO EARTHQUAKE ANALYSIS	Classes: 09

Introduction - Excitation by rigid base translation – Lumped mass approach - SDOF and MDOF systems - I. S. Code methods of analysis for obtaining response of multi storied buildings..

Text Books:

1. Mario Paz, "Structural Dynamics", C.B.S Publishers, New Delhi.
2. Anil K. Chopra, "Dynamics of Structures", Pearson Education (Singapore), Delhi,
3. I.S: 1893 - 1984, "Code of practice for Earthquake resistant design of Structures" and latest I.S: 1893 - 2002 (version) Part-1.

Reference Books:

1. Clough & Penzien, "Dynamics of Structures", McGraw Hill Book Col, 1975.
2. Hurty and Rubinsteian, "Dynamics of Structures", McGraw Hill Book Col, 1975.

Web References:
1. https://nptel.ac.in/content/syllabus_pdf/101105081.pdf
E-Text Books:
1. https://www.scribd.com/document/40277945/Introduction-to-Structural-Dynamics-Biggs 2.https://books.google.co.in/books?id=NEORjcl018AC&pg=PA104&lpg=PA104&dq=Introduction+to+Structural+Dynamics

DESIGN OF HYDRAULLIC STRUCTURES

PE – V : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB44	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Get the knowledge about various types of canals and their designs.
II. Enrich the design principles involved in design of barrages and weirs.
III. Obtain a broad knowledge on different types of head works and cross regulators.
IV. Understand the basics of canal falls and their necessity.
V. Do analysis for Cross Drainage works.

MODULE - I	**DESIGN OF CANALS**	**Classes: 10**

Classification of canals, principles considered for the canal alignment, design parameters of canal section, design of lined canals, design of unlined canals.

MODULE - II	**DESIGN OF BARRAGES AND WEIRS**	**Classes: 08**

Differences between barrages and weirs, basic components of barrage and weir, structural design considerations for barrage and weir – problems.

MODULE - III	**DIVERSION HEAD WORKS AND CROSS REGULATORS**	**Classes: 10**

Components and layout of head works, hydraulic design and structural design considerations for head works – problems.

Cross regulators – Types of regulators – Design of cross regulator andDistributor head regulator.

MODULE - IV	**CANAL FALLS**	**Classes: 08**

Canal falls – Definition, necessity and location, classification of falls, design principles of syphon well drop, notch fall, Sarada fall, Straight glacis fall; Offtakealignment.

MODULE - V	**CROSS DRAINAGE WORKS**	**Classes: 09**

Types, factors affecting the suitability of each types, Classification ofaqueducts, design principles of different types of aqueducts, design of cross drainage works - Syphon aqueduct and Canal syphon.

Text Books:

1. B.C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Pande Brij Basi Lal, "Irrigation and Water Power Engineering", Laxmi publications Pvt. Ltd., New Delhi, 16th Edition, 2016.
2. Santosh Kumar Garg, "Water Resources Engineering Irrigation Engineering & Hydraulic Structures - Vol.2", 1st edition, 1976.

Reference Books:

1. Herbert Michael Wilson, "Irrigation Engineering", Nabu Press, 1st Edition, 2010.
2. G.L. Asawa, "Irrigation and Water Resources Engineering", New Age publishers, 1st Edition, 2005.
3. Bernard Alfred Etcheverry, "Irrigation Practice and Engineering...", Nabu Press, 1st Edition, 2010.

Web References:

1. https://nptel.ac.in/courses/105105110/
2. https://nptel.ac.in/courses/105103096/

E-Text Books:
1. https://www.e-booksdirectory.com/details.php?ebook=2264

EARTHQUAKE ENGINEERING

PE – V : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB45	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes:	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Provide a coherent development to the students for the courses in sector of earthquake engineering
II. Present the foundations of many basic engineering concepts related earthquake Engineering
III. Give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
IV. Involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy

MODULE - I	**INTRODUCTION TO DYNAMIC LOADS**	**Classes: 09**

Static load versus dynamic load, types of dynamic forces, force control anddisplacement control

MODULE -II	**BASICS OF SEISMOLOGY**	**Classes: 09**

Earth and its interior, plate tectonics, convection currents, the earth quake,inter plate earthquake (convergent boundaries, divergent boundaries andtransform boundaries), intra plate earthquake (faults and types of faults),seismic waves, basic terminology, measuring units and instruments.

MODULE - III	**BEHAVIOR OF STRUCTURES DURING EARTHQUAKE AND EARTHQUAKE RESISTANTFEATURES OFSTRUCTURE**	**Classes: 09**

Inertia forces in structures-behavior of brick masonry structures: behavior of brick masonry walls,
box action, different types of bandsbehavior of stone masonry structures: behavior of stone masonry walls, earthquake resistant features of stone masonry structures behavior of rc structures: load transfer path, strength hierarchy, reversal of stresses, importance of beam column joints, importance of stiffness and ductility (capacity design concept) in structures.

Effect of short column, effect of soft storey, improper detailing, effect of masonry infill walls, effect of eccentricity, effect of pounding, effect off loating columns, effect of flexibility and effects of setbacks, earthquake resistant features of RC structures earthquake design philosophy.

MODULE - IV	**FUNDAMENTALS OF EARTHQUAKE VIBRATIONS OF STRUCTURES**	**Classes: 09**

equation of motion (by newton's law and by d'alembert's principle),degrees of freedom, simplified single degree of freedom, mathematical modeling, equation of motion for free vibration for damped and un dampedsystem (single degree of freedom system), equation of motion for forcedvibration for damped and un damped system(single degree of freedomsystem), logarithmic decrement.

MODULE - V	**EARTHQUAKE LOAD ANALYSIS ON STRUCTURES**	**Classes: 09**

Introduction to methods of earthquake load analysis (linear static, linear dynamic, nonlinear static, nonlinear dynamic) analysis of structure by linear static method (seismic coefficient method) analysis of structure by linear dynamic method (random response method)

Text Books:

1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications
2. Manish Shrikhande & Pankaj Agrawal; Earthquake Resistant Design of Structures, PHI Publication, New Delhi
3. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi
4. A. K. Chopra; Dynamics of Structures, Pearson, New Delhi

Reference Books:
1. IS: 1893 (Part-I) 2002, Criteria for Earthquake Resistant Design General Provision to Building 2. IS: 13920 (1993), Code of Practice for Ductile Detailing of RC Structures 3. IS: 4326 (1993), Code of Practice for Earthquake Resistant Design and Construction of Buildings 4. IS: 13827 (1993), Improving Earthquake Resistance of Earthen Buildings 5. IS: 13828 (1993), Guide lines for Improving Earthquake Resistance of low Strength Masonry Buildings
Web References:
1. http://www.cdeep.iitk.ac.in/nptel 2. http://www.nptel.iitm.ac.in
E-Text Books:
1. http://www.sadra.ac.ir/images/userfiles/files/03.pdf 2. https://panchayatrajengineers.wordpress.com/2019/02/09/earthquake-resistance-design-of-structures-by-s-k-duggal-pankaj-agarwal/

PRESTRESSED CONCRETE STRUCTURES

PE – VI : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB46	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the importance of Pre-stressed concrete and the evolution of pre-stressing to overcome the shortcoming of reinforced concrete.
II. Assess the losses of pre-stress in PSC members due various causes like friction, elastic shortage of concrete, shrinkage, creep, etc.
III. Analyze sections of PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design PSC beams of rectangular and I sections for flexure.
IV. Design shear reinforcements, structural elements for shear, torsion and anchorage as per the provisions of BIS.
V. Analyze Composite beams and deflections.

MODULE - I	INTRODUCTION	Classes: 09

Historic development- General principles of pre-stressing pre-tensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of pre-stressing Materials- high strength concrete and high tensile steel their characteristics. Methods and Systems of pre-stressing: Pre-tensioning and Post-tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

MODULE -II	LOSSES OF PRE-STRESS	Classes: 09

Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

MODULE - III	FLEXURE	Classes: 09

Analysis of sections for flexure, beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams, Elastic design of PSC beams of rectangular and I sections Kern line, Cable profile and cable layout.

Shear: General Considerations, Principal tension and compression, Improving shear resistance of concrete by horizontal and vertical pre-stressing and by using inclined or parabolic cables, Analysis of rectangular and I beams for shear, Design of shear reinforcements- Bureau of Indian Standards (BIS) Code provisions.

MODULE - IV	TRANSFER OF PRE-STRESS IN PRE-TENSIONED MEMBERS	Classes: 09

Transmission of pre-stressing force by bond,Transmission length, Flexural bond stresses, IS code provisions, Anchorage zone stresses in post tensioned members, stress distribution in End block, Analysis by Guyon, Magnel, Zielinski and Rowe's methods, Anchorage zone reinforcement, BIS Provisions.

MODULE - V	COMPOSITE BEAMS AND DEFLECTIONS	Classes: 09

Different Types: Propped and Unpropped, stress distribution, Differential shrinkage, Analysis of composite beams, General design considerations.

Deflections: Importance of control of deflections, Factors influencing deflections, short term deflections of uncracked beams, prediction of long time deflections, BIS code requirements.
Text Books:
1. N. Krishna Raju, . "Pre-stressed Concrete", Tata McGraw Hill Book Education Pvt. Ltd, 5th Edition, 1998.
Reference Books:
1. T.Y. Lin and Burn, "Design of Pre-stress Concrete Structures", John Wiley, New York1. 2. S. Ramarnrutham, Dhanpat Rai & Sons, "Prestressed Concrete", Delhi. 3. N. Rajagopalan, "Prestressed Concrete", Narosa Publishing House
Web References:
1. http://www.jsce.or.jp/committee/concrete/e/newsletter/newsletter01/recommendation/FRP-bar/d-11.pdf 2. https://www.academia.edu/35252359/Lecture_Note_17_PRESTRESS_CONCRETE
E-Text Books:
1. https://www.scribd.com/document/356892578/Prestressed-concrete-pdf 2. https://thebookee.net/pr/prestressed-concrete-structures-ramamrutham

ADVANCED STRUCTURAL ANALYSIS

PE – VI : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB47	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of equilibrium and compatibility equations.
II. Analyze the two dimensional problems.
III. Analyze the model analysis.
IV. Apply Finite element method to problems.
V. Understand the discretization process.

MODULE - I	**INTRODUCTIONOFELASTICITY**	**Classes: 09**

Elasticity: Introduction, Components of strain and strain, Hooke's law, Plane stress and plane strain, Equations of equilibrium and compatibility.

MODULE - II	**TWODIMENSIONALPROBLEMS**	**Classes: 09**

Boundary conditions, Two dimensional problems in rectangular and polar coordinates, Bending of simple and cantilever beams.

MODULE - III	**MODELANALYSIS**	**Classes: 09**

Model Analysis: Structural similitude, Direct and indirect model analysis, Model material and model making, Measurement for forces and deformations

MODULE - IV	**INTRODUCTIONTOFINITEELEMENTMETHOD**	**Classes: 09**

Introduction to Finite element method for structural analysis; Review of principle of virtual work, Ritz method.

MODULE - V	**DISCRETIZATIONOFDOMAIN**	**Classes: 09**

Discretization of domain, Basic element shape, Discretization process; Application of finite element method to one and two- dimensional plane stress strain elements. Prerequisite.

Text Books:

1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishers, 1st Edition, 2009.
2. A.K.Jain, "Advanced Structural Analysis", Nem Chand and Brosi Publications, 3rd Edition, 2015.
3. S. S. Bhavikatti, "Structural Analysis Vol.2",Vikas Publishing House, New Delhi, 2010.
4. R. C. Hibbler, "Structural Analysis", Pearson Education, India, 2008.

Reference Books:

1. T. S. Thandavamoorthy, "Structural Analysis", Oxford Higher Education, India, 2011.
2. C. S. Reddy, "Basic Structural Analysis", McGraw Hill Education (India), Delhi, 2000.

3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill Education (India), Delhi.
Web References:
1. https://lecturenotes.in/subject/154/structural-analysis-1-sa-1 2. https://nptel.ac.in/downloads/105101085/ 3. http://www.ce.memphis.edu/3121
E-Text Books:
1. https://www.kopykitab.com/Structural-Analysis-I-by-S-S-Bhavikatti 2. https://www.pdfdrive.com/fundamental-structural-analysis-e25550099.html

STRUCTURAL ANALYSIS BY MATRIX METHODS

PE – VI : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB48	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of Force and displacement methods.
II. Analyse the Structure by force method.
III. Analyse the Structure by Displacement method.
IV. Understand the process of Stiffness method.
V. Understand the development of Transformation matrices.

MODULE - I	INTRODUCTIONTO FORCE AND DISPLACEMENT	Classes: 09

Introduction to system approach: Force and Displacement methods.

MODULE -II	FORCE METHOD	Classes: 09

Matrix Force Method: Introduction to flexibility approach, Choice of redundant, static equilibrium matrix, deformation compatibility matrix, member flexibility matrix, static equilibrium and deformation compatibility checks. Application for trusses, continuous beams and rigid frames.

MODULE - III	STIFFNESS METHOD	Classes: 09

Matrix Displacement or Stiffness Method: Introduction to displacement approach, calculation of kinematic indeterminacy, development of stiffness matrices for continuous beams and rigid jointed frames.

Development of matrix displacement approach and application to continuous beams and rigid frames.

MODULE - IV	TRANSFORMATION OF MATRICES	Classes: 09

Transformation Matrices: Element Approach: Introduction to Element Approach, Development of force transformation matrices and system flexibility matrix using element approach.

MODULE - V	DEVELOPMENT OF TRANSFORMATION MATRICES	Classes: 09

Development of transformation matrices and system stiffness matrix using element approach, Analysis of structures using element approach.

Text Books:

1 A.K.Jain , “Advanced Structural Analysis”, Nem Chand and Brosi Publications, 3rd Edition, 2015.
2. Devdas Menon, “Advanced Structural Analysis”, Narosa Publishers, 1st Edition, 2009.
3. S. S. Bhavikatti, “Structural Analysis Vol.2”, Vikas Publishing House, New Delhi, 2010.
4. R. C. Hibbler, “Structural Analysis”, Pearson Education, India, 2008.

Reference Books:

1. T. S. Thandavamoorthy, “Structural Analysis”, Oxford Higher Education, India, 2011. 2. C. S. Reddy , “Basic Structural Analysis”, McGraw Hill Education (India), Delhi, 2000. 3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill Education (India), Delhi.
Web References:
1. https://lecturenotes.in/subject/154/structural-analysis-1-sa-1 2. https://nptel.ac.in/downloads/105101085/ 3. http://www.ce.memphis.edu/3121
E-Text Books:
1. https://www.kopykitab.com/Structural-Analysis-I-by-S-S-Bhavikatti 2. https://www.pdfdrive.com/fundamental-structural-analysis-e25550099.html

CONSTRUCTION ENGINEERING AND MANAGEMENT

PE – VI : CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB49	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Know how, construction projects are administered with respect to contract structures and issues.
II. Understand the basic construction dynamics- various stakeholders, project objectives, processes, and resources required and project economics.
III. Analyze various modern construction practices.
IV. Understand how to put forward the ideas and understandings to others with effective communication processes.
V. Analyze the Classification of costs and cost trade- off in construction projects.

MODULE - I	BASICS OF CONSTRUCTION	Classes: 09

Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution.

MODULE -II	CONSTRUCTION PROJECT PLANNING	Classes: 09

Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

MODULE - III	PLANNING AND ORGANIZING CONSTRUCTION SITE AND RESOURCES	Classes: 09

Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing;

Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

MODULE - IV	PROJECT MONITORING & CONTROL	Classes: 09

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites.

MODULE - V	CONSTRUCTION COSTS	Classes: 09
Make-up of construction costs; Classification of costs, time-cost trade-off in construction projects, compression and decompression.		
Text Books:		
1. Varghese, P.C., "Building Construction", Prentice Hall India, 2007. 2. National Building Code, Bureau of Indian Standards, New Delhi, 2017. 3. Chudley, R., Construction Technology, ELBS Publishers, 2007		
Reference Books:		
1. Peurifoy, R.L. "Construction Planning, Methods and Equipment", McGraw Hill, 2011. 2. Nunnally, S.W. "Construction Methods and Management", Prentice Hall, 2006 6. 3. Jha, Kumar Neeraj., "Construction Project Management", Theory & Practice, Pearson Education India, 2015. 4. Punmia, B.C., Khandelwal, K.K., "Project Planning with PERT and CPM", Laxmi Publications, 2016.		
Web References:		
https://nptel.ac.in/courses/105106149/		
E-Text Books:		
1. https://www.scribd.com/doc/231678531/k-k-Chitkara-Construction-Project-Management 2. http://civilcafe.weebly.com/uploads/2/8/9/8/28985467/total_construction_project_management_by_george_j._ritz_-_civilenggforall.pdf 3. http://www.opentextbooks.org.hk/system/files/export/15/15694/pdf/Project_Management.pdf		

FLIGHT CONTROL THEORY

OE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB53	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Apply stability criteria to determine the stability of an aircraft, and specify the aircraft time-domain and frequency-domain response specifications.
II. Understand classical control theory in the frequency domain and modern control theory in the state-space are effectively mixed to provide the student with a modern view of systems theory.
III. Design control techniques for aircraft control systems, and study some feedback control applications.
IV. Study the controllability and observability of aerospace systems, and apply the modern control techniques to design enhanced flight control systems.

MODULE-I	INTRODUCTION TO CONTROL SYSTEMS	Classes: 10

Dynamical systems-principal constituents-input, output-process (plant)-block diagram representation. Inputs- control input, noise. Function of controls regulation (hold), tracking (command)-examples. Measure of effectiveness. Sensitivity of output to control input, noise and system parameters- robustness. Deterministic and stochastic control. Control in everyday life. The pervasiveness of control in nature, engineering and societal systems. The importance of study of control system. Need for stable, effective (responsive), robust control system. Modeling of dynamical systems by differential equations-system parameters. Examples from diverse fields. First and second order systems, higher order systems, single input single output systems, and multiple-input multiple-output.

MODULE-II	MATHEMATICAL MODELLING OF DYNAMIC SYSTEMS	Classes: 10

Control system performance- time domain description- output response to control inputs-- impulse and indicial response- characteristic parameters- significance- relation to system parameters- examples- first and second order linear systems, higher order systems. Synthesis of response to arbitrary input functions from impulse and indicial response. Review of Fourier transforms and Laplace transforms- inverse transforms- significance, applications to differential equations. 's' (Laplace) domain description of input-output relations- transfer function representation- system parameters- gain, poles and zeroes. Characteristic equation- significance- examples. Frequency and damping ratio of dominant poles.
Relation of transfer functions to impulse response. Partial fraction decomposition of transfer functions-significance.

MODULE -III	STEADY STATE RESPONSE ANALYSIS	Classes: 10

System type, steady state error, error constants- overall system stability. Application of feedback in stability augmentation, control augmentation, automatic control-examples. Composition, reduction of block diagrams of complex systems-rules and conventions. Control system components - sensors, transducers, servomotors, actuators, filters-modeling, transfer functions. Single-input single-output systems. Multiple input-multiple output systems, matrix transfer functions-examples. Types of control problems- the problem of analysis, control synthesis, system synthesis- examples- static control of aircraft. Extension to dynamic control. System identification from input output measurements importance.

Experimental determination of system transfer functions by frequency response measurements. Example. Frequency domain description- frequency response- gain and phase shift- significance- representation asymptotic (Bode) plots, polar (Nyquist) plots, frequency transfer functions. Characteristic parameters

corner frequencies, resonant frequencies, peak gain, and bandwidth- significance. First and second order systems- extension to higher order systems.

MODULE-IV	A IRCRAFT RESPONSE TO CONTROLS	Classes:07

Approximations to aircraft transfer functions, control surface actuators-review. Response of aircraft to elevator input, Response of aircraft to rudder input and Response of aircraft to aileron input to atmosphere. Need for automatic control. Auto pilots Stability augmentation systems-pitch damper and yaw damper.

MODULE -V	FLYING QUALITIES OF AIRCRAFT	Classes: 08

Reversible and irreversible flight control systems. Flying qualities of aircraft-relation to airframe transfer function. Pilot's opinion ratings. Flying quality requirements- pole-zero, frequency response and time-response specifications. Displacement and rate feedback determination of gains conflict with pilot input s resolution-control augmentation systems- Full authority fly-by-wire. Auto Pilot-Normal acceleration, Turn rate, Pitch rate Commands-Applications.

Text Books:

1. Kuo, B.C., “Automatic Control Systems”, Prentice Hall India, 1992.
2. Stevens, B.L. and Lewis, F.L., “Aircraft Control and Simulation”, John Wiley, 1992.

Reference Books:

1. Mc Lean, D., “Automatic Flight Control Systems”, Prentice Hall, 1990 J.
2. Bryson, A.E., “Control of Aircraft and Spacecraft”, Princeton University Press, 1994.
3. E H J Pallett, Shawn Coyle, “Automatic Flight Control”, 4th Edition, 2002.

E-Text Books:

1. https://www.e-booksdirectory.com/
2. https://www.aerospaceengineering.es/book/

AIRFRAME STRUCTURAL DESIGN

OE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB54	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Familiarize students with the important issues and methodologies of aircraft design.
II. Illustrate the process of aircraft synthesis as an outcome of the integration of the disciplines of aerodynamics, performance, stability and control, propulsion, structures and aero elasticity.
III. Understand role and lay-out of main structural members of load carrying airframe components as well as the relevant basic design philosophies.
IV. Develop the ability to function as a member of a team in a design setting; including the ability to conduct a peer review of the other team members.
V. Familiarize students with Federal Aviation Regulations as a means for ensuring passenger safety

MODULE-I	INTRODUCTION AIRWORTHINESS REQUIREMENTS	Classes: 10

Structural design and sizing- stages- Principal structural components of aircraft. Design requirements- structural integrity, stiffness, service life. Constraints- baseline aerodynamic configuration, external loading, weight, operating conditions, conformity to government regulations. Design for durability, damage tolerance. Airworthiness requirements - loads, safety margins, material properties, methods of estimation- construction, operation, maintenance, training- procedures. Critical load conditions. Limit and ultimate loads- definition, significance. Aircraft materials- mechanical properties- design data- allowable, allowable bases. Failure theory. Flight loads- atmospheric, maneuver- construction of flight envelope

MODULE-II	EXTERNAL LOADS-ESTIMATION, FASTENERS AND STRUCTURAL JOINTS	Classes: 10

Wing loads- air load span wise distribution, effect of fuselage, engine nacelle, wing stores, control surfaces, landing, taxi, dynamic gust loads, wing weight distribution. Empennage loads- gust, maneuver, control surface. Fuselage loads- distribution of weight, fore body loads, after body loads, internal pressure, propulsion loads. Landing gear loads- landing conditions, ground handling loads, retraction loads. Miscellaneous loads. Airplane weight data, stiffness data, theories of failure.

Fasteners and fittings- role, significance, general design considerations, criteria for allowable strength. Margins of safety. Fastener systems, types, fastener information, dimensions, material, allowable strength-tensile, shear, bending, bearing, Rivets, bolts and screws, nuts- detail design considerations. Fastener selection. Fittings- lugs, bushings and bearings- loading, design and analysis. Joints- spliced, eccentric, gusset, welded, brazed, bonded- types, methods of joining, failure modes. Fatigue design considerations. Stress concentration- causes, methods of reduction. Fastener load distribution and by-pass load- severity factor, structural joint life prediction. Shim control and requirement.

MODULE -III	DESIGN OF WING, TAIL UNIT STRUCTURES	Classes: 10

The wing- role- summary of wing loads, structural components- wing box, leading and trailing edges. Wing layout- location of spars, ailerons and flaps, rib spacing and direction, root rib bulkhead, span wise stiffeners, wing covers- skin-stringer panels, integrally stiffened panels, access holes, attachment of leading edge and trailing edge panels.

Spars- general rules of spar design. Ribs and bulkheads- rib spacing and arrangement. Wing root joints, carry through structure. Fighter wing design- problems with swept wings.Wing box, root rib bulkhead-

estimation of loads, stress analysis, design parameters, optimisation, sizing, margins of safety. Leading and trailing edge assembly- control surfaces, flaps- structure

MODULE-IV	DESIGN OF FUSELAGE, LANDING GEAR, ENGINE MOUNTS	Classes:07

Function of fuselage- loading, general requirements. Ultimate strength of stiffened cylindrical structure- review, Principal structural components- skin and stringers, frame and floor beam, pressure bulkhead, wing and fuselage intersection- lay out, loading, stress analysis, sizing. Forward fuselage, aft fuselage structures, fuselage openings- windows, doors- design considerations.

Landing gear- purpose, types, general arrangement, loads- design considerations- ground handling, take-off, landing, braking, pavement loading, support structure. Stowage and retraction, gear lock- kinematic design. Shock absorbers- function, types, components, operation, loads, materials, design. Wheels and brakes, tire selection. Engine mounts- types- wing pod, rear fuselage, tail, fuselage mount, loads, design considerations

MODULE -V	FATIGUE LIFE, DAMAGE TOLERANCE, FAIL-SAFE DESIGN- WEIGHT CONTROAND BALANCE	Classes: 08

Catastrophic effects of fatigue failure- examples- modes of failure- design criteria- fatigue stress, fatigue performance, fatigue life. Fatigue design philosophy- fail-safe, safe life. Service behaviour of aircraft structures- effect of physical and load environment design and of detail of fabrication Structural life-methods of estimation- the scatter factor- significance Fail-safe design- the concept, requirements, damage tolerance-estimation of fatigue strength

Text Books:

1. Niu, M.C., Airframe Structural Design, second edition, Hongkong Conmlit Press, 1988, ISBN: 962-7128-09-0.

2. Niu, M.C., Airframe Stress Analysis and Sizing, second edition, Hongkong Conmlit Press, 1997, ISBN: 962-7128-08-2.

Reference Books:

1. Bruhn, E.H., Analysis and Design of Flight Vehicles Structures, Tri -state Offset Company, USA, 1965.
2. Peery, D.J, and Azar, J.J., Aircraft Structures, second edition, Mc Graw-Hill, N.Y., 1993.
3. Megson, T.H.G., Aircraft Structures for Engineering Students, Butterworth-Heinemann/ Elsevier, 2007. Fielding, J.P.,
4. Introduction to Aircraft Design, Cambridge University Press, 2005, ISBN: 0-521-657222-9

E-Text Books:

2. https://www.e-booksdirectory.com/
2. https://www.aerospaceengineering.es/book/

MECHANICAL PROPERTIES OF MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB54	Open	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the physical and mechanical, metallurgical engineering concepts for metals and preparation of alloys.
II. Understand the stages of design process and evolution of materials.
III. Interpret the basis for material selection in engineering design through case studies.
IV. Explore the material property plots, database and optimization techniques to identify the best performing materials for a given application.
V. Estimate the material life and their impact on industries and environment.

MODULE-I	STRUCTURE OF METALS	Classes : 09

Structure of metals: Crystallography, Miller indices, packing efficiency, density calculations, grains and grain boundaries, effect of grain size on the properties, determination of grain size by different methods, constitution of alloys, necessity of alloying, types of solid solutions, Hume-Rothery rules, intermediate alloy phases.

MODULE-II	MATERIAL SELECTION	Classes : 09

The basics, metals and metallic structure, metallic alloys, ceramics and glasses, polymers and composites for mechanical design, material properties: surface and other functional properties, the selection strategy, Attribute limits and material indices, the selection procedure, shape factor, Computer-aided selection, and the structural index Case Studies: Diaphragms for pressure actuators, Deflection limited design with brittle polymers, Nylon bearings for ship rudders.

MODULE-III	PROCESSES AND PROCESS SELECTION	Classes: 09

Introduction and synopsis, classifying processes, the processes: shaping, joining, and finishing, Systematic process selection, Ranking: process cost, Computer - aided process selection, supporting information Case studies: Forming ceramic tape valves, Forming a silicon nitride micro-beam, Fabricating a pressure vessel.

MODULE-IV	DESIGN PROCESS	Classes: 09

Material Selection using Ashby method, micro-structural shape factors, exploring and comparing structural sections, multiple Constraints and objectives in material selection, optimal selection with and without shape factor, multiple objectives, role of materials in shaping the product character.

MODULE-V	METHODS TO MINIMIZE COST OF MATERIAL HANDLING	Classes : 09

Environmental Impact: Materials and the environment, the material life cycle, material and energy consuming systems, the eco-attributes of materials, eco-selection, Case studies-Drink containers and crash barriers. materials and industrial design: Introduction and synopsis, the requirements pyramid, product character, using materials and processes to create product personality.

Text Books:
1. M. F. Ashby, “Material Selection in Mechanical Design”, Elsevier, 4th Edition, 2015. 2. M.Ashby,K.Johnson, “Materials and Design”, Lakshmi Publications, Elsevier, 3rd Edition, 2014.
Reference Books:
1. Kenneth G. Budinski, “Engineering Materials: Properties and Selection”, PHI, 1st Edition, 2013. 2. J. G. Gerdeen, H. W. Lord, R. A. L., “Engineering Design with Polymers and Composites”, CRC Press, 2nd Edition, 2011.
Web References:
1. http://nptel.ac.in/courses/112106138/
E-Text Book:
1. https://accessengineeringlibrary.com/browse/precision-engineering

AUTOMATION IN MANUFACTURING

OE – I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB55	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Describe the basic concepts of automation in manufacturing systems.
II. Acquire the fundamental concepts of automated flow lines and their analysis.
III. Classify automated material handling, automated storage and retrieval systems.
IV. Illustrate adaptive control systems and automated inspection methods.

MODULE-I	**INTRODUCTION AND MANUFACTURING OPERATIONS**	**Classes: 09**

Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles and Strategies Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations

MODULE-II	**INDUSTRIAL CONTROL SYSTEM**	**Classes: 09**

Basic Elements of an Automated System, Advanced Automation Functions and Levels of Automation, Continuous versus Discrete control, Computer Process control, Forms of Computer Process Control.

MODULE-III	**AUTOMATED MANUFACTURING SYSTEMS**	**Classes: 09**

Components of Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme

Single Station Manned Workstations and Single Station Automated Cells.

MODULE-IV	**GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS**	**Classes: 09**

Part Families, Parts Classification and coding, Production Flow Analysis, Cellular Manufacturing, and Flexible Manufacturing Systems: What is an FMS, FMS Components, FMS Applications, benefits, FMS Planning and Implementation issues.

MODULE-V	**Manufacturing Support System**	**Classes: 09**

Process Planning, Computer Aided Process Planning, Concurrent Engineering and Design for Manufacturing, Advanced Manufacturing Planning, Just-in Time Production System, basic concepts of lean and Agile manufacturing.

Text Books:

1. R. Thomas Wright and Michael Berkeihiser, "Manufacturing and Automation Technology", 3rd Edition,2012
2. M.P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing" / PE/PHI.

Reference Books:
1. Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, "Computer Aided Manufacturing"‖, Pearson 1st Edition, 2009. 2. R Thomas Wright, Michael Berkeihiser, "Manufacturing and Automation Technology", Good Heart/Willcox Publishers, 1st Edition, 2013.
Web References:
1.https://www3.nd.edu/~manufact/MPEM_pdf_files/Ch14.pdf 2. http://nptel.ac.in/courses/112102011
E-Text Book:
1. https://docs.google.com/file/d/0B7uir_9DoCLFaGduckFqQmcwUnc/edit?usp=drive 2.https://lehrerfortbilduw.de/faecher/nwt/fb/atechnik/grundlagen/en/kapitel/563060_Fundamentals_of_automation_technology.pdf

REMOTE SENSING AND GIS

OE – I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB50	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the Photogrammetric techniques, concepts, components of Photogrammetry
II. Introduce the students to the basic concepts and principles of various components of remote sensing.
III. Provide an exposure to GIS and its practical applications in Civil Engineering.
IV. Analyze the energy interactions in the atmosphere and earth surface features.

MODULE - I	INTRODUCTION TO PHOTOGRAMMETRY	Classes: 09

Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

MODULE -II	REMOTE SENSING	Classes: 09

Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

MODULE - III	GEOGRAPHIC INFORMATION SYSTEM AND TYPES OF DATA REPRESENTATION	Classes: 09

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.

Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

MODULE - IV	GIS SPATIAL ANALYSIS	Classes: 09

Computational Analysis Methods(CAM), Visual Analysis Methods (VAM), Data storagevector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

MODULE - V	WATER RESOURCES APPLICATIONS	Classes: 09

Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development and Watershed characteristics.

Text Books:
1. Remote Sensing and GIS by B.Bhatta, Oxford University Press,New Delhi. 2. Fundamentals of remote sensing by Gorge Joseph , Universities press, Hyderabad.
Reference Books:
1. LRA Narayana, “Remote Sensing and its applications”, University Press 1999. 2. S.Kumar, “Basics of Remote Sensing & GIS”, Laxmi Publications. 3. M.Anji Reddy, “Remote Sensing and GIS”, B.S. Pubiliications, New Delhi. 4. Tsung Chang, “GIS”, TMH Publications & Co.,
Web References:
3. https://nptel.ac.in/courses/105103193/ 4. https://nptel.ac.in/courses/121107009/ 5. https://nptel.ac.in/courses/105108077/
E-Text Books:
1.https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105107160/lec20.pdf

PROJECT SAFETY MANAGEMENT

OE – I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB51	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes:	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the various safety concepts and requirements applied to construction projects.
II. Study the of construction accidents, safety programmes, contractual obligations, and design for safety.
III. Understand the safety and health of persons at work in connection with the use of plant and machinery.
IV. A structured management approach to control safety risks in operations.

MODULE - I	**CONSTRUCTION ACCIDENTS**	**Classes: 09**

Accidents and their Causes – Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications -The introduction of OH&S management system.

MODULE -II	**SAFETY PROGRAMMES**	**Classes: 09**

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives.

MODULE - III	**CONTRACTUAL OBLIGATIONS**	**Classes: 09**

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping

Comparison of Actions and Laws – Agreements, Subject Matter, Violation, Appointment of Arbitrators, Conditions of Arbitration – Powers and Duties of Arbitrator.

MODULE - IV	**DESIGNING FOR SAFETY**	**Classes: 09**

Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.

MODULE - V	**OWNERS' AND DESIGNERS' OUTLOOK**	**Classes: 09**

Owner's responsibility for safely – Owner preparedness – Role of designer in ensuring safety – Safety clause in design document.

Text Books:

1. Raymond Elliot Levitt and Nancy Morsesamelson "Construction Safety Management" copyright materials, Wiley; 2nd Edition, 1993.
2. Charles D. Reese, "occupational health and safety", CRC Press, 2003.

Reference Books:
1. Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 1997. 2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Tamilnadu Factory Act, Department of Inspectorate of factories, Tamilnadu. Health Management, Prentice Hall Inc., 2001.
Web References:
1. https://nptel.ac.in/content/storage2/courses/114106039/Tutorial%2012%20key.pdf 2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/114106039/lec36.pdf
E-Text Books:
1. https://safetyrisk.net/free-safety-ebooks/ 2. https://boilersinfo.com/fire-safety-management-handbook-3rd-edition/

COMPUTER ARCHITECTURE

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB32	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the organization and architecture of computer systems and electronic computers.
II. Study the assembly language program execution, instruction format and instruction cycle.
III. Design a simple computer using hardwired and micro programmed control methods.
IV. Study the basic components of computer systems besides the computer arithmetic.
V. Understand input-output organization, memory organization and management, and pipelining.

MODULE - I	INTRODUCTION TO COMPUTER ORGANIZATION	Classes: 09

Basic computer organization, CPU organization, memory subsystem organization and interfacing, input or output subsystem organization and interfacing, a simple computer levels of programming languages, assembly language instructions, a simple instruction set architecture.

MODULE -II	ORGANIZATION OF A COMPUTER	Classes: 09

Register transfer: Register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations, shift micro operations; Control memory.

MODULE -III	CPU AND COMPUTER ARITHMETIC	Classes: 09

CPU design: Instruction cycle, data representation, memory reference instructions, input-output, and interrupt, addressing modes, data transfer and manipulation, program control.
Computer arithmetic: Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit.

MODULE -IV	INPUT-OUTPUT ORGANIZATION	Classes: 09

Input or output organization: Input or output Interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access.

MODULE -V	MEMORY ORGANIZATION	Classes: 09

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory; Pipeline: Parallel processing, Instruction pipeline;

Text Books:

1. M. Morris Mano, "Computer Systems Architecture", Pearson, 3rd Edition, 2015.
2. Patterson, Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann, 5th Edition, 2013.

Reference Books:

1. John. P. Hayes, “Computer System Architecture”, McGraw-Hill, 3rd Edition, 1998.
2. Carl Hamacher, Zvonko G Vranesic, Safwat G Zaky, “Computer Organization”, McGraw-Hill, 5th Edition, 2002.
3. William Stallings, “Computer Organization and Architecture”, Pearson Edition, 8th Edition, 2010.

Web References:

1. https://www.tutorialspoint.com/computer_logical_organization/
2. https://www.courseera.org/learn/comparch
3. https://www.cssimplified.com/.../computer-organization-and-assembly-language-programming

E-Text Books:

1. https://www.groupes.polymtl.ca/inf2610/.../ComputerSystemBook.pdf
2. https://www.cse.hcmut.edu.vn/~vtphuong/KTMT/Slides/TextBookFull.pdf

ANALYSIS OF ALGORITHMS AND DESIGN

OE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB33	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
II. Solve problems using data structures such as binary search trees, and graphs.
III. Choose the appropriate data structure and algorithm design method for a specified application.
IV. Solve problems using algorithm design methods such as the divide and conquer, greedy method, dynamic programming, branch and bound, backtracking,

MODULE -I	INTRODUCTION	Classes: 09

Algorithm: Pseudo code for expressing algorithms; Performance analysis: Space complexity, time complexity; Amortized Complexity, Asymptotic notations: Big O notation, omega notation, theta notation and little o notation.

MODULE -II	DIVIDE AND CONQUER	Classes: 09

Divide and Conquer: General method, applications: Binary search, quick sort, merge sort, Strassen‘s matrix multiplication.

MODULE -III	TRAVERSAL TECHNIQUES AND GREEDY METHOD	Classes: 09

Efficient non recursive binary tree traversal algorithms, spanning trees; Graph traversals: Breadth first search, depth first search, connected components, biconnected components.

Greedy method: The general method, job sequencing with deadlines, knapsack problem, single source shortest paths.

MODULE -IV	DYNAMIC PROGRAMMING	Classes: 09

Dynamic programming: The general method, matrix chain multiplication, optimal binary search trees, 0/1 knapsack problem, all pairs shortest paths problem.

MODULE -V	BRANCH AND BOUND, BACKTRACKING	Classes: 09

Branch and bound: The general method, travelling salesperson problem; Backtracking: The general method, the 8 queens problem, graph coloring.

Text Books:

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, “Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, “The Design And Analysis Of Computer Algorithms, Pearson India, 1st Edition, 2013.

Reference Books:

1. Levitin A, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2012.
2. Goodrich, M. T. R Tamassia, "Algorithm Design Foundations Analysis and Internet Examples", John Wiley and Sons, 1st Edition, 2001.
3. Base Sara Allen Vangelder, "Computer Algorithms Introduction to Design and Analysis", Pearson, 3rd Edition, 1999.

Web References:

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

E-Text Books:

1.http://ebook/com/item/introduction_to_the_design_and_analysis_of_algorithms_3rd_editionananylevitin/
2. https://drive.google.com/file/d/0B_Y1VbyboEDBTDVxVXpVbnk4TVE/edit?pref=2&pli=1
3. http://www.amazon.com/Computer-Algorithms-Introduction-Design-Analysis/dp/0201612445

RELATIONAL DATABASE MANAGEMENT SYSTEMS

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB34	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the role of database management system in an organization and learn the database concepts.
II. Design databases using data modeling and Logical database design techniques.
III. Construct database queries using relational algebra and calculus and SQL.
IV. Understand the concept of a database transaction and related concurrent, recovery facilities.
V. Learn how to evaluate a set of queries in query processing.

MODULE -I	CONCEPTUAL MODELING INTRODUCTION	Classes: 09

Introduction to Databases and Database Management System - Database system Applications Advantages of DBMS over File System - Data Models – Instances and schema - View of Data - Database Languages - DDL-DML - Database Users and Administrator - Database System Structure.

MODULE -II	RELATIONAL APPROACH	Classes: 09

Database Design and ER diagrams – Attributes and Entity Sets – Relationships and Relationship Sets – Constraints - Keys - Design Issues - Entity-Relationship Diagram- Weak Entity Sets - Extended E-R Features- Database Design with ER model - Database Design for Banking Enterprise.

MODULE -III	SQL QUERY - BASICS , RDBMS - NORMALIZATION	Classes: 09

Introduction to the Relational Model – Structure of RDBMS - Integrity Constraints over Relations – Enforcing Integrity Constraints – Querying Relational Data - Relational Algebra and Calculus.

Introduction to SQL- Data Definition commands, Data Manipulation Commands, Basic Structure, Set operations Aggregate Operations - Join operations - Sub queries and correlated queries, SQL functions, views ,Triggers, Embedded SQL

MODULE -IV	TRANSACTION MANAGEMENT	Classes: 09

Functional Dependencies– Introduction , Basic Definitions, Trivial and Non trivial dependencies, closure of a set of dependencies, closure of attributes, irreducible set of dependencies- Schema Refinement in Database Design- Problems Caused by Redundancy Decompositions – Problem Related to Decomposition –- Lossless Join Decomposition – Dependency Preserving Decomposition - FIRST, SECOND, THIRD Normal Forms – BCNF –Multi valued Dependencies – Fourth Normal Form.

MODULE -V	DATA STORAGE AND QUERY PROCESSING	Classes: 09

Transaction concept- Transaction state- Implementation of atomicity and Durability- Concurrent executions – Serializability, Recoverability; File Organization – Organization of records in file - Data Dictionary Storage – Indexing and Hashing – Basic Concepts , Ordered Indices,B^{+}Tree Index files, B- tree index files

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 6th Edition, 2017.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 6th Edition, 2014.
2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2007.
3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000.
4. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003.

Web References:

1. https://www.youtube.com/results?search_query=DBMS+onluine+classes
2. http://www.w3schools.in/dbms/
3. http://beginnersbook.com/2015/04/dbms-tutorial/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re
3. https://docs.google.com/file/d/0B9aJA_iV4kHYM2dieHZhMHhyRVE/edit

MOOC Course

1. https://onlinecourses.nptel.ac.in/noc18_cs15/preview
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/

ADVANCED DATA STRUCTURES

OE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB30	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic data structures and techniques of algorithm analysis.
II. Understand dictionaries, hashing mechanisms and skip lists for faster data retrieval.
III. Comprehension of heaps, priority queues and its operations.
IV. Understand balanced trees and their operations.
V. Illustration of tries and pattern matching algorithms.

MODULE -I	OVERVIEW OF DATA STRUCTURES	Classes: 09

Algorithms; Performance analysis: Time complexity and Space complexity, Asymptotic notation. Review of basic data structures - The list ADT, Stack ADT, Queue ADT, Linked list – Single linked list, Double linked list, Circular linked list.

MODULE –II	DICTIONARIES, HASH TABLES	Classes: 09

Dictionaries: Linear list representation, Skip list representation, operations - insertion, deletion and searching, Hash table representation, hash functions, collision resolution - separate chaining, open addressing - linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists.

MODULE -III	PRIORITY QUEUES	Classes: 09

Priority Queues – Definition, ADT, Realizing a Priority Queue using Heaps, Insertion, Deletion, Application- Heap Sort, External Sorting- Model for external sorting, Multiway merge, Polyphase merge.

MODULE -IV	SEARCH TREES	Classes: 09

Binary Search Trees - Definition, ADT, Operations - Searching, Insertion, Deletion, AVL Trees - Definition, ADT, Balance factor, Operations – Insertion, Deletion, Searching, Introduction to Red – Black and Splay Trees, B-Trees, B-Tree operations - insertion, deletion, searching, Comparison of Search Trees.

MODULE -V	PATTERN MATCHING AND TRIES	Classes: 09

Pattern matching algorithms - the Boyer - Moore algorithm, the Knuth – Morris - Pratt algorithm. Tries – Definition, concepts of digital search tree, Binary trie, Patricia, Multi-way trie.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G.A. V.Pai, "Data Structures and Algorithms", Tata McGraw Hill, New Delhi, 1st Edition, 2008.
3. Richard F Gilberg, Behrouz A Forouzan, "Data Structures - A Pseudocode Approach with C", Cengage Learning, Thomson Press (India) Ltd, 2nd Edition, 2006.

Reference Books:

1. D. Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hop craft, Ullman, "Design and Analysis of Computer Algorithms", Pearson Education India, 1st Edition, 1998.
3. Goodman, Hedetniemi, "Introduction to Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.
4. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Course Technology, 3rd Edition, 2005.
5. M. T. Goodrich, R. Tomassia, "Data structures and Algorithms in Java", Wiley India, 3rd Edition, 2011.

Web References:

5. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
6. https://www.geeksforgeeks.org/data-structures/
7. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

E-Text Books:

1. https://pdfs.semanticscholar.org/19ec/55ed703eb24e1d98a4abd1a15387281cc0f8.pdf
2. https://www.academia.edu/35961658/Data.Structures.A.Pseudocode.Approach.with.C.2nd.edition_1_.pdf
3. https://sonucgn.files.wordpress.com/2018/01/data-structures-by-d-samantha.pdf

MOOC Course

1. https://nptel.ac.in/courses/106103069/
2. https://www.coursera.org/learn/data-structures
3. https://www.edureka.co/blog/data-structures-algorithms-in-java/
4. https://www.edx.org/micromasters/ucsandiegox-algorithms-and-data-structures

DATA COMMUNICATIONS AND NETWORKS

OE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB31	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

OBJECTIVES:

The course should enable the students to:

I. Develop an understanding of modern network architectures from a design and performance perspective.
II. Understand the basics and challenges of network communication.
III. Provide an opportunity to do network programming using TCP/IP.
IV. Understand the operation of the protocols that are used inside the Internet.

MODULE - I	**DATA COMMUNICATIONS**	**Classes: 09**

Components, Direction of Data flow, Networks, Components and Categories, Types of Connections, Topologies, Protocols and Standards, ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN.

MODULE – II	**THE PHYSICAL LAYER**	**Classes: 09**

Transmission modes, Switching, Circuit Switched Networks, Transmission Media, Datagram Networks, Virtual Circuit Networks.

MODULE – III	**THE DATALINK LAYER**	**Classes: 09**

Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.

MODULE – IV	**THE NETWORK LAYER**	**Classes: 09**

Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols

MODULE – V	**THE TRANSPORT AND APPLICATION LAYER**	**Classes: 09**

Introduction, client server programming, WWW (World Wide Web) and HTTP (Hyper Text Transfer Protocol), FTP (File Transfer Protocol), E-MAIL, TELNET, SECURE SHELL, DNS(Domain Naming System), SNMP (Simple Network Management Protocol). Introduction to Application Layer: HTTP (Hyper Text Transfer Protocol), DNS(Domain Naming System).

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 5th Edition, 2012.
2. Andrew S. Tanenbaum, David.j.Wetherall, "Computer Networks", Prentice-Hall, 5th Edition, 2010.

Reference Books:

1. Douglas E. Comer "Internetworking with TCP/IP ", Prentice-Hall, 5th Edition, 2011.
2. Peterson, Davie, Elsevier "Computer Networks", 5th Edition, 2011
3. Comer, "Computer Networks and Internets with Internet Applications", 4th Edition, 2004.
4. Chawan- Hwa Wu, Irwin, "Introduction to Computer Networks and Cyber Security", CRC publications, 2014.

Web References:

1. http://computer.howstuffworks.com/computer-networking-channel.htm
2. http://www.ietf.org
3. http://www.rfc-editor.org/
4. https://technet.microsoft.com/en-us/network/default.aspx

E-Text Books:

1. http://www.freebookcentre.net/networking-books-download/Lecture-Notes-on-Computer-Networks.html
2. http://www.freebookcentre.net/networking-books-download/Introduction-to-Computer-Networks.html

MOOC Course

1. https://www.mooc-list.com/course/networking-introduction-computer-networking-stanford-university
2. https://lagunita.stanford.edu/courses/Engineering/Networking/Winter2014/about.

NETWORK SECURITY

OE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB32	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic categories of threats to computers and networks.
II. Understand various cryptographic algorithms and be familiar with public-key cryptography.
III. Apply authentication functions for providing effective security.
IV. Analyze the application protocols to provide web security.
V. Discuss the place of ethics in the information security area.

MODULE-I	ATTACKS ON COMPUTERS AND COMPUTER SECURITY	Classes: 09

Attacks on computers and computer security: Introduction, the need for security, security approaches, principles of security, types of security attacks, security services, security mechanism, a model for network security; Cryptography concepts and techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

MODULE-II	SYMMETRIC AND ASYMMETRIC KEY CIPHERS	Classes: 09

Symmetric key ciphers: Block cipher principles and algorithms (DES,AES), block cipher modes of operation, stream ciphers, and placement of encryption function, key distribution; Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie-Hellman).

MODULE-III	MESSAGE AUTHENTICATION ALGORITHM AND HASH FUNCTIONS	Classes: 09

Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes.

Hash functions: Hash functions, secure hash algorithm, digital signatures. Authentication application: Kerberos, X.509 authentication service.

MODULE-IV	E-MAIL SECURITY	Classes: 09

E-mail Security: Pretty Good Privacy; S/MIME
IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

MODULE-V	WEB SECURITY	Classes: 09

Web security: Web security considerations, secure socket layer and transport layer security, secure electronic transaction,
Intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, countermeasures, firewall design principles; Types of firewalls.

Text Books

1. William Stallings, "Cryptography and Network Security", Pearson Education, 4th Edition, 2005.
2. Atul Kahate, "Cryptography and Network Security", McGraw-Hill, 2nd Edition, 2009.

Reference Books
1. C K Shymala, N Harini, Dr. T R Padmanabhan, “Cryptography and Network Security”, Wiley India, 1st Edition, 2016. 2. Behrouz A. Forouzan Debdeep Mukhopadhyay, “Cryptography and Network Security”, McGraw- Hill, 2nd Edition, 2010.
Web References
1. http://bookboon.com/en/search?q=INFORMATION+SECURITY 2. https://books.google.co.in/books/about/Cryptography_Network_Security_Sie_2E.html?id=Kokjwdf0E7QC 3. https://books.google.co.in/books/about/Information_Security.html?id=Bh45pU0_E_4C
E-Text Books
1. https://books.google.co.in/books/about/Information_Security.html 2. http://www.amazon.in/Cryptography-Network-Security-Behrouz-Forouzan/dp/007070208X

SOFT SKILLS AND INTERPERSONAL COMMUNICATION

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB18	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Communicate in a comprehensible English accent and pronunciation.
II. Use the four language skills i.e., Listening, Speaking, Reading and Writing effectively.
III. Develop the art of interpersonal communication skills to avail the global opportunities
IV. Enhances the understanding of soft skills resulting in an overall grooming of the skills

MODULE-I	SOFT SKILLS	Classes: 09

Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Application of Soft Skills, Discovering the Self; Setting Goals; Positivity and Motivation: Developing Positive Thinking and Attitude

MODULE -II	EFFECTIVENESS OF SOFT SKILLS	Classes: 09

Developing interpersonal relationships through effective soft skills; Define Listening, Speaking, Reading and Writng skills; Barriers to Listening, Speaking, Reading and Writing; Essential formal writing skills; Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.

MODULE-III	ORAL AND AURAL SKILLS	Classes: 09

Vocabulary:
Sounds of English vowels sounds and constant sounds, Word Accent and connected speech- contractions, questions tags, Listening for information, Taking notes while listening to lectures (use of Dictionary).

Group Discussion: Importance, Planning, Elements, Skills, Effectively disagreeing, Initiating.

MODULE-IV	VERBAL AND NON-VERBAL COMMUNICATION	Classes: 09

Interpersonal communication-verbal and nonverbal etiquette; Body language, grapevine, Postures, Gestures, Facial expressions, Proximity; Conversation skills, Critical thinking, Teamwork, Group Discussion, Impact of Stress; Measurement and Management of Stress

MODULE-V	INTERPERSONAL COMMUNICATION	Classes: 09

Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing introduction and conclusion; Techniques for writing precisely; Letter writing; Formal and Informal letter writing; E-mail writing, Report Writing.

Text Books:

Handbook of English for Communication (Prepared by Faculty of English, IARE)

Reference Books:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. "The Hard Truth about Soft Skills", London: HarperCollins E-books, 2007.
4. Stein, Steven J. & Howard E. Book. "The EQ Edge: Emotional Intelligence and Your Success" Canada: Wiley & Sons, 2006
5. Suresh Kumar. English for Success. Cambridge University Press IndiaPvt.Ltd.2010.
6. Dorling Kindersley. Communication Skills & Soft Skills - An Integrated Approach. India Pvt. Ltd. 2013.

Web References:

1. www.edufind.com
2. www.myenglishpages.com
3. http://grammar.ccc.comment.edu
4. http://owl.english.prudue.edu

E-Text Books:

1. http://bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. https://americanenglish.state.gov/files/ae/resource_files/developing_writing.pdf
4. http://learningenglishvocabularygrammar.com/files/idiomsandphraseswithmeaningsandexamplespdf.pdf
5. http://www.robinwood.com/Democracy/General Essays/CriticalThinking.pdf

CYBER LAW AND ETHICS

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB19	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand key terms and concepts in cyber society, cyber ethics.
II. Analyze fundamentals of Cyber Law
III. Learn the importance of nine P's in ethics.
IV. Understand artificial intelligence and Blockchain ethics.

MODULE-I	CYBER SOCIETY	Classes: 09

Definitions, Specificities of the Cyberspace, Dimensions of Cyber Ethics in Cyber Society, Fourth Industrial Revolution, Users' Motivations in Cyber-Space, Core Values and Virtues, Old Values or Eschatological Vision?, Cyber Ethics by Norms, Laws and Relations Artificial Intelligence Ethics: "AI for Good", Cyber-Capitalism: Cyber-Ethics as Business Ethics.

MODULE-II	CYBER LAW AND CYBER ETHICS	Classes: 09

Cyber Law and Cyber Ethics

The Importance of Cyber Law, The Significance of Cyber Ethics, Cyber Crime is Unethical and Illegal, Ethics Education has Positive Impact, The Need for Cyber Regulation Based on Cyber Ethics, Very Dangerous Times.

MODULE-III	ETHICS IN THE INFORMATION SOCIETY, THE NINE P'S	Classes: 09

Principles: Ethical Values, Participation: Access to Knowledge for All, People: Community, Identity, Gender, Generation, Education, Profession: Ethics of Information Professions, Privacy: Dignity, Data Mining, Security.

Piracy: Intellectual Property, Cybercrime, Protection: Children and Young People,
Power: Economic Power of Technology, Media and Consumers, Policy: Ethics of Regulation and Freedom.

MODULE-IV	DISRUPTIVE CYBER TECHNOLOGIES AND AI ETHICS	Classes: 09

Disruptive Cyber Technologies and Ethics -I

Artificial: Negative Moral Judgment?, Artificial: Ethically Positive Innovation?, Intelligence: Action-oriented Ability, Creation Story: Human Beings Responsibility, The Commandment to Love and Artificial Intelligence; **Artificial Intelligence Ethics:**Top Nine Ethical Issues in Artificial Intelligence, Five Core Principles to Keep AI Ethical, Ethics Should Inform AI – But Which Ethics?

MODULE-V	DISRUPTIVE CYBER TECHNOLOGIES AND ETHICS -II	Classes: 09

Disruptive Cyber Technologies and Ethics -II

BLOCKCHAIN ETHICS:

Blockchain Definition and Description, Blockchain Anonymity and Privacy: Ethical, No Possibility to Be Forgotten, Blockchain for Voting, Blockchain for Transparent Trade Tracing, Blockchain Energy: Environmental Impact, Decentralised or Majority-Owned, Ethically More Benefits or Dangers, future jobs in cyber society.

Text Books:
1. Christoph Stuckelberger, Pavan Duggal, “Cyber Ethics 4.0 Serving humanity with values”, Globethics.net Global Series, 2018.
Reference Books:
1. Dr. Farooq Ahmad, Cyber Law in India, Allahbad Law Agency- Faridabad. 2. J.P. Sharma, SunainaKanojia, Cyber Laws 3. Harish Chander , Cyber Laws and IT Protection
E-Reference:
1. https://www.globethics.net/documents/4289936/13403236/Ge_Global_17_web_isbn9782889312641.pdf/

ECONOMIC POILICIES IN INDIA

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB20	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Introduce the economic development elements and its measures
II. Provide inside knowledge on monetary policy and its importance in economic development
III. Communicate the importance of fiscal policies in promoting the economy
IV. Explore the policies and practices in resource base infrastructure
V. Discuss the industrial and exit policies related to the industries

MODULE-I	INTRODUCTION ECONOMIC DEVELOPMENT AND ITS DETERMINANTS	CLASSES: 09

Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.

MODULE-II	MONEY, BANKING AND PRICES	CLASSES: 09

Analysis of price behavior in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India

MODULE-III	FISCAL POLICY AND PUBLIC FINANCES	CLASSES: 09

Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel economy; Problems relating to fiscal policy; Fiscal sector reforms in India.

MODULE-IV	RESOURCE BASE AND INFRASTRUCTURE	CLASSES: 09

Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing infrastructure development. Policies and Performance in Industry Growth; productivity; diversification; small scale industries; public sector; competition policy; foreign investment.

MODULE-V	THE INDUSTRIAL AND EXIT POLICIES	CLASSES: 09

Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit policy – issues in labour market reforms; approaches for employment generation

Text Books:

1. The Wealth of Nations-Adam Smith, introduction by Alan B Krueger.
2. The Strength of Economic Development by Albert Hirschman.
3. Money, Banking and Public Finance by Dr. V.C.Sinha
4. Government of India, Economic Survey (Annual), Ministry of Finance, New Delhi.
5. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, New Delhi.

Reference Books:

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press, Amritsar.
4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State Perspectives, Book well, Delhi.
5. Chakravarty, S. (1987), Development Planning: The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth: The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep & Deep Publications, New Delhi.

Web References:

1. Parikh, K. S. (1999), India Development Report – 1999-2000, Oxford University Press, New Delhi8.
2. Reserve Bank of India, Report on Currency and Finance, (Annual).
3. Sandesara, J. c. (1992), Industrial Policy and Planning, 1947-19919 : Tendencies, Interpretations and Issues, Sage Publications, New Delhi.

GLOBAL WARMING AND CLIMATE CHANGE

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB21	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the importance of Ozone layer in the atmosphere.
II. Comprehend composition of atmosphere.
III. Understand impacts of climate change on ecosystem.
IV. Understand initiatives taken by different countries to reduce emission of greenhouse gases.

MODULE - I	EARTH'S CLIMATE SYSTEM	Classes: 09

Role of ozone in environment, Ozone layer – Ozone depleting gases, Green House Effect – Radioactive effects of Greenhouse gases, The Hydrological cycle, Green House Gases and Global Warming, Carbon Cycle.

MODULE -II	ATMOSPHERE AND ITS COMPONENTS	Classes: 09

Importance of Atmosphere – Physical and chemical characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere,Atmospheric stability, Temperature profile of the atmosphere,Lapse rates, Temperature inversion, Effects of inversion on pollution dispersion.

MODULE - III	IMPACTS OF CLIMATE CHANGE	Classes: 09

Causes of Climate change: Changes of Temperature in the environment, Melting of ice pole, sea level rise, Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem, Water Resources, Human Health, Industry, Settlement and Society.

Methods and Scenarios, Projected Impacts for different regions, Uncertainties in the projected impacts of Climate Change, Risk of Irreversible Changes.

MODULE - IV	OBSERVED CHANGES AND ITS CAUSES	Classes: 09

Climate change and Carbon credits, CDM – Initiatives in India-Kyoto Protocol, Paris Convention - Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks. The Montreal Protocol – UNFCCC – IPCC – Global Climate Models (GCM) - Evidences of Changes in Climate and Environment- on a Global scale and in India.

MODULE - V	CLIMATE CHANGE AND MITIGATION MEASURES	Classes: 09

Clean Development Mechanism, Carbon Trading – Examples of future clean technology, Biodiesel – Natural Compost, Eco-friendly plastic, Alternate Energy –Hydrogen, Bio-fules, Solar Energy, Wind and Hydroelectric Power. Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices – Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry – Carbon sequestration, Carbon capture and storage (CCS), Waste (MSW & Bio-waste, Biomedical, Industrial waste) – International and Regional cooperation.

Text Books:

1. Dr. Sushil Kumar Dash, "Climate Change: An Indian Perspective (Environment and Development)", Cambridge University Press India Pvt Ltd, 2007.
2. Adaptation and mitigation of climate change – Scientific Technical Analysis, Cambridge University Press, Cambridge, 2006.

Reference Books:
1. Atmospheric Science, J.M. Wallace and P.V Hobbs, Elsevier/ Academic Press, 2006. 2. "Climate Change and Climate Variability on Hydrological Regimes", Jan C. Van Dam, Cambridge University Press, 2003.
E-Text Books:
1. https://www.worldcat.org/title/encyclopedia-of-global-warming-climate-change/oclc/805580328 2. https://libguides.nus.edu.sg/c.php?g=433566&p=2955835

INTELLECTUAL PROPERTY RIGHTS

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB22	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Gain knowledge in world trade organization and agreements between nations.
II. Safeguard the intellectual property with international trade agreements.
III. Understand types of intellectual property rights.
IV. Apply different laws in protection of intellectual property rights and its implementation.

MODULE- I	INTRODUCTION	Classes: 10

General agreement on tariffs and trade (GATT) eight rounds: Uruguay round, world trade organization: structure, technology transfer, dispute resolution mechanism, Doha declaration world trade organization agreements including trade related intellectual properties rights and trade related investment measures.

MODULE- I	WORLD INTELLECTUAL PROPERTY ORGANIZATION	Classes: 08

Paris convention, Bern convention, Budapest treaty, Madrid agreement, huge agreement.

MODULE- I	PATENTS	Classes: 09

Historical background of intellectual property rights, introduction, definition and classification of intellectual property, patents, patentable and non-patentable inventions. Legal requirements for patents, types of patent applications, patent document: specification and claims, important procedural aspects, management of intellectual property rights assets and intellectual property portfolio, commercial exploitation of intellectual property.

MODULE- I	DESIGNS AND GEOGRAPHICAL INDICATIONS	Classes: 10

Designs: basic requirements, procedure, convention application term, date, geographical indication: definition, what can be registered, who can apply, rights, term, restrictions.

MODULE- I	TRADEMARK AND COPYRIGHTS	Classes: 08

Definition, classification of trademarks, classifications of goods and services, Vienna classification, trademarks procedure, trademarks enforcement: infringement and passing off, remedies, copyrights, term of copyrights, and procedure of copyright assignment of copyright, copyright infringement remedies.

Text Books:

1. P. K. Vasudeva,World Trade Organization: Implications on Indian Economy, Pearson Education,2015.
2. P.KrishnaRao, WTO, Text and cases, Excel Books, 2015.
3. Carlos M.Correa- Intellectual property rights, The WTO and Developing countries-Zed books.

Reference Books:

1. Caves, Frankel, Jones, World Trade and Payments-An Introduction, Pearson4. Education, 2015.
2. Carlos M.Correa- Intellectual property rights, The WTO and Developing countries-Zed books.
3. Peter-Tobias stoll, Jan busche, Katrianarend- WTO- Trade –related aspects of IPR- Library of Congress.

Web References:
1. http://www.ebooks directory.com 2. http://Campus guides.lib.utah.edu
E-Text Books:
1. http://www.bookboon.com 2. http://www.freemagagement.com 3. http://www.emeraldinsight.com

ENTREPRENEURSHIP

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB23	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the Entrepreneurial process and also inspire them to be Entrepreneurs.
II. Adopting of the key steps in the elaboration of business idea.
III. Understand the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

MODULE-I	**UNDERSTANDING ENTREPRENEURIAL MINDSET**	**Classes: 09**

The revolution impact of entrepreneurship- The evolution of entrepreneurship - Functions of Entrepreneurs – types of entrepreneurs -Approaches to entrepreneurship- Process approach- Role of entrepreneurship in economic development- Twenty first century trends in entrepreneurship.

MODULE-II	**INDIVIDUAL ENTREPRENEURIAL MIND-SET AND PERSONALITY**	**Classes: 09**

The entrepreneurial journeyStress and the entrepreneur - the entrepreneurial ego - Entrepreneurial motivations- Motivational cycle – Entrepreneurial motivational behavior – Entrepreneurial competencies. Corporate Entrepreneurial Mindset, the nature of corporate entrepreneur- conceptualization of corporate entrepreneurship Strategy-sustaining corporate entrepreneurship.

MODULE-III	**LAUNCHING ENTREPRENEURIAL VENTURES**	**Classes: 09**

Opportunities identification- Finding gaps in the market place – techniques for generating ideas-entrepreneurial Imagination and Creativity- the nature of the creativity process - Innovation and entrepreneurship.

Methods to initiate Ventures- Creating new ventures-Acquiring an Established entrepreneurial venture-Franchising- advantage and disadvantages of Franchising.

MODULE-IV	**LEGAL CHALLENGES OF ENTREPRENEURSHIP**	**Classes: 09**

Intellectual property protection - Patents, Copyrights - Trademarks and Trade secrets - Avoiding trademark pitfalls. Feasibility Analysis - Industry and competitor analysis - Formulation of the entrepreneurial Plan- The challenges of new venture start-ups, developing an effective business model – Sources of finance - Critical factors for new venture development - The Evaluation process

MODULE-V	**STRATEGIC PERSPECTIVES IN ENTREPRENEURSHIP -**	**Classes: 09**

Strategic planning - Strategic actions strategic positioning- Business stabilization - Building the adaptive firms - Understanding the growth stage – Internal growth strategies and external growth strategies, Unique managerial concern of growing ventures. Initiatives by the Government of India to promote entrepreneurship, Social and women entrepreneurship.

Text Books:
1. D F Kuratko and T V Rao, "Entrepreneurship- A South-Asian Perspective", Cengage Learning, 2012. 2. Bruce R. Barringer/ R.Duane Ireland, "Entrepreneurship Successfully Launching New Ventures", Pearson, 4th Edition, 2015. 3. S.S.Khanka, Entrepreneurship Development, S. Chand Publications, 2015.
Reference Books:
1. Stuart Read, Effectual Entrepreneurship, Routledge, 2013. 2. Rajeev Roy, Entrepreneurship, Oxford publications, 2nd Edition, 2012. 3. Nandan .H, Fundamentals of Entrepreneurship, PHI, 2013.

MICROPROCESSORS AND INTERFACING

OE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB55	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the architecture of 8085 and 8086 microprocessors.
II. Analyze and develop the programming and interfacing techniques of 8086 microprocessor.
III. Understand the architecture of advanced microprocessors and microcontrollers.
IV. Analyze the basic concepts and programming of 8051 microcontroller.

MODULE -I	**Introduction to 8 bit and 16 bit Microprocessor.**	**Classes: 08**

An over view of 8085, Architecture of 8086 Microprocessor, register organization of 8086, 8086 flag register. Addressing modes of 8086, Instruction set of 8086. Assembler directives, procedures, and macros. Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

MODULE -II	**Operation of 8086 and Interrupts.**	**Classes: 09**

Pin diagram of 8086-Minimum mode and maximum mode of operation with Timing diagrams. Interrupt structure of 8086: Vector interrupt table, Interrupt service routines. Introduction to DOS and BIOS interrupts.

MODULE -III	**Interfacing with 8086.**	**Classes: 09**

Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA, DMA data transfer Method, Interfacing with 8237/8257. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance.

Serial data transfer schemes: Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing. TTL to RS 232C and RS232C to TTL conversion.

MODULE -IV	**ADVANCED MICRO PROCESSORS**	**Classes: 09**

Introduction to 80286, Salient Features of 80386, Real and Protected Mode Segmentation & Paging, Salient Features of Pentium, Branch Prediction, and Overview of RISC Processors.

MODULE -V	**8051 MICROCONTROLLER ARCHITECTURE**	**Classes: 10**

8051 Microcontroller Architecture, Register set of 8051, Modes of timer operation, Serial port operation, Interrupt structure of 8051, Memory and I/O interfacing with 8051.

Text Books:

1. A.K.Ray and K.M.Bhurchandi, "Advanced Microprocessor and Peripherals", TMH, 2000.
2. Deshmukh, "Micro Controllers", Tata McGraw Hill Edition, TMH, 2000

Reference Books:

1. Douglas U, "Micro Processors & Interfacing", Hall, 2007.
2. By Liu, GA Gibson, "Micro Computer System 8086/8088 Family Architecture, Programming and Design", PHI, 2nd Edition, 2007.

Web References:
1. http://www.nptel.ac.in/downloads/106108100/ 2. http://www.the8051microcontroller.com/web-references 3. http://www.iare.ac.in
E-Text Books:
1. https://books.google.co.in/books 2. http://www.www.jntubook.com 3. http://www.ebooklibrary.org/articles/mpmc

PRINCIPLES OF COMMUNICATION

OE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB56	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Determine the performance of analog modulation schemes in time and frequency domains
II. Determine the performance of analog communication systems
III. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

MODULE -I	**AMPLITUDE MODULATION**	**Classes: 08**

Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector.

MODULE -II	**DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION**	**Classes: 09**

Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

MODULE -III	**SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION**	**Classes: 09**

SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

MODULE -IV	**ANGLE MODULATION**	**Classes: 09**

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

MODULE -V	**DIGITAL REPRESENTATION OF ANALOG SIGNALS**	**Classes: 10**

Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing

Text Books:

1. Communication Systems, Simon Haykins & Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press., 4th edition.
2. An Introduction to Analog and Digital Communication, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.

3. Principles of Communication Systems, H.Taub & D.L.Schilling, TMH, 2011. 4. Communication Systems, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004. 5. Communication Systems: Analog and Digital, R.P.Singh and S.Sapre: TMH 2nd edition, 200
Web References:
1. http://www.web.eecs.utk.edu 2. https://everythingvtu.wordpress.com 3. http://nptel.ac.in/ 4. http://www.iare.ac.in
E-Text Books:
1. http://www.bookboon.com/ 2. http://www.jntubook.com 3. http://www.smartzworld.com 4. http://www.archive.org

IMAGE PROCESSING

OE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB57	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the image fundamentals and mathematical transforms necessary for image processing.
II. Describe the image enhancement techniques.
III. Analyze the image compression procedures.
IV. Design the image segmentation and representation techniques.

MODULE -I	**DIGITAL IMAGE FUNDAMENTALS**	**Classes: 10**

Digital Image through scanner, digital camera. Concept of gray levels. Gray level to binary image conversion. Sampling and quantization. Relationship between pixels. Imaging Geometry.

MODULE -II	**IMAGE TRANSFORMS**	**Classes: 09**

2-D FFT , Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform.

MODULE -III	**IMAGE ENHANCEMENT**	**Classes: 08**

Point processing. Histogram processing. Spatial filtering. Enhancement in frequency domain, Image smoothing, Image sharpening.

MODULE -IV	**IMAGE SEGMENTATION**	**Classes: 08**

Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

MODULE -V	**IMAGE COMPRESSION**	**Classes: 10**

Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

Text Books:

1. R.C. Gonzalez & R.E. Woods, "Digital Image Processing", Addison Wesley/ Pearson education, 2nd Education, 2002.

Reference Books:

1. A.K.Jain, "Fundamentals of Digital Image Processing, PHI. 3RD Edition, 2003.
2. – Rafael C. Gonzalez, Richard E Woods and Steven, "Digital Image Processing using MAT LAB" L. Edition, PEA, 2004.
3. William K. Pratt, John, "Digital Image Processing", Wilely , 3rd Edition, 2004.

Web References:

1. https://imagingbook.com/
2. https://en.wikipedia.org/wiki/Digital_image_processing
3. http://www.tutorialspoint.com/dip/
4. http://www.imageprocessingplace.com/

E-Text Books:

1. http://www.sci.utah.edu/~gerig/CS6640-F2010/dip3e_chapter_02.pdf
2. http://www.faadooengineers.com/threads/350-Digital-Image-Processing
3. http://newwayofengineering.blogspot.in/2013/08/anil-k-jain-fundamentals-of-digital.html

ELECTRICAL ENGINEERING MATERIALS

OC – IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB55	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Learn the basics of materials used in electrical engineering.
II. Realize the dielectric properties of insulators in static and alternating fields.
III. Explain the importance of magnetic properties and superconductivity.
IV. Explain the behavior of conductivity of metals and classifications of semiconductor materials.

MODULE-I	**ELEMENTARY MATERIALS SCIENCE CONCEPTS**	**Classes: 06**

Bonding and types of solids, crystalline state and their defects, classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, hall effect.

MODULE-II	**DIELECTRIC PROPERTIES OF INSULATORS IN STATIC AND ALTERNATING FIELD**	**Classes: 06**

Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, internal field in solids and liquids, properties of Ferro-Electric materials, polarization, piezoelectricity, frequency dependence of electronic and Ionic polarizability, complex dielectric constant of non-dipolar solids, dielectric losses.

MODULE-III	**MAGNETIC PROPERTIES AND SUPER CONDUCTIVITY**	**Classes: 07**

Magnetization of matter, magnetic material classification, ferromagnetic origin, curie-weiss law, soft and hard magnetic materials:

Superconductivity and its origin, zero resistance and Meissner effect, critical current density.

MODULE-IV	**CONDUCTIVITY OF MATERIALS**	**Classes: 08**

Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.

MODULE-V	**SEMICONDUCTOR MATERIALS**	**Classes: 08**

Classification of semiconductors, semiconductor conductivity, temperature dependence, carrier density and energy gap, trends in materials used in electrical equipment.

Text Books:

1. J Dekker, "Electrical Engineering Materials Adrianus", Phi Learning Publishers, 2nd Edition, 1996.
2. Solymar, L, "Electrical Properties of Materials", Oxford University Press-New Delhi 8th Edition, 2009.

Reference Books:
1. Indulkar C, "Introduction to Electrical Engineering Materials", S Chand &Company Ltd-New Delhi 4th Edition, 2004. 2. SK Bhattacharya, "Electrical and Electronic Engineering Materials", Khanna Publishers, New Delhi, 2nd Edition, 1998.
Web References:
1. https://www.electrical4u.com/electrical-engineering-materials/ 2. https://lecturenotes.in/subject/219/electrical-engineering-materials-eem
E-Text Books:
1. https://www.books.google.co.in/books/about/A_Textbook_of_Electrical_Engineering_Mat.html?id=Ee8ruUXkJeMC. 2. https://www.amazon.in/Introduction-Electrical-Engineering-Materials-ebook/dp/B00QUYKXTI

NON CONVENTIONAL ENERGY SOURCES

OE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB56	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the various types of renewable energy sources.
II. Analyze the principle and operation of direct energy conversion.
III. Understand and analyze the hybrid energy systems.
IV. Understand the renewable energy sources to real world electrical and electronics problems.

MODULE-I	PRINCIPLES OF SOLAR RADIATION	Classes: 08

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

MODULE - II	SOLAR ENERGY COLLECTION AND SOLAR ENERGY STORAGE AND APPLICATIONS	Classes: 10

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and
drying, photovoltaic energy conversion

MODULE - III	WIND ENERGY AND BIO-MASS	Classes: 09

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects

MODULE - IV	GEOTHERMAL ENERGY AND OCEAN ENERGY	Classes: 10

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

MODULE - V	DIRECT ENERGY CONVERSION	Classes: 08

Need for DEC, Carnot cycle, limitations, principles of DEC.

Text Books:

1.G.D. Rai, "Non-Conventional Energy Sources", TMH, 3rd Edition 2009.
2.Twidell & Weir, "Renewable Energy Sources", CRC Press, 1st Edition, 2008.

Reference Books:

1. Renewable Energy resources /Tiwari and Ghosal/Narosa
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Renewable Energy sources and emerging technologies by D.P. Kothari, K.C. Singhal, P.H.I

NANO TECHNOLOGY

OE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB57	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Impart the basic knowledge in Nano Science and Technology.
II. Give insight into many aspects of Nano science, technology and their applications in the prospective of materials science.
III. Develop new devices and technologies for applications in a wide range of industrial sectors including information technology, medicine, manufacturing, high-performance materials

UNIT-I INTRODUCTION

History and scope, can small things make a big difference, classification of nanostructured materials, fascinating nanostructures, applications of nanomaterials, Nature: The best of nanotechnologist, challenges, and future prospects.

UNIT-II UNIQUE PROPERTIES OF NANOMATERIALS

Microstructure and Defects in Nanocrystalline Materials: Dislocations, twins, stacking faults and voids, grain boundaries, triple, and disclinations, effect of Nano-dimensions on materials behavior: Elastic properties, melting point, diffusivity, grain growth characteristics, enhanced solid solubility; Magnetic Properties: Soft magnetic Nanocrystalline alloy, permanent magnetic Nanocrystalline materials, giant magnetic resonance, electrical properties, optical properties, thermal properties, and mechanical properties.

UNIT-III SYNTHESIS ROUTES

Bottom up approaches: Physical vapor deposition, inert gas condensation, laser ablation, chemical vapor deposition, molecular beam Epitaxy, solgel method, self assembly.

Top down approaches: Mechanical alloying, Nano-lithography, consolidation of Nano powders: Shock wave consolidation, hot isostatic pressing and cold isostatic pressing spark plasma sintering.

UNIT-IV TOOLS TO CHARACTERIZE NANOMATERIALS

X-Ray Diffraction (XRD), small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

UNIT-V APPLICATIONS OF NANOMATERIALS

Nano-electronics, micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, food and agricultural industry, cosmetic and consumer goods, structure and engineering, automotive industry, water treatment and the environment, Nano-medical applications, textiles, paints, energy, defence and space applications, concerns and challenges of Nanotechnology.

Text Books:

1. B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, "Text Book of Nano Science and Nano Technology", University Press-IIM.
2. Charles P. Poole, Jr., and Frank J. Owens, "Introduction to Nanotechnology", Wiley India Edition, 2012.

Reference Books

1. T. Pradeep, "Nano: The Essentials", McGraw- Hill Education.
2. David Ferry, "Transport in Nano structures", Cambridge University Press, 2000.
3. Challa S., S. R. Kumar, J. H. Carola, "Nanofabrication towards Biomedical Application: Techniques, tools", Application and impact Edition.
4. Michael J. O'Connell. "Carbon Nanotubes: Properties and Applications", Cambridge University Press.
5. S. Dutta, "Electron Transport in Mesoscopic Systems", Cambridge University Press.

Web References:

1.https://www.dummies.com/education/.../useful-nanotechnology-information-websites/
2.https://www.ncbi.nlm.nih.gov/books/NBK21031/
3.https://libguides.northwestern.edu › LibGuides

E-Text Book:

1. https://www.accessengineeringlibrary.com/.../textbook-of-nanoscience-and-nanotechn
2. https://www.azonano.com/book-reviews-index.aspx
3. https://en.wikibooks.org/wiki/Nanotechnology/Print_version

ENVIRONMENTAL SCIENCES

IV Semester: AE / CSE / IT / ECE / EEE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB07	Mandatory	-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

COURSE OBJECTIVES:

The course should enable the students to:

I. Analyze the interrelationship between living organism and environment.
II. Understand the importance of environment by assessing its impact on the human world.
III. Enrich the knowledge on themes of biodiversity, natural resources, pollution control and waste management.
IV. Understand the constitutional protection given for environment.

MODULE-I ENVIRONMENT AND ECOSYSTEMS

Environment: Definition, scope and importance of environment, need for public awareness; Ecosystem: Definition, scope and importance of ecosystem, classification, structure and function of an ecosystem, food chains, food web and ecological pyramids, flow of energy; Biogeochemical cycles; Biomagnifications

MODULE-II NATURAL RESOURCES

Natural resources: Classification of resources, living and nonliving resources; Water resources: Use and over utilization of surface and ground water, floods and droughts, dams, benefits and problems; Mineral resources: Use and exploitation; Land resources; Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

MODULE-III BIODIVERSITY AND BIOTIC RESOURCES

Biodiversity and biotic resources: Introduction, definition, genetic, species and ecosystem diversity; Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values; India as a mega diversity nation; Hot spots of biodiversity

Threats to biodiversity: Habitat loss, poaching of wildlife, human-wildlife conflicts; Conservation of biodiversity: In situ and ex situ conservation; National biodiversity act.

MODULE-IV ENVIRONMENTAL POLLUTION, POLLUTION CONTROL TECHNOLOGIES AND GLOBAL ENVIRONMENTAL PROBLEMS

Environmental pollution: Definition, causes and effects of air pollution, water pollution, soil pollution, noise pollution; Solid waste: Municipal solid waste management, composition and characteristics of e-waste and its management; Pollution control technologies: Waste water treatment methods, primary, secondary and tertiary; Concepts of bioremediation; Global environmental problems and global efforts: Climate change, ozone depletion, ozone depleting substances, deforestation and desertification

MODULE-V ENVIRONMENTAL LEGISLATIONS AND SUSTAINABLE DEVELOPMENT

Environmental legislations: Environmental protection act, air act1981, water act, forest act, wild life act, municipal solid waste management and handling rules, biomedical waste management and handling rules2016, hazardous waste management and handling rules, Environmental impact assessment(EIA); Towards sustainable future: Concept of sustainable development, population and its explosion, crazy consumerism, environmental education, urban sprawl, concept of green building

Text Books:

1. Benny Joseph, “Environmental Studies”, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2005.
2. Erach Bharucha, “Textbook of Environmental Studies for Undergraduate Courses”, Universities Press. 2005.

Reference Books:

1. Anji Reddy .M, “Textbook of Environmental Sciences and Technology”, BS Publications, 2007.
2. Anjaneyulu, “Introduction to Environmental Sciences”, BS Publications, 2004.
3. Anubha Kaushik, Perspectives in Environmental Science, New age international. 3rd Edition, 2006.
4. Tyler Miller, Scott Spoolman, “Environmental Science”, Cengage Learning, 14th Edition, 2012.

Web References:

1. https://www.tndte.com
2. https://www.nptel.ac.in/downloads
3. https://www.scribd.com
4. https://www.cuiet.info
5. https://www.sbtebihar.gov.in
6. https://www.ritchennai.org

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

VII Semester: AE / CSE / IT / ECE / EEE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB17	Mandatory	-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

COURSE OBJECTIVES:

The course should enable the students to:

I. Understand the concept of Traditional knowledge and its importance
II. Know the need and importance of protecting traditional knowledge.
III. Know the various enactments related to the protection of traditional knowledge.
IV. Understand the concepts of Intellectual property to protect the traditional knowledge

MODULE-I	INTRODUCTION TO TRADITIONAL KNOWLEDGE

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

MODULE-II	PROTECTION OF TRADITIONAL KNOWLEDGE

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

MODULE-III	LEGAL FRAME WORK AND TK

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);

B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

MODULE-IV	TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

MODULE-V	TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS:

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.

Text Books:

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

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-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 **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments **(Project management and finance).**

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF CIVIL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

A graduate of the Civil Engineering Program should:

PEO – I: To impart proficiency in engineering knowledge and skills to analyze, design, build, maintain, or improve civil engineering based systems. (Professional Excellence)

PEO – II: To offer broad education and practical skills so that the students can carry out technical investigations within realistic constraints such as economic, environmental, societal, safety and sustainability. (Understanding Socio-Economic Aspects)

PEO – III: To impart ability to collaborate with and function on multidisciplinary teams to offer engineering solutions to the society (Technical Collaboration)

PEO – IV: To create interest in the students to engage in life-long learning in advanced areas of civil engineering and related fields. (Continued Self-Learning)

PEO – V: To educate the students in ethical values and social responsibility to use engineering techniques and modern tools necessary for civil engineering practice to serve the society effectively. (Effective Contribution to Society)

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: **ENGINEERING KNOWLEDGE:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.

PSO – II: **BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.

PSO – III: **SELF-LEARNING AND SERVICE:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 Shall IARE award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3 What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6 Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Program Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 Can IARE have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9 Can IARE give a provisional degree certificate?

Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B,C,D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits for UG/PG program?

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m} \left(C_j S_j \right) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, The institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Boared of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Sheet etc fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28 Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or IARE?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programs also?

Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT / PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr. / Ms. ---------- joining I Semester / III Semester for the academic year 2018-2019 / 2019-2020 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/laboratory/project) and secure attendance of not less than 75% in every course as stipulated by Institute. I am fully aware that an attendance of less than 65% in more than 60% of theory courses in a semester will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R18 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number