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
ELECTRONICS AND COMMUNICATION 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 CIA 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.

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

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)

ELECTRONICS AND COMMUNICATION 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
AHSB04	Waves and Optics	BSC	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
AHSB10	Engineering Physics Laboratory	BSC	Foundation	0	0	3	1.5	30	70	100
AMEB02	Engineering Graphics and Design Laboratory	ESC	Foundation	1	0	4	3	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
ACSB01	Programming for Problem Solving	ESC	Foundation	3	0	0	3	30	70	100
AEEB03	Electrical Circuits	ESC	Foundation	3	1	0	4	30	70	100
PRACTICAL										
AHSB09	Engineering Chemistry 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
AEEB06	Electrical Circuits Analysis 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										
AHSB05	Complex Analysis and Special Functions	BSC	Foundation	3	0	0	3	30	70	100
AECB06	Electronic Devices and Circuits	PCC	Core	3	1	0	4	30	70	100
AECB07	Digital System Design	PCC	Core	3	1	0	4	30	70	100
AECB08	Probability Theory and Stochastic Process	PCC	Core	3	1	0	4	30	70	100
ACSB03	Data Structures	PCC	Core	3	0	0	3	30	70	100
PRACTICAL										
AECB09	Electronic Devices and Circuits Laboratory	PCC	Core	0	0	3	1.5	30	70	100
AECB10	Digital System Design Laboratory	PCC	Core	0	0	2	1	30	70	100
ACSB05	Data Structures Laboratory	PCC	Core	0	0	3	1.5	30	70	100
TOTAL				**15**	**03**	**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										
AECB11	Analog and Pulse Circuits	PCC	Core	3	1	0	4	30	70	100
AECB12	Analog Communications	PCC	Core	3	1	0	4	30	70	100
AECB13	Electromagnetic Waves and Transmission Lines	PCC	Core	3	0	0	3	30	70	100
AECB14	Signals and Systems	PCC	Core	3	0	0	3	30	70	100
AEEB16	Control Systems	PCC	Core	3	1	0	4	30	70	100
AHSB07	Environmental Science	MC-II	---	0	0	0	0	30	70	100
PRACTICAL										
AECB15	Analog and Pulse Circuits Laboratory	PCC	Core	0	0	3	1.5	30	70	100
AECB16	Analog Communications Laboratory	PCC	Core	0	0	3	1.5	30	70	100
AECB17	Signals and Systems Laboratory	PCC	Core	0	0	2	1	30	70	100
TOTAL				**15**	**03**	**08**	**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										
AECB18	Antennas and Wave Propagation	PCC	Core	2	1	0	3	30	70	100
AECB19	Linear and Digital IC Applications	PCC	Core	2	1	0	3	30	70	100
AECB20	Digital Communications	PCC	Core	3	0	0	3	30	70	100
ACSB38	JAVA Programming	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										
AECB21	Linear and Digital IC Applications Laboratory	PCC	Core	0	0	2	1	30	70	100
AECB22	Digital Communications 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										
AECB23	Digital Signal Processing	PCC	Core	2	1	0	3	30	70	100
AECB24	Microprocessors and Microcontrollers	PCC	Core	2	1	0	3	30	70	100
AHSB14	Business Economics and Financial Analysis	PCC	Core	3	0	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										
AECB25	Digital Signal Processing Laboratory	PCC	Core	0	0	2	1	30	70	100
AECB26	Microprocessors and Microcontrollers 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										
AECB27	VLSI Design	PCC	Core	3	0	0	3	30	70	100
AECB28	Satellite and Microwave 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	Essence of Indian Traditional Knowledge	MCC	---	0	0	0	0	30	70	100
PRACTICAL										
AECB29	VLSI Design Laboratory	PCC	Core	0	0	3	1.5	30	70	100
AECB30	Antennas and Microwave Engineering Laboratory	PCC	Core	0	0	3	1.5	30	70	100
AECB61	Project work – I	SEC	Core	0	0	10	5	30	70	100
TOTAL				**15**	**01**	**14**	**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										
AECB62	Project Work – II / Full Semester Internship	SEC	Core	0	0	12	6	30	70	100
TOTAL				**06**	**00**	**12**	**12**	**90**	**210**	**300**

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE - I: SEMICONDUCTOR TECHNOLOGY

Course Code	Course Title
AECB31	Introduction to MEMS
AECB32	Electronic Measurements and Instrumentation
AECB33	Nano Electronics: Devices and Materials
AECB34	RF Circuit Design

PROFESSIONAL ELECTIVE - II: IMAGE PROCESSING

Course Code	Course Title
AECB35	Digital Image Processing
AECB36	Speech and Audio Processing
AECB37	Video Processing
AECB38	Wavelets

PROFESSIONAL ELECTIVE - III: ADVANCED COMMUNICATIONS

Course Code	Course Title
AECB39	Cellular and Mobile Communications
AECB40	Mobile Adhoc Networks
AECB41	Optical Communications
AECB42	Wireless Communications and Networks

PROFESSIONAL ELECTIVE - IV: MICRO ELECTRONICS

Course Code	Course Title
AECB43	Advanced Programmable Logic Device Architectures
AECB44	Digital design through Verilog
AECB45	Scripting Languages for VLSI Design
AECB46	Design for Testability

PROFESSIONAL ELECTIVE - V: SIGNAL AND DATA PROCESSING

Course Code	Course Title
AECB47	Advanced Digital Signal Processing
AECB48	Information Theory and Coding
AECB49	Error Correction Codes
AECB50	Radar Systems and Processing

PROFESSIONAL ELECTIVE - VI: EMBEDDED SYSTEMS

Course Code	Course Title
AECB51	Embedded C
AECB52	Real Time Systems
AECB53	Embedded Networking
AECB54	Advanced RISC Machine Architectures

OPEN ELECTIVE - I

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 ELECTIVES – II

Course Code	Course Title
ACEB52	Energy from Waste
ACEB53	Disaster Management
AAEB55	Elements of Aeronautics
AAEB28	Aviation Management
AMEB56	Introduction to Robotics
AMEB57	Rapid Prototyping

OPEN ELECTIVE - III

Course Code	Course Title
AECB58	Embedded Systems
AECB59	Cognitive Radio
AECB60	IoT and Applications
AEEB58	Industrial Automation and Control
AEEB59	Artificial Neural Networks
AEEB60	Renewable Energy Sources

OPEN ELECTIVE - IV

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

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	0	0	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: 06

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: 06

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: 06

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; Oneword substitutes.

Grammar:

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

MODULE - IV	READING SKILLS	Classes: 06

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: 06

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

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	0	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

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 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	0	0	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 39				Total Classes: 39		

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	

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	0	4	3	30	70	100
Contact Classes: 15	Tutorial Classes: Nil	Practical Classes: 60				Total Classes: 75		

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

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	0	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.

PROGRAMMING FOR PROBLEM SOLVING

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

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB01	Foundation	3	0	0	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 adequate knowledge by problem solving techniques.
II. Understand programming skills using the fundamentals and basics of C Language.
III. Improve problem solving skills using arrays, strings, and functions.
IV. Understand the dynamics of memory by pointers.
V. Study files creation process with access permissions.

MODULE - I	INTRODUCTION	Classes: 10

Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, algorithms, flowcharts; Introduction to C language: Computer languages, History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types; Operators and expressions.

MODULE - II	CONTROL STRUCTURES	Classes: 08

Conditional Control structures: Decision statements; Simple if, if-else, else if ladder, Nested if and Case Statement-switch statement; Loop control statements: while, for and do while loops. jump statements, break, continue, goto statements

MODULE - III	ARRAYS AND FUNCTIONS	Classes: 10

Arrays: Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays; Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.

Functions: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive

MODULE - IV	STRUCTURES, UNIONS AND POINTERS	Classes: 09

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, passing structures through pointers, self-referential structures, unions, bit fields, typedef, enumerations; Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers. Dynamic memory allocation: Basic concepts, library functions

MODULE - V	FILE HANDLING AND BASICALGORITHMS	Classes: 08

Files: Streams, basic file operations, file types, file opening modes, input and output operations with files, special functions for working with files, file positioning functions, command line arguments. Searching, basic sorting algorithms (bubble, insertion, selection), algorithm complexity through example programs (no formal definitions required).

Text Books:

1. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd Edition, 2017.
2. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6th Edition, 2012.

Reference Books:

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.
2. YashavantKanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.
3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
4. R. S. Bichkar, "Programming with C", Universities Press, 2nd Edition, 2012.
5. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.
6. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

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. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm
2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/
3. http://www.enggnotebook.weebly.com/uploads/2/2/7/1/22718186/ge6151-notes.pdf

MOOC Course

1. https://www.alison.com/courses/Introduction-to-Programming-in-c
2. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

ELCTRICAL CIRCUITS

II Semester: EEE / ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB03	Foundation	3	1	0	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. Classify circuit parameters and apply Kirchhoff's laws for network reduction.
II. Apply mesh analysis and nodal analysis to solve electrical networks.
III. Illustrate single phase AC circuits and apply steady state analysis to time varying circuits.
IV. Analyze electrical circuits with the help of network theorems

MODULE-I	INTRODUCTION TO ELECTRICAL CIRCUITS	Classes:09

Circuit concept: Basic definitions, Ohm's law at constant temperature, classifications of elements, R, L, C parameters, independent and dependent sources, voltage and current relationships for passive elements (for different input signals like square, ramp, saw tooth, triangular and complex), temperature dependence of resistance, tolerance, source transformation, Kirchhoff's laws, equivalent resistance of series, parallel and series parallel networks.

MODULE-II	ANALYSIS OF ELECTRICAL CIRCUITS	Classes:09

Circuit analysis: Star to delta and delta to star transformation, mesh analysis and nodal analysis by Kirchhoff's laws, inspection method, super mesh, super node analysis; Network topology: definitions, incidence matrix, basic tie set and basic cut set matrices for planar networks, duality and dual networks.

MODULE-III	SINGLE PHASE AC CIRCUITS AND RESONANCE	Classes: 10

Single phase AC circuits: Representation of alternating quantities, instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms, phase and phase difference, 'j' notation, concept of reactance, impedance, susceptance and admittance, rectangular and polar form, concept of power, real, reactive and complex power, power factor.

Steady state analysis: Steady state analysis of RL, RC and RLC circuits (in series, parallel and series parallel combinations) with sinusoidal excitation; Resonance: Series and parallel resonance, concept of band width and Q factor.

MODULE-IV	MAGNETIC CIRCUITS	Classes: 09

Magnetic circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, analysis of series and parallel magnetic circuits.

MODULE-V	NETWORK THEOREMS (DC AND AC)	Classes: 08

Network Theorems: Tellegen's, superposition, reciprocity, Thevenin's, Norton's, maximum power transfer, Milliman's and compensation theorems for DC and AC excitations, numerical problems.

Text Books:

1. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010.
2. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.

Reference Books:

1. John Bird, "Electrical Circuit Theory and Technology", Newnes, 2nd Edition, 2003.
2. C L Wadhwa, "Electrical Circuit Analysis including Passive Network Synthesis", New Age International, 2nd Edition, 2009.
3. David A Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.
4. E Hughes, "Electrical and Electronics Technology", Pearson Education, 2010.
5. A Chakrabarthy, "Electric Circuits", Dhanipat Rai & Sons, 6th Edition, 2010.
6. V D Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Web References:

1. https://www.igniteengineers.com
2. https://www.ocw.nthu.edu.tw
3. https://www.uotechnology.edu.iq
4. https://www.iare.ac.in

E-Text Books:

1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
2. https://www.www.jntubook.com
3. https://www.allaboutcircuits.com
4. https://www.archive.org

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	--

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	0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes:36		

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: AERO / CSE / IT / MECH | II Semester: ECE / EEE / 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

ELECTRICAL CIRCUITS ANALYSIS LABORATORY

II Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB06	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. Examine the basic laws and network reduction techniques.
II. Predict the characteristics of sinusoidal function.
III. Measure impedance of series RL, RC and RLC circuits.
IV. Prove the various theorems used to reduce the complexity of electrical network.

LIST OF EXPERIMENTS

Expt. 1	**OHM'S LAW, KVL AND KCL**
Verification of Ohm's law, KVL and KCL using hardware and digital simulation.	
Expt. 2	**MESH ANALYSIS**
Determination of mesh currents using hardware and digital simulation.	
Expt. 3	**NODAL ANALYSIS**
Measurement of nodal voltages using hardware and digital simulation.	
Expt. 4	**SINGLE PHASE AC CIRCUITS**
Calculation of average value, RMS value, form factor, peak factor of sinusoidal wave using hardware.	
Expt. 5	**IMPEDANCE OF SERIES RL,RC,RLC CIRCUIT**
Examine the impedance of series RL,RC,RLC Circuit	
Expt. 6	**SERIES RESONANCE**
Verification of series resonance using hardware and digital simulation.	
Expt. 7	**PARALLEL RESONANCE**
Verification of parallel resonance using hardware and digital simulation.	
Expt. 8	**SUPERPOSITION THEOREM**
Verification of superposition theorem using hardware and digital simulation	
Expt. 9	**RECIPROCITY THEOREM**

Verification of reciprocity theorem using hardware and digital simulation.	
Expt. 10	**MAXIMUM POWER TRANSFER THEOREM**
Verification of maximum power transfer theorem using hardware and digital simulation .	
Expt. 11	**THEVENINS THEOREM**
Verification of Thevenin's theorem using hardware and digital simulation.	
Expt. 12	**NORTON'S THEOREM**
Verification of Norton's theorem using hardware and digital simulation.	
Expt. 13	**COMPENSATION THEOREM**
Verification of compensation theorem using hardware and digital simulation	
Expt. 14	**MILLIMAN'S THEOREM**
Verification of Milliman's theorem using hardware and digital simulatio	

Reference Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2006.
2. William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.
3. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.iare.ac.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 24 STUDENTS:

SOFTWARE: Microsoft Windows 7 and MATLAB – V 8.5
HARDWARE: 06 numbers of Intel Desktop Computers with 2 GB RAM

COMPLEX ANALYSIS AND SPECIAL FUNCTIONS

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB05	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 basic theory of complex functions to express the power series.
II. Evaluate the contour integration using Cauchy residue theorem.
III. Enrich the knowledge of probability on single random variables and probability distributions.

MODULE -I	COMPLEX FUNCTIONS AND DIFFERENTIATION	Classes: 08

. Complex functions differentiation and integration: Complex functions and its representation on argand plane, concepts of limit, continuity, differentiability, analyticity, Cauchy-Riemann conditions and harmonic functions; Milne-Thomson method, Bilinear Transformation.

MODULE –II	COMPLEX INTEGRATION	Classes: 10

Line integral: Evaluation along a path and by indefinite integration; Cauchy's integral theorem; Cauchy's integral formula; Generalized integral formula; Power series expansions of complex functions and contour Integration: Radius of convergence.

MODULE –III	POWER SERIES EXPANSION OF COMPLEX FUNCTION	Classes: 10

Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point; Isolated singular point; Pole of order m; Essential singularity; Residue: Cauchy Residue Theorem. Evaluation of Residue by Laurent Series and Residue Theorem.

Evaluation of integrals of the type

1. $\int_0^{2\Pi} f(\cos\theta, \sin\theta)d\theta$ 2. $\int_{-\infty}^{\infty} f(x)dx$

MODULE –IV	SPECIAL FUNCTIONS - I	Classes: 08

Improper integrals; Beta and Gamma functions: Definitions; Properties of Beta and Gamma function; Standard forms of Beta functions; Relationship between Beta and Gamma functions.

MODULE -VI	SPECIAL FUNCTIONS - II	Classes: 09

Bessel's Differential equation: Bessel function, properties of Bessel function, Recurrence relations of Bessel function, Generating function and Orthogonality of Bessel function, Trigonometric expansions involving Bessel function.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. Churchill, R.V. and Brown, J.W, "Complex Variables and Applications", Tata Mc Graw-Hill, 8th Edition, 2012.
2. A. K. Kapoor, "Complex Variables Principles and Problem Sessions", World Scientific Publishers, 1st Edition, 2011.
3. Murray Spiegel, John Schiller, "Probability and Statistics", Schaum's Outline Series, 3rd Edition, 2010.

Web References:

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

E-Text Books:

1. http://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.

ELECTRONIC DEVICES AND CIRCUITS

Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB06	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. Introduce components such as diodes, BJTs and FETs.
II. Know the applications of components.
III. Know the switching characteristics of components.
IV. Give understanding of various types of amplifier circuits.

MODULE -I	DIODE AND APPLICATIONS	Classes: 08

Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers With Capacitive Filter, Clippers-Clipping at two independent levels, Clampers-Clamping Operation, types, Clamping Circuit Theorem, Comparators.

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

Principle of Operation and characteristics - Common Emitter, Common Base, Common Collector Configurations, Operating point, DC & AC load lines, Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, Conversion of h-parameters.

MODULE - III	TRANSISTOR BIASING AND STABILIZATION	Classes: 10

Bias Stability, Fixed Bias, Collector to Base bias, Self Bias, Bias Compensation using Diodes and Transistors.

Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

MODULE - IV	JUNCTION FIELD EFFECT TRANSISTOR	Classes: 08

Construction, Principle of Operation, Pinch-Off Voltage, Volt- Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor, MOSFET Construction and its Characteristics in Enhancement and Depletion modes.

MODULE - V	FET AMPLIFIERS	Classes: 09

Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers. Basic Concepts of MOSFET Amplifiers.

Special Purpose Devices: Zener Diode - Characteristics, Voltage Regulator; Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode.

Text Books:

1. Electronic Devices and Circuits - Jacob Millman, McGraw Hill Education.
2. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, Pearson, 2009.

Reference Books:

1. The Art of Electrionics , Horowitz, 3rdEdition Cambridge University Press, 2018
2. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
3. Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2 Ed., McGraw Hill, 2008.
4. Electronic Devices and Circuits, S. Salivahanan, N.Suresh Kumar, A Vallvaraj, 2nd Edition, TMH.

Web References:

1. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf
2. https://archive.org/details/ElectronicDevicesCircuits
3. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/BASIC ELECTRONICS/home_page.htm
4. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
5. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

E-Text Books:

1. http://services.eng.uts.edu.au/pmcl/ec/Downloads/LectureNotes.pdf
2. http://nptel.ac.in/courses/122106025/
3. http://www.freebookcentre.net/electronics-ebooks-download/Electronic-Devices-and-Circuits-(PDF-313p).html
4. https://www.jntubook.com/electronic-device-circuits-textbook-free-download/
5. http://www.faadooengineers.com/threads/32735-Electronic-Devices-And-Circuits-(EDC)-by-J-B-Gupta-full-book-pdf

DIGITAL SYSTEM DESIGN

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB07	Core	3	1	0	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 common forms of number representation in logic circuits.
II. Learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
III. Understand the concepts of combinational logic circuits and sequential circuits.
IV. Understand the Realization of Logic Gates Using Diodes & Transistors.

MODULE - I	**LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN**	**Classes: 08**

Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion

MODULE - II	**MSI DEVICES**	**Classes: 10**

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

MODULE - III	**SEQUENTIAL LOGIC DESIGN**	**Classes: 10**

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers.

Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

MODULE - IV	**LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES**	**Classes: 08**

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

MODULE - V	**VLSI DESIGN FLOW**	**Classes: 09**

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Text Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th Edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd Edition ,2006

Reference Books:

1. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
2. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd Edition 2012.

Web References:

1. mcsbzu.blogspot.com
2. http://books.askvenkat.com
3. http://worldclassprogramme.com
4. http://www.daenotes.com
5. http://nptel.ac.in/courses/117106086/1

E-Text Books:

1. https://books.google.co.in/books/about/Switching_Theory_and_Logic_Design
2. https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld
3. https://www.researchgate.net/.../295616521_Switching_Theory_and_Logic_Design
4. https://books.askvenkat.com/switching-theory-and-logic-design-textbook-by-anand-kumar/
5. http://www.springer.com/in/book/9780387285931

PROBABILITY THEORY AND STOCHASTIC PROCESSES

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB08	Core	3	1	0	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 random experiments, sample space and event probabilities.
II. Study the random variables, density and distribution functions, moments and transformation of random variables.
III. Understand the concept of random process and sample functions (signals).
IV. Explore the temporal and spectral characteristics of random processes.

MODULE - I	PROBABILITY, RANDOM VARIABLES AND OPERATIONS ON RANDOM VARIABLES	Classes: 09

Random Experiments, Sample Spaces, Events, Probability, Axioms, Joint, Conditional and Total Probabilities, Bay's Theorem, Independent Events. Random Variables: Definition, Conditions for mapping function of a Random Variable, Types of Random Variable, Distribution and Density functions: Definition and Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, random variables, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties, Expected Value of a Random Variable, Function of a Random Variable, Standard and Central Moments, Variance and Skew, Chebychev's Inequality

MODULE - II	SINGLE RANDOM VARIABLE TRANSFORMATIONS - MULTIPLE RANDOM VARIABLES	Classes: 09

Characteristic Function, Moment Generating Function, Monotonic and Non-monotonic Transformations of Single Random Variables (Continuous and Discrete), Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Joint Density Function and its Properties, Marginal Density Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem: Equal and Unequal Distribution.

MODULE - III	OPERATIONS ON MULTIPLE RANDOM VARIABLES – EXPECTATIONS	Classes: 09

Expected value of a function of multiple random variables, Correlation and Covariance , Correlation Coefficient, Joint Moments about the origin, Joint Central moments, Joint characteristic function, Joint moment generating function

Jointly Gaussian random variables: Two random variables case and N random variable case, Properties, Transformations of Multiple Random Variables, Jacobian Matrix, Linear Transformations of Gaussian Random Variables

MODULE - IV	RANDOM PROCESSES – TEMPORAL CHARACTERISTICS	Classes: 09

Random Process: Definition and Classification, Distribution and Density Functions, Stationarity and Statistical Independence., First- Order, Second- Order , Wide-Sense Stationarities (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic and Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian and Poisson Random Processes. Response of Linear Systems to Random Process input, Mean and MS value of System Response, Autocorrelation Function of Response, Cross- Correlation between Input and Output.

MODULE - V	RANDOM PROCESSES – SPECTRAL CHARACTERISTICS	Classes: 09

Power Density Spectrum: Definition and Properties, Relationship between Power Density Spectrum and Autocorrelation Function, Cross Power Spectral Density: Definition and Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, System Evaluation using Random Noise, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Noise Bandwidth, White and Colored Noises

Text Books:

1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", TMH, 4th Edition, 2001.

Reference Books:

1. Bruce Hajck, "Random Processes for Engineers", Cambridge Unipress, 2015.
2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.
3. K. Murugesan, P. Guruswamy, "Probability, Statistics & Random Processes", Anuradha Agencies, 3rd Edition, 2003.
4. B.P. Lathi, "Signals, Systems & Communications" B.S. Publications, 2003.

Web References:

1. www.britannica.com/topic/probability-theory
2. www.math.uiuc.edu/~r-ash/BPT.html
3. https://www.ma.utexas.edu/users/gordanz/.../introduction_to_stochastic_processes.pdf
4. nptel.ac.in/courses/111102014/
5. http://vceece2k10.blogspot.in/p/semester-2-1.html

E-Text Books:

1. http://freecomputerbooks.com/mathProbabilityBooks.html
2. http://www.springer.com/in/book/9780387878584
3. http://www.e-booksdirectory.com/listing.php?category=15

DATA STRUCTURES

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
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	**NON LINEAR 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

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB09	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. Implement and study the characteristics of Diodes and Transistors.
II. Illustrate the concept of rectification using half wave and full wave rectifiers.
III. Design and Construct different amplifier circuits.

LIST OF EXPERIMENTS

WEEK-1 ELECTRONIC WORKSHOP PRACTICE

Identification, specifications, testing of R, L, C components (Color Codes), potentiometers, switches (SPDT, DPDT and DIP), coils, gang condensers, relays, bread boards, PCBs, identification, specifications and testing of active devices, diodes, BJTs, low power JFETs, MOSFETs, power transistors, LEDs, LCDs, optoelectronic devices, SCR, UJT, DIACs.

WEEK-2 ELECTRONIC WORKSHOP PRACTICE

Study and operation of

a. Multimeters (Analog and Digital)
b. Function Generator
c. Regulated Power Supplies
d. Study and Operation of CRO

WEEK-3 PN DIODE CHARACTERISTICS

Verification of V-I characteristics of PN diode and calculate static and dynamic resistance using hardware and digital simulation.

WEEK-4 ZENER DIODE CHARACTERISTICS AND VOLTAGE REGULATOR

Verification of V-I characteristics of Zener diode and perform Zener diode as a Voltage regulator using hardware and digital simulation.

WEEK-5 HALF WAVE RECTIFIER

Verification of half wave rectifier without and with filters using hardware and digital simulation.

WEEK-6 FULL WAVE RECTIFIER

Verification of Full Wave Rectifier without and with filters using hardware and digital simulation.

WEEK-7 TRANSISTOR CB CHARACTERISTICS

Verification of Input and Output characteristics of CB configuration using hardware and digital simulation.

WEEK-8	TRANSISTOR CE CHARACTERISTICS
Verification of Input and Output Characteristics of CE configuration using hardware and digital simulation.	
WEEK-9	**FREQUENCY RESPONSE OF CE AMPLIFIER**
Determine the Gain and Bandwidth of CE amplifier using hardware and digital simulation.	
WEEK-10	**FREQUENCY RESPONSE OF CC AMPLIFIER**
Determine the Gain and Bandwidth of CC amplifier using hardware and digital simulation.	
WEEK-11	**UJT CHARACTERISTICS**
Verification of V-I Characteristics of UJT using hardware and digital simulation.	
WEEK-12	**SCR CHARACTERISTICS**
Verification of V-I Characteristics of SCR using hardware and digital simulation.	
WEEK-13	**FET CHARACTERISTICS**
Verification of V-I Characteristics of FET using digital simulation.	
WEEK-14	**FREQUENCY RESPONSE OF CS AMPLIFIER**
Determine the Gain and Bandwidth of CS amplifier using digital simulation.	
WEEK-15	**FREQUENCY RESPONSE OF CD AMPLIFIER**
Determine the Gain and Bandwidth of CS amplifier using digital simulation.	

Reference Books:

1. J. Millman, C.C.Halkias, Millman's, "Integrated Electronics",Tata McGraw Hill, 2nd Edition, 2001.
2. J. Millman, C.C.Halkias and Satyabrata Jit, "Millman's Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998.
3. Mohammad Rashid, "Electronic Devices and Circuits", Cengage learning, 1st Edition, 2014.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2009.

Web References:

1. https://archive.org/details/ElectronicDevicesCircuits
2. http://www.tedpavlic.com/teaching/osu/ece327/

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V DC
2	Cathode Ray Oscilloscope	0-20 MHz
3	Digital voltmeter	0-1V, 0-20 V
4	Digital ammeter	0-200 mA, 0-200 µA
5	Resistors	1KΩ, 100KΩ, 470 Ω, 150 Ω,10KΩ, 47K Ω,1MΩ, 2.2k Ω, 220KΩ
6	Capacitors	0.01µF, 0.01µF, 100 µF(Electrolytic) , 10µF (Electrolytic)
7	Diodes	1N4007, 4V7, 6V2.
8	Transistors	BC107, 2N2646, C106MG /XL084.
9	Semiconductor Trainer Kit	--
10	Connecting Wires and Patch cords	--
11	Decade resistance box	10 Ω -100k Ω
12	Decade Capacitance box	10µF-100 µF
13	Function Generator	10Hz-1M Hz
14	Digital Multimeters	0-20V/ 0-200mA/10 Ω -10k Ω
15	Bread Board	--

DIGITAL SYSTEM DESIGN LABORATORY

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB10	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. Design of combinational circuits using Verilog Hardware Description Language.
II. Implementation of Sequential circuits using Verilog Hardware Description Language.
III. Demonstration of different case studies for Verilog HDL implementation.

LIST OF EXPERIMENTS

WEEK - l	**REALIZATION OF A BOOLEAN FUNCTION**

Design and simulate the HDL code to realize three and three variable Boolean functions

WEEK-2	**DESIGN OF DECODER AND ENCODER**

Design and simulate the HDL code for the following combinational circuits

a. 3 to 8 Decoder
b. 8 to 3 Encoder (With priority and without priority)

WEEK-3	**DESIGN OF MULTIPLEXER AND DEMULTIPLEXER**

Design and simulate the HDL code for the following combinational circuits

a. Multiplexer
b. De-multiplexer

WEEK -4	**DESIGN OF CODE CONVERTERS**

Design and simulate the HDL code for the following combinational circuits

a. 4 - Bit binary to gray code converter
b. 4 - Bit gray to binary code converter
c. Comparator

WEEK -5	**FULL ADDER AND FULL SUBTRACTOR DESIGN MODELING**

Write a HDL code to describe the functions of a full Adder and full subtractor using three modeling styles

WEEK -6	**DESIGN OF 8-BIT ALU**

Design a model to implement 8-bit ALU functionality

WEEK -7	**HDL MODEL FOR FLIP FLOPS**

Write HDL codes for the flip-flops - SR, D, JK, T

WEEK -8	**DESIGN OF COUNTERS**
Write a HDL code for the following counters a. Binary counter b. BCD counter (Synchronous reset and asynchronous reset)	
WEEK-9	**HDL CODE FOR UNIVERSAL SHIFT REGISTER**
Design and simulate the HDL code for universal shift register	
WEEK-l0	**HDL CODE FOR CARRY LOOK AHEAD ADDER**
Design and simulate the HDL code for carry look ahead adder	
WEEK-l1	**HDL CODE TO DETECT A SEQUENCE**
Write a HDL code to detect the sequence 1010101 and simulate the code	
WEEK-l2	**CHESS CLOCK CONTROLLER FSM USING HDL**
Design a chess clock controller FSM using HDL and simulate the code	
WEEK-l3	**TRAFFIC LIGHT CONTROLLER USING HDL**
Design a traffic light controller using HDL and simulate the code	
WEEK-l4	**ELEVATOR DESIGN USING HDL CODE**
Write HDL code to simulate Elevator operations and simulate the code	

Reference Books:

1. Samir Palnitkar , "Verilog HDL: "A Guide to Digital Design and Synthesis", Sun Microsystems Press, 2nd Edition, 2003.
2. T.R. Padmanabhan, B. Bala Tripura Sundari, "Design Through Verilog HDL", New Jersey, Wiley-IEEE Press, 2009. ISBN: 978-0-471-44148-9
3. Zainalabedin Navabi, "Verilog Digital System Design", TMH, 2nd Edition, 2008.
4. Peter Minns, Ian Elliott, "FSM-based Digital Design using Verilog HDL", John Wiley & Sons Ltd, 2008.

Web References:

1. https://inst.eecs.berkeley.edu/~cs150/fa06/Labs/verilog-ieee.pdf
2. http://www.asic-world.com/ www.sxecw.edu.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

HARDWARE: Desktop Computer Systems 36 nos

SOFTWARE: Xilinx

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 searching 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	

ANALOG AND PULSE CIRCUITS

IV SEMESTER: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB11	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. Learn the concepts of high frequency analysis of transistors.
II. Understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
III. Familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
IV. Construct various multivibrators using transistors and sweep circuits.

MODULE-I	MULTISTAGE AMPLIFIERS	Classes: 08

Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade amplifier, Darlington pair.
Transistor at High Frequency: Hybrid - model of Common Emitter transistor model, f_α, β and unity gain bandwidth, Gain band width product.

MODULE-II	FEEDBACK AMPLIFIERS	Classes: 10

Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations.

MODULE-III	OSCILLATORS AND LARGE SIGNAL AMPLIFIERS	Classes: 08

Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class C Amplifiers. Tuned Amplifiers: Single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning.

MODULE-IV	LINEAR WAVE SHAPING AND SAMPLING GATES	Classes: 10

Linear wave shaping circuits: High pass RC and low pass RC circuits, response to step and square inputs with different time constants, high pass RC circuit as a differentiator, low pass RC circuit as an integrator.
Sampling gates: basic operating principle of sampling gate, uni and bi directional sampling gates.

MODULE-V	MULTIVIBRATORS	Classes: 09

Bistable multivibrator, unsymmetrical triggering, symmetrical triggering; Schmitt trigger; Monostable multivibrator, Astable multivibrator.

Text Books:

1. Jacob Millman, Christos C Halkias, "Integrated Electronics" McGraw Hill Education, 2nd Edition, 2010.
2. Thomas L. Floyd, "Electronic Devices Conventional and Current Version", Pearson Education, 2015.

Reference Books:

1. David A. Bell, "Electronic Devices and Circuits", Oxford, 5th Edition, 1986.
2. Robert L. Boylestead, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 11th Edition, 2009.

Web References:

1. www.nptel.ac.in
2. notes.specworld.in/pdc-pulse-and-digital-circuits
3. http:// www.introni.it/pdf/Millman-Taub- Pulse and Digital Switching Waveforms 1965.pdf
4. https://www.jntubook.com/pulse-digital-circuits-textbook-free-download/

E-Text Books:

1. https://www.jntubook.com/electronic-circuit-analysis-textbook
2. http://tradownload.com/results/neamen-electronic-circuit-analysis-and-design-.htm
3. http://www.igniteengineers.com
4. http://www.ocw.nthu.edu.tw

ANALOG COMMUNICATIONS

IV SEMESTER: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB12	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. Introduce he communication system and need of modulation.
II. Understand the concepts of Amplitude Modulation and its types (DSB-SC, SSB and VSB).
III. Underastand the concepts of Angular Modulation, FM and types of FM
IV. Describe the behavior of analog communications in the presence of noise and also the basics of analog pulse modulation techniques
V. Classify and discuss the different types of transmitters and receivers

MODULE-1	AMPLITUDE MODULATION	Classes-09

Introduction to communication system, Need for modulation, Frequency Division Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop.

MODULE-II	SSB MODULATION	Classes-09

SSB Modulation: Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelop detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems.

MODULE-III	ANGLE MODULATION	Classes-09

Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power,

Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM and AM.

MODULE-IV	NOISE IN ANALOG COMMUNICATION SYSTEM:	Classes-09

Types of Noise: Resistive (Thermal) Noise Source, Shot noise, Extraterrestrial Noise, Arbitrary Noise Sources, White Noise, Narrowband Noise- In phase and quadrature phase components and its Properties, Modeling of Noise Sources, Average Noise Bandwidth, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks. Noise in DSB and SSB System Noise in AM System, Noise in Angle Modulation System, Noise Triangle in Angle Modulation System, Pre-emphasis and de-emphasis.

MODULE-V	RECEIVERS	Classes-09
Receiver Types -Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting. Pulse Modulation: Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation and demodulation of PWM, PPM, Generation and demodulation of PPM, Time Division Multiplexing.		

Text Books:

1. S. S. Haykin, "Communication Systems", Wiley Eastern, 2nd Edition, 2006.
2. Taub, Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 4th Edition, 2013

Reference Books:

1. B.P. Lathi, "Communication Systems‖, BS Publication", 2nd Edition, 2006.
2. John G. Proakis, Masond, Salehi, "Fundamentals of Communication Systems", PEA, 1st Edition,2006
3. George Kennedy, Bernard Davis, "Electronics and Communication System", Tata McGraw Hill, 5th Edition, 2011.

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

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

IV SEMESTER: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB13	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. Familiarize about 3D vector co-ordinate systems and electromagnetic field concepts.
II. Have skills in selecting appropriate Maxwell's equations in electromagnetic theory for a given application and analyze the problem.
III. Investigate the propagation characteristics of electromagnetic waves at boundary of different media.
IV. Demonstrate the ability to compute various parameters for transmission lines using smith chart and classical theory.

MODULE -I	ELECTROSTATICS	Classes: 10

Electrostatics: Coulomb's law, electric field intensity, fields due to different charge distributions; Electric flux density, Gauss law and its applications; Scalar electric potential; Energy density, illustrative problems; Conductors and dielectrics-characterization; Convection and conduction currents; Dielectric constant, isotropic and homogeneous dielectrics; Continuity equation and relaxation time, conductivity, power absorbed in conductor, Poisson's and Laplace's equations; Capacitance: Parallel plate, co axial, spherical capacitors; Method of images; Illustrative problems.

MODULE -II	MAGNETOSTATICS	Classes: 10

Magnetostatics: Biot-savart law; Ampere's circuital law and applications; Magnetic flux density; Magnetic scalar and vector potentials; Forces due to magnetic fields; Ampere's force law; Boundary conditions: Dielectric- dielectric, dielectric conductor interfaces; Inductances and magnetic energy; Illustrative problems; **Maxwell's equations (Time varying fields):** Faraday's law; Inconsistency of ampere's law for time varying fields and definition for displacement current density; Maxwell's equations in differential form, integral form and word Statements.

MODULE -III	UNIFORM PLANE WAVES	Classes: 08

Uniform plane waves: Wave equations for conducting and perfect dielectric media; Relation between E and H; Wave propagation in lossless and conducting media, Loss tangent, Intrinsic impedance; Skin depth; Polarization, Illustrative problems.

Reflection/refraction of plane waves: Reflection and refraction at normal incidence, reflection and refraction at oblique incidence; Standing waves; Brewster angle, critical angle, total internal reflection, surface impedance; Poynting vector and poynting theorem-applications; Power loss in plane conductor; Illustrative problems.

MODULE -IV	TRANSMISSION LINE CHARACTERISTICS	Classes: 09

Transmission line characteristics: Types; Transmission line parameters; Transmission line equations; Characteristic impedance, propagation constant; Phase and group velocities; Infinite line concepts, Loss less /low loss transmission line characterization; condition for distortion less and minimum attenuation in transmission lines; Loading: Types of loading; Illustrative problems.

MODULE -V	UHF TRANSMISSION LINES AND APPLICATIONS	Classes: 08

UHF transmission lines and applications: Input impedance relations; SC and OC lines; Reflection coefficient, VSWR; UHF lines as circuit elements, λ/4, λ/2 and λ/8 lines, impedance transformations, significance of Z_{min} and Z_{max}; Smith chart: Configuration and applications; Single and double stub matching; Illustrative problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetic", Oxford University Press, 4th Edition, 2009.
2. E.C. Jordan, K.G. Balmain, "Electromagnetic waves and Radiating Systems", PHI learning, 2nd Edition, 2000.
3. Umesh Sinha, Satya Prakashan, "Transmission lines and Networks", Tech India Publications, 1st Edition, 2010.

Reference Books:

1. Nathan Ida, "Engineering Electromagnetic", Springer (India) Pvt. Ltd, 2nd Edition, 2005
2. William H. Hayt Jr., John A. Buck, "Engineering electromagnetic", Tata McGraw Hill, 7th Edition, 2006.
3. G. Sashibushana Rao, "Electromagnetic Field theory and Transmission Lines, Wiley India, 2013.
4. John D. Ryder, "Networks, Lines and Fields", PHI learning, 2nd Edition, 1999.

Web References:

1. http:// web.stanford.edu/class
2. http://www.electronicagroup.com
3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html
4. http://nptel.ac.in/courses/antennas
5. http://www.tutorialspoint.com/discrete_mathematics

E-Text Books:

1. http://www.bookboon.com/en/concepts-in-electrostatics-ebook
2. http://www.www.jntubook.com
3. http://www.allaboutcircuits.com
4. http://www.archive.org

SIGNALS AND SYSTEMS

IV Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB14	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. Classify signals and systems and their analysis in time and frequency domains.
II. Study the concepts of distortion less transmission through LTI systems, convolution and correlation properties.
III. Understand Laplace and Z-transforms their properties for analysis of signals and systems.
IV. Identify the need for sampling of CT signals, types and merits and demerits of each type.

MODULE - I	SIGNAL ANALYSIS	Classes: 08

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

MODULE - II	FOURIER SERIES	Classes: 10

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms:

Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transforms.

MODULE - III	SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS	Classes: 10

Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics.

Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

MODULE - IV	LAPLACE TRANSFORM AND Z-TRANSFORM	Classes: 08

Laplace Transforms

Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. **Z–Transforms** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

MODULE - V	SAMPLING THEOREM	Classes: 09

Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling. **Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

Text Books:

1. B.P. Lathi, "Signals, Systems & Communications", BSP, 2013.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Edition 2010.

Reference Books:

1. Simon Haykin and Van Veen, "Signals and Systems" , Wiley Publications, 2nd Edition, 2010.
2. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.

Web References:

1. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1
2. https://www.mooc-list.com/course/digital-signal-processing-coursera

E-Text Books:

1. http://onlinevideolecture.com/ebooks
2. http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Boo

CONTROL SYSTEMS

IV Semester: ECE, EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB16	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. Organize modeling and analysis of electrical and mechanical systems.
II. Analyse control systems by block diagrams and signal flow graph technique.
III. Demonstrate the analytical and graphical techniques to study the stability.
IV. Illustrate the frequency domain and state space analysis.

MODULE-I	INTRODUCTION AND MODELING OF PHYSICAL SYSTEMS	Classes: 08

Control systems: Introduction, open loop and closed loop systems, examples, comparison, mathematical modeling and differential equations of physical systems, concept of transfer function, translational and rotational mechanical systems, electrical systems, force, voltage and force, current analogy.

MODULE-II	BLOCK DIAGRAM REDUCTION AND TIME RESPONSE ANALYSIS	Classes: 10

Block Diagrams: Block diagram representation of various systems, block diagram algebra, characteristics of feedback systems, AC servomotor, signal flow graph, Mason's gain formula; Time response analysis: Standard test signals, shifted unit step, shifting theorem, convolution integral, impulse response, unit step response of first and second order systems, time response specifications, steady state errors and error constants, dynamic error coefficients method, effects of proportional, derivative and proportional derivative, proportional integral and PID controllers.

MODULE-III	CONCEPT OF STABILITY AND ROOT LOCUS TECHNIQUE	Classes: 09

Concept of stability: Necessary and sufficient conditions for stability, Routh's and Routh Hurwitz stability criterions and limitations.

Root locus technique: Introduction, root locus concept, construction of root loci, graphical determination of 'k' for specified damping ratio, relative stability, effect of adding zeros and poles on stability.

MODULE-IV	FREQUENCY DOMAIN ANALYSIS	Classes: 10

Frequency domain analysis: Introduction, frequency domain specifications, stability analysis from Bode plot, Nyquist plot, calculation of gain margin and phase margin, determination of transfer function, correlation between time and frequency responses.

MODULE-V	STATE SPACE ANALYSIS AND COMPENSATORS	Classes: 08

State Space Analysis: Concept of state, state variables and state model, derivation of state models from block diagrams, diagonalization, solving the time invariant state equations, state transition matrix and properties, concept of controllability and observability; Compensators: Lag, lead, lead - lag networks.

Text Books:

1. I J Nagrath, M Gopal, "Control Systems Engineering", New Age International Publications, 3rd Edition, 2007.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th Edition, 2003.
3. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.

Reference Books:

1. Anand Kumar, "Control Systems", PHI Learning, 1st Edition, 2007.
2. S Palani, "Control Systems Engineering", Tata McGraw-Hill Publications, 1st Edition, 2001.
3. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

ANALOG AND PULSE CIRCUITS LABORATORY

IV Semester: ECE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB15	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. Simulate and analyze single stage and multistage amplifiers and oscillators.
II. Demonstrate the principles of feedback amplifiers and oscillators through simulation.
III. Implementation of circuits for linear and non-linear wave shaping.
IV. Analyze the characteristics of different multivibrators.

LIST OF EXPERIMENTS

WEEK-1	**BASIC AMPLIFIERS/ LINEAR WAVESHAPING**

a. Simulate frequency response of common emitter amplifier and common base amplifier.
b. Design RC low pass and high pass circuit for different time constants.

WEEK -2	**BASIC AMPLIFIERS/ LINEAR WAVESHAPING**

a. Design RC low pass and high pass circuit for different time constants
b. Simulate frequency response of common emitter amplifier and common base amplifier.

WEEK -3	**TWO STAGE RC COUPLED AMPLIFIER/ NON-LINEAR WAVESHAPING**

a. Simulate frequency response of two stage RC coupled amplifier.
b. Design transfer characteristics of clippers and clampers

WEEK - 4	**TWO STAGE RC COUPLED AMPLIFIER/ NON-LINEAR WAVESHAPING**

a. Design transfer characteristics of clippers and clampers.
b. Simulate frequency response of two stage RC coupled amplifier.

WEEK -5	**SINGLE TUNED AMPLIFIERS/ TRANSISTOR AS A SWITCH**

a. Simulate a single tuned amplifier.
b. Design of transistor as a switch.

WEEK-6	**SINGLE TUNED AMPLIFIERS/ TRANSISTOR AS A SWITCH**

a. Design of transistor as a switch.
b. Simulate a single tuned amplifier.

WEEK -7	**FEEDBACK AMPLIFIERS/ COMPARATOR**

a. Simulate voltage series feedback amplifier and current shunt feedback amplifier.
b. Design of comparator circuit.

WEEK-8	**FEEDBACK AMPLIFIERS/ COMPARATOR**

a. Design of comparator circuit.
b. Simulate voltage series feedback amplifier and current shunt feedback amplifier

WEEK-9	RC PHASE SHIFT OSCILLATOR USING TRANSISTOR/ MULTIVIBRATORS

a. Simulate sine wave generated for a particular frequency by an RC phase shift oscillator.
b. Design different types of multivibrators and plot its waveforms.

WEEK-10	RC PHASE SHIFT OSCILLATOR USING TRANSISTOR/ MULTIVIBRATORS

a. Design different types of multivibrators and plot its waveforms.
b. Simulate sine wave generated for a particular frequency by an RC phase shift oscillator.

WEEK-11	OSCILLATORS/ SCHMIT TRIGGER

a. Simulate sine wave generated for a particular frequency by Colpitts and Hartley oscillator.
b. Design a Schmitt trigger circuit.

WEEK-12	OSCILLATORS/ SCHMIT TRIGGER

a. Design a Schmitt trigger circuit.
b. Simulate sine wave generated for a particular frequency by Colpitts and Hartley oscillator.

WEEK-13	POWER AMPLIFIERS/ UJT AS A RELAXATION OSCILLATOR

a. Simulate class A power amplifier (transformer less) and class B power amplifier.
b. Design of UJT as a relaxation oscillator.

WEEK-L4	POWER AMPLIFIERS/ UJT AS A RELAXATION OSCILLATOR

a. Design of UJT as a relaxation oscillator.
b. Simulate class A power amplifier (transformer less) and class B power amplifier.

Reference Books:

1. Jacob Millman, Herbert Taub , Mothiki S. PrakashRao, “Pulse Digital and Switching Waveforms”, Tata McGraw-Hill, 3rd Edition, 2008.
2. David A. Bell, “Solid State Pulse Circuits”, PHI, 4th Edition, 2002.
3. J. Millman, C. C. Halkias, “Integrated Electronics”, Tata McGraw-Hill. 1st Edition, 2008.
4. B. P. Singh, Rekha Singh, “Electronic Devices and Circuits”, Pearson, 1st Edition, 2006.
5. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw-Hill, 1st Edition, 2002.

Web References:

1. http://www.tedpavlic.com/teaching/osu/ece327/
2. http://www.ee.iitkgp.ac.in
3. http://www.citchennai.edu.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 nos

SOFTWARE : NI Multisim

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S No	Name of the Equipment	Range
1	Dual Dc Regulated Power Supply	0-30V DC
2	Cathode Ray Oscilloscope	0-20 MHz
3	Function Generator	0-10 MHz
4	Semiconductor Kits	0-15 V
5	Resistors	100Ω,150 Ω,820 Ω,1k Ω,1.5k Ω, 2.2kΩ, 10kΩ, 22k Ω, 47k Ω
6	Capacitors	0.1µF, 0.001µF, 0.022µF, 0.0022µF 0.0033µF,100pF, 1000µF, 22µF
7	Diode	1N4007,4148
8	UJT	2N2646
9	Transistors	BC107,2N2222
10	Inductors	1mH,5mH
11	Probes / Connecting wires	--

ANALOG COMMUNICATIONS LABORATORY

IV Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB16	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. Study various modulation techniques in communications.
II. Visualize various spectrums using spectrum analyzer.
III. Observe receiver characteristics.
IV. Understand the importance of AGC and VCO

LIST OF EXPERIMENTS

Week-l	**LTI SYSTEM AND ITS RESPONSE**
a) Verification of linearity, time invariance, stability properties of a given system b) Computation of impulse, step, sinusoidal response of a given linear time invariant system using MATLAB	
Week-2	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using hardware and MATLAB	
Week-3	**DSB-SC MODULATOR & DETECTOR**
Generation of AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Balanced Modulator.	
Week-4	**SSB-SC MODULATOR & DETECTOR (PHASE SHIFT METHOD)**
Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB	
Week-5	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using hardware and MATLAB	
Week-6	**PRE-EMPHASIS & DE-EMPHASIS**
Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware and MATLAB	
Week-7	**FREQUENCY DIVISION MULTIPLEXING & DE MULTIPLEXING**
Generation of the frequency division multiplexing and demultiplexing circuit and to verify its operation	
Week-8	**TIME DIVISION MULTIPLEXING & DE MULTIPLEXING**
To study the operation of Time-Division multiplexing	
Week-9	**AGC CHARACTERISTICS**

To study the AGC Characteristics.	
Week-10	**CHARACTERISTICS OF MIXER**
To obtain the mixer characteristics of a super heterodyne receiver.	
Week-l1	**PHASE LOCKED LOOP**
To compare the theoretical and practical values of capture range and lock range of phase locked loop.	
Week-l2	**GENERATION OF DSBSC USING RING MODULATION OBSERVATION OF OUTPUT WAVEFORM**
To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Ring Modulator.	
Week-l3	**FREQUENCY SYNTHESIZER**
To study the operation of frequency synthesizer using PLL.	
Week-l4	**SPECTRAL ANALYSIS OF AM AND FM SIGNALS USINGSPECTRUM ANALYZER**
To study the operation of spectrum analyzer	

Reference Books:

1. Devdas Shetty, Richard A. Kolk (2011), ―Mechatronics System Design‖, PWS Publishing Company.
2. Dan Necsulescu, (2002), ―Mechatronics‖, 3rd Edition, Pearson Education.
3. Michael B. Histand and David G. Alciatore (2005), ―Introduction to Mechatronics and Measurement systems‖, McGraw-Hill.
4. B.P. Singh (2002), ―Advanced Microprocessor and Microcontrollers‖, New Age International Publisher.

Web References:

1. https://ocw.mit.edu/courses/electrical.../6...analog-communications.../lecture-notes
2. https://everythingvtu.wordpress.com
3. http://www.iare.ac.in

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 nos

SOFTWARE:MATLAB

SIGNALS AND SYSTEMS LABORATORY

IV Semester: ECE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB17	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 the basics of MATLAB.
II. Simulate the generation of signals and operations on them.
III. Illustrate Gibbs phenomenon.
IV. Analyze the signals using Fourier, Laplace and Z transforms.

LIST OF EXPERIMENTS

WEEK-1	**BASIC OPERATIONS ON MATRICES**

Review basic operations on matrices by using MATLAB

WEEK -2	**GENERATIN OF VARIOUS SIGNALS AND SEQUENCE**

Generation of various signals and sequences such as unit impulse, sinc, Gaussian, exponential, saw tooth, triangular, sinusoidal by using MATLAB.

WEEK -3	**OPERATION ON SIGNALS AND SEQUENCES**

Operation on signals and sequences such as addition, subtraction, multiplication, scaling, shifting, folding by using MATLAB

WEEK - 4	**GIBBS PHENOMENON**

Verification of Gibbs phenomenon by using MATLAB

WEEK -5	**FOURIER TRANSFORMS AND INVERSE FOURIER TRANSFORM**

Finding the Fourier Transform and inverse Fourier transform of a given signal/sequence and plotting its magnitude and phase spectrum by using MATLAB.

WEEK-6	**PROPERTIES OF FOURIER TRANSFORMS**

Verifying Time shifting and scaling, time and differentiation properties of Fourier transforms by using MATLAB.

WEEK -7	**LAPLACE TRANSFORMS**

Finding the Laplace transform of a given signal and locate its zeros and poles in s-plane.

WEEK -8	**Z-TRANSFORMS**

Finding the z - transform of a given sequence and locate its zeros and poles in z-plane.

WEEK -9	**CONVOLUTION BETWEEN SIGNALS AND SEQUENCES**
Finding convolution between two signals /sequences by using MATLAB.	
WEEK 10	**AUTO CORRELATION AND CROSS CORRELATION**
Finding auto correlation and cross correlation between signals and sequences by using MATLAB.	
WEEK 11	**GAUSS IAN NOISE**
Generation of Gaussian noise, computation of its mean, M.S. value and its Skew, kurtosis, and PSD, probability distribution function by using MATLAB.	
WEEK 12	**WIENER – KHINCHINE RELATIONS**
Verification of wiener – Khinchine relations using MATLAB.	
WEEK 13	**DISTRIBUTION AND DENSITY FUNCTIONS OF STANDARD RANDOM VARIABLES**
Finding distribution and density functions of standard random variables and plot them by using MATLAB	
WEEK 14	**WIDE SENSE STATIONARY RANDOM PROCESS**
Checking a random process for stationary in wide sense by using MATLAB.	

Reference Books:

1. S. Varadarajan , M. M. Prasada Reddy , M. Jithendra Reddy , "Signals and systems introduces MATLAB programs", I K International Publishing House Pvt. Ltd, 2016.
2. Scott L. Miller, Donald G. Childers, "Probability and Random Processes: With Applications to Signal Processing and communications", Elsevier, 2004.
3. Krister Ahlersten, "An Introduction to Matlab", BookBoon, 2012.
4. K. S. Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

Web References:

1. http://in.mathworks.com/help/matlab
2. http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf
3. https://www.probabilitycourse.com/chapter12/Chapter_12.pdf
4. http://www.iare.ac.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 nos

SOFTWARE : MATLAB

ANTENNAS AND WAVE PROPAGATION

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB18	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. Proficient in the radiation phenomena associated with various types of antennas and understand basic terminology and concepts of antennas along with emphasis on their applications.
II. Analyze the electric and magnetic field emission from various basic antennas with mathematical formulation of the analysis.
III. Explain radiation mechanism of different types of antennas and their usage in real time field.
IV. Justify the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

MODULE -I	ANTENNA BASICS	Classes: 09

Antenna fundamentals: Introduction, Basic Antenna Parameters-Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height, illustrative Problems, Fields from Oscillating Dipole, Field Zones, Front-to-Back Ratio, Antenna Theorems, Radiation, Retarded Potentials, Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole, Current Distributions, Field Components, Radiated Power, Radiation Resistance, Loop Antennas- Introduction, Small circular Loop, Comparison of Far Fields of Small Loop and Short Dipole.

MODULE -II	VHF,UHF AND MICROWAVE ANTENNAS-I	Classes: 10

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas-Helical Geometry, Helix modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

MODULE -III	VHF,UHF AND MICROWAVE ANTENNAS-II	Classes: 10

Microstrip Antennas-Introduction, Basic characteristics of micro strip antennas, Feeding Methods, Methods of Analysis, Rectangular and Circular micro strip antennas, Basic concepts of Smart antennas, concepts and benefits of smart antennas, fixed weight beam forming, adaptive beam forming.

Reflector Antennas- Introduction, Paraboloidal Reflectors- Geometry, Pattern Characteristics, Feed Methods Lens Antennas:Introduction, Geometry of Non-metallic Dielectric Lenses ,Zoning, Tolerances, Applications, Slot Antenna, Babinet's Principle, Applications.

MODULE -IV	ANTENNA ARRAYS AND MEASUREMENTS	Classes: 08

Antenna Arrays: Point Sources- Definition, Patterns, Arrays of 2 Isotropic Sources – Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays- Broadside Arrays, End-fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-Uniform Amplitude Distributions, General considerations and Binomial Arrays, Illustrative Problems

Antenna Measurements: Introduction, Concepts – Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors Patterns to be Measured, Pattern Measurement Arrangement Directivity Measurement,

Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

MODULE -V	RADIO WAVE PROPAGATION	Classes: 08

Wave Propagation - I: Introduction, definitions, categorizations ,different Modes of Wave Propagation; Ground wave propagation: Introduction, plane earth reflections, , wave tilt, curved earth reflections; Space wave propagation: Introduction, field strength variation with distance and height, effect of earth‘s curvature, absorption, super refraction, M-Curves, duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations; Wave propagation – II: Sky wave propagation: Introduction, structure of ionosphere, refraction and reflection of sky waves by ionosphere; Ray path, critical frequency, MUF, LUF, OF, virtual height and skip distance; Relation between MUF and skip distance; Multi-hop propagation.

Text Books:

1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, “Antennas and Wave Propagation”, TMH, 4th Edition, 2010.
2. C.A. Balanis, “Antenna Theory”, John Wiley and Sons, 2nd Edition, 2001.

Reference Books:

1. E.C. Jordan, K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 2nd Edition, 2000.
2. E.V.D. Glazier, H.R.L. Lamont, “Transmission and Propagation”, Her Majesty's Stationery Office, 1958.
3. F.E. Terman, “Electronic and Radio Engineering”, McGraw-Hill, 4th Edition, 1955.
4. K.D. Prasad, Satya Prakashan, “Antennas and Wave Propagation”, Tech India Publications, 1st Edition, 2001.

Web References:

1. http:// web.stanford.edu/class
2. http://www.electronicagroup.com
3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html
4. http://nptel.ac.in/courses/antennas

E-Text Books:

1. http://www.ebookgalaxy.in/2016/01/antennas-and-wave-propagation-by-g-s-n.html#.WBGI7NJ97IU
2. https://www.jntubook.com/antennas-wave-propagation-textbook
3. http://117.55.241.6/library/E-Books/Antennas_mcgraw-hill_2nd_ed_1988-john_d_kraus.pdf
4. http://www.archive.org

LINEAR AND DIGITAL IC APPLICATIONS

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB19	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. Be acquainted to basic building blocks, principles and characteristics of op-amp.
II. Design linear and non linear functional modules using operational amplifier.
III. Analyze and design filters, timers, analog to digital and digital to analog Converters.
IV. Understand the functionality and characteristics of commercially available digital integrated circuits

MODULE -I	OPERATIONAL AMPLIFIER	Classes: 08

Operational Amplifier: Differential Amplifier, DC and AC analysis of dual input balanced output configuration, dual input unbalanced output. Characteristics of Op-amps, Op-amp block diagram, ideal and practical Op-amp specifications. DC characteristics: Input & output offset voltages & currents, drift. AC characteristics: Frequency response, slew rate, CMRR and PSRR.

MODULE -II	APPLICATIONS OF OPERATIONAL AMPLIFIERS	Classes: 09

Linear applications of Op-amps: Inverting and non-inverting amplifier, integrator, differentiator, instrumentation amplifier, AC amplifier. Non-linear applications of Op-Amps: Comparators, multi vibrators, triangular, saw tooth, square wave generators, log and anti-log amplifiers. Introduction to voltage regulators, features of 723 Regulator, three terminal voltage regulators.

MODULE -III	ACTIVE FILTERS AND TIMERS	Classes: 09

Active Filters: Classification of filters, 1^{st} order low pass and high pass filters, 2^{nd} order low pass, high pass, band pass, band reject and all pass filters.

Timers: Introduction to 555 timer, functional diagram, mono-stable, astable operations and applications, schmitt trigger. PLL: Introduction, block schematic, principles and description of individual blocks, 565 PLL.

MODULE -IV	DATA CONVERTERS	Classes: 10

Data converters: Introduction, classification, need of data converters. DAC techniques: weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC. ADC techniques: Flash converters, successive approximation, integrating ADC. DAC/ADC characteristics.

MODULE -V	DIGITAL IC APPLICATIONS	Classes: 09

Study of digital logic families such as Resistor Transistor Logic(RTL), Diode Transistor Logic(DTL), Transistor Logic(TTL), Emitter Coupled Logic and CMOS. Characteristics of digital logic families containing fan-in, fan-out, power dissipation, propagation delay and noise margin, Familiarity with commonly available 74XX & CMOS 40XX series ICs-Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register(IC 74194), Synchronous counters (74LS93,74HC163), Decade Counters, (74HC190).

Text Books:

1. D.RoyChowdhury, "Linear Integrated Circuits", New age international (p)Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, "Op-Amps &linear ICs'', PHI, 3rd Edition, 2003.
3. JohnF.Wakerly, "Digital Design Principles and Practices", Prentice Hall, 3rd Edition, 2005.
4. M. MorrisMano, Michael D. Ciletti, "Digital Design‖,Pearson Education/PHI, 3rd Edition, 2008.

Reference Books:

1. Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1stEdition, 2008.

Web References:

1. https://www.nptel.ac.in
2. https://www.svecw.edu.in
3. https://www.smartzworld.com
4. https://www.crectirupati.com

E-Text Books:

1. https://books.google.co.in/books?isbn=8122414702
2. https://books.google.co.in/books?isbn=013186389

DIGITAL COMMUNICATIONS

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB20	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 different digital modulation techniques.
II. Discuss the importance of error detection and correction codes and use them in the presence of the channel.
III. Describe and analyze the methods of transmission of digital data using baseband and carrier modulation techniques.
IV. Decompose codes separately into source codes and develop competency in modeling and analyzing communication system elements

MODULE -I	PULSE DIGITAL MODULATION	Classes: 10

Pulse Modulation: Analog pulse modulation, Types of pulse modulation; PAM (Single polarity, double polarity); Generation & demodulation of PWM; Generation and demodulation of PPM; Introduction: Elements of digital communication systems, advantages and disadvantages of digital communication systems, applications; Pulse Digital Modulation: Elements of PCM; Sampling, quantization and coding; Quantization error, non-uniform quantization and companding; Differential PCM (DPCM);Adaptive DPCM; Delta modulation and its drawbacks; Adaptive delta modulation; Comparison of PCM and DM systems; Noise in PCM and DM systems.

MODULE -II	DIGITAL MODULATION TECHNIQUES	Classes: 08

Digital Modulation Techniques**:** Introduction, ASK modulator, coherent ASK detector, non-coherent ASK detector, FSK, bandwidth and frequency spectrum of FSK, non-coherent FSK detector, coherent FSK detector; BPSK, coherent BPSK detection; QPSK; DPSK, DEPSK; Optimal reception of digital signal**:** Baseband signal receiver; Probability of error; Optimum filter; matched filter, probability of error using matched filter; Correlation receiver; Calculation of probability of error for ASK, FSK,BPSK.

MODULE -III	BASE BAND TRANSMISSION AND PULSE SHAPING	Classes: 10

Base Band Transmission: Requirements of a line encoding format, Various line encoding formats: Unipolar, Polar, Bipolar; computation of power spectral densities of various line encoding formats. Scrambling techniques: BZ8S, HDB3.

Pulse Shaping: Inter symbol interference; pulse shaping to reduce ISI; Nyquist's criterion; Raised cosine filter; Equalization; Correlative level coding; Duo-binary encoding, modified duo –binary coding; Eye diagrams; Cross Talk.

MODULE -IV	INFORMATION THEORY AND SOURCE CODING	Classes: 09

Information Theory: Information, entropy, conditional entropy; Mutual information; Channel capacity; Various mathematical modeling of communication channels and their capacities; Source coding: Fixed length and variable length Source Coding Schemes, Huffman coding; Shannon fano coding, Source coding to increase average information per bit; Lossy source coding; Channel coding theorem; Hartley Shannon law; Tradeoff between bandwidth and S/N ratio; Spread spectrum modulation: Useofspreadspectrum;Directsequencespreadspectrum(DSSS);CodedivisionmultipleaccessusingDSSS, frequency hopping spread spectrum; PN-Sequences: Generation and characteristics; Synchronization in spread spectrum systems.

MODULE -V	LINEAR BLOCK CODES AND SOURCE CODES	Classes: 08

Linear Block Codes: Introduction to error control coding; Matrix description of linear block codes, error detection and error correction capabilities of linear block codes; Hamming code; Binary cyclic codes algebraic structure, encoding, syndrome calculation and decoding; Convolution Codes: Introduction, Encoding of convolution codes; Time Domain Approach; Transform Domain Approach; General approach; State, Tree And Trellis Diagram; Decoding using Viterbi Algorithm; Burst Error Correction: Block Inter leaving and convolution interleaving.

Text Books:

1. Herbert Taub, Donald L. Schilling, "Principles of Communication Systems", TMH, 3rd Edition,2008
2. K. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley & Sons, 2nd Edition, 2005.
3. Simon Haykin, "Digital communications", John Wiley, 3rd Edition, 2005.

Reference Books:

1. John Proakis, "Digital Communications", TMH, 2nd Edition1983.
2. B.P.Lathi, "Modern Analog and Digital Communication", Oxford reprint, 3rd Edition, 2004.
3. Singh, Sapre, "Communication Systems Analog and Digital", TMH, 2nd Edition, 2004.

Web References:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

E-Text Books:

1. https://www.jntubook.com/dgital-communications-textbook
2. http://tradownload.com/results/neamen-digital-communications-.html
3. http://www.everythingvtu.wordpress.com

JAVA PROGRAMMING

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB38	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 basic object oriented programming concepts and apply them in problem solving.
II. Illustrate inheritance concepts for reusing the program.
III. Demonstrate on the multi-tasking by using multiple threads.
IV. Develop data-centric applications using JDBC.
V. Understand the basics of java console and GUI based programming.

MODULE -I	FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING:	Classes: 10

Object oriented paradigm - Basic concepts of Object Oriented Programming - Benefits of OOP - Applications of OOP

Java Evolution: Java Features - How Java differs from C and C++ - Java and Internet - Java and World Wide Web - Web Browsers - Hardware and Software Requirements - Java Environment. Overview of Java Language: Simple Java Program - Java Program Structure - Java Tokens- Java Statements - Implementing a Java Program - Java Virtual Machine - Constants - Variables - Data types - Scope of Variables-Symbolic Constants-Type Casting and type promotions – Operators, Operator Precedence and Associativity - Control Statements – break - continue- Arrays-Multi dimensional arrays, Wrapper Classes - Simple examples.

MODULE -II	CLASSES AND OBJECTS:	Classes: 09

Classes and Objects - Constructors – methods - this keyword – garbage collection- finalize - Overloading methods and constructors - Access Control- Static members – nested and inner classes – command line arguments - variable length arguments.

Inheritance: Forms of inheritance – specialization, specification, construction, extension, limitation, combination, benefits and costs of inheritance. Super uses- final - polymorphism, method overriding - dynamic method dispatch –abstract classes – exploring String class.

MODULE -III	PACKAGES AND INTERFACES:	Classes: 08

Defining and accessing a package – understanding CLASSPATH – access protection importing packages – Interfaces - Defining and implementing an interface, Applying interfaces, Variables in interfaces and extended interfaces. Exploring java.lang and java.util packages.

Exception Handling-Fundamentals, usage of try, catch, multiple catch clauses, throw, throws and finally. Java Built in Exceptions and creating own exception subclasses.

MODULE -IV	MULTITHREADED PROGRAMMING:	Classes: 08

Java Thread life cycle model – Thread creation - Thread Exceptions - Thread Priority – Synchronization - Messaging - Runnable Interface - Interthread Communication - Deadlock - Suspending, Resuming and stopping threads.

I/O Streams: File – Streams – Advantages - The stream classes – Byte streams – Character streams.

MODULE -V	APPLET PROGRAMMING:	Classes: 10

How Applets differ from Applications - Applet Life Cycle - Creating an Applet - Running the Applet- Designing a Webpage - Applet Tag - Adding Applet to HTML file - More about Applet Tag - Passing parameters to Applets - Aligning the display.

Event handling: basics of event handling, Event classes, Event Listeners, delegation event model, handling mouse and keyboard events, adapter classes, AWT Class hierarchy - AWT Controls - Layout Managers and Menus, limitations of AWT.

Text Books:

1. Herbert Schildt, "The Complete Reference Java J2SE", TMH Publishing Company Ltd, New Delhi, 5th Edition, 2008.
2. Cay Horstmann, "Big Java", John Wiley and Sons, 2nd Edition, 2006.

Reference Books:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

Web References:

1. http://www.javatpoint.com/java-tutorial
2. http://www.javatutorialpoint.com/introduction-to-java/

E-Text Books:

1.http://bookboon.com/en/java-programming-language-ebooks
2.https://en.wikibooks.org/wiki/Java_Programming

LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB21	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. Implement different circuits and verify circuit concepts.
II. Study the concepts of multi vibrators and filters.
III. Verify the operations of the 555 timers and PLLs and their applications.
IV. Design and verify combinational and sequential circuits.

LIST OF EXPERIMENTS

WEEK - I	**INVERTING, NON-INVERTING AND DIFFERENTIAL AMPLIFIERS**

To construct and test the performance of an Inverting, Non-inverting amplifier and Differential amplifier using IC741.

WEEK-2	**INTEGRATOR AND DIFFERENTIATOR**

To construct and test the performance of an Integrator and Differentiator using IC 741.

WEEK-3	**SECOND ORDER ACTIVE LOWPASS, HIGHPASS AND BANDPASS FILTERS**

To design and verify the operation of the Active low pass and High pass using IC 741.

WEEK-4	**SECOND ORDER ACTIVE BAND PASS AND BANDREJECT FILTERS**

To design and verify the operation of the Band pass and Band reject filters using IC 741.

WEEK -5	**ASTABLE MULTIVIBRATORS USING 555**

To design and construct an astable multivibrators using IC 555.

WEEK -6	**MONOSTABLE MULTIVIBRATORS 555**

To design and construct Monostable multivibrators using IC 555.

WEEK -7	**SCHMITT TRIGGER USING 555**

To design and construct schmitt trigger using NE555 Timer.

WEEK -8	**PLL USING IC 565**

Verifying characteristics of PLL.

WEEK -9	**INSTRUMENTATION AMPLIFIER**

To design and verify the operation of instrumentation amplifier using IC 741.

WEEK-10	**DIGITAL TO ANALOG CONVERTER**
. To design and verify the operation of R-2R and Inverted R-2R DAC Converter using IC 741.	
WEEK-11	**IC 723**
To design and implement voltage regulator using IC 723.	
WEEK-l2	**RTL LOGIC**
Verify Functionality of NOR and NAND gate using RTL Logic.	
WEEK-l3	**DTL LOGIC**
Verify Functionality of NOR and NAND gate using DTL Logic.	

Text Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New age international (p) Ltd, 2nd Edition,2003
2. Ramakanth A. Gayakwad, "Op-Amps & linear ICs", PHI, 3rdEdition,2003.
3. John F. Wakerly, "Digital Design Principles and Practices", Prentice Hall, 3rdEdition,2005.

Reference Books:

1. Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1st Edition, 2008.

Web References:

1. http://www.ee.iitkgp.ac.in
2. http://www.citchennai.edu.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 24 STUDENTS:

HARDWARE: Trainer kits, Analog and Digital ICs (IC741,555,74XX)

DIGITAL COMMUNICATIONS LABORATORY

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB22	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. Analyze various digital modulation techniques.
II. Verify the sampling theorem.
III. Understand the spectral characteristics of Amplitude Modulation
IV. Analyze various pulse modulation techniques.

LIST OF EXPERIMENTS

Week-l	**SAMPLING THEOREM – VERIFICATION**
Verification of sampling theorem for under, perfect, over sampling cases	
Week-2	**PULSE AMPLITUDE MODULATION AND DEMODULATION**
Generation of Pulse Amplitude modulation and demodulation using hardware and matlab	
Week-3	**PULSE WIDTH MODULATION AND DEMODULATION**
Generation of Pulse width modulation and demodulation using hardware and matlab	
Week-4	**PULSE POSITION MODULATION AND DEMODULATION.**
Generation of pulse position modulation and demodulation using hardware and matlab	
Week-5	**PULSE CODE MODULATION**
Generation of pulse code modulation and demodulation using hardware and understanding the concept analog to digital conversion	
Week-6	**DIFFERENTIAL PULSE CODE MODULATION**
Generation of differential pulse code modulation and demodulation using hardware	
Week-7	**DELTA MODULATION.**
Generation of delta modulation and demodulation using hardware .Understanding difference between PCM and DM	
Week-8	**FREQUENCY SHIFT KEYING**
Generation of Frequency shift keying modulation and demodulation using hardware	
Week-9	**PHASE SHIFT KEYING.**
Generation of Phase shift keying modulation and demodulation using hardware	

Week-l0	**DIFFERENTIAL PHASE SHIFT KEYING**
Generation of Differential Phase shift keying modulation and demodulation using hardware	
Week-l1	**AMPLITUDE SHIFT KEY(ASK)**
Generation of Amplitude Shift Key modulation and demodulation using hardware	
Week-l2	**QUADRATURE PHASE SHIFT KEYING**
Generation of QPSK modulation and demodulation using hardware	
Week-l3	**MATLAB for QPSK & SIMULINK for DPSK.**
Understand frequency domain description of Quadrature Phase Shift Keying and Differential Phase shift keying	
Week-l4	**STUDY OF THE SPECTRAL CHARACTERISTICS OF AMPLITUDE MODULATION**
Understand frequency domain description of Amplitude Modulation	

Reference Books:

1. K.SamShanmugam, "Digital and Analog Communication Systems", Joh Wiley & Sons, 2nd Edition, 2005.
2. B.P.Lathi, "Modern Analog and Digital Communication", Oxford reprint, 3rd Edition, 2004.
3. Singh,Sapre, "Communication Systems Analog and Digital", TMH, 2nd Edition,2004

Web References:

1. https://ocw.mit.edu/courses/electrical.../6...digital-communications.../lecture-notes
2. https://everythingvtu.wordpress.com
3. http://www.iare.ac.in

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 nos

SOFTWARE:MATLAB

DIGITAL SIGNAL PROCESSING

VI Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB23	Core	2	1	0	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. Provide background and fundamental material for the analysis and processing of digital signals and to familiarize the relationships between continuous-time and discrete-time signals and systems.
II. Study fundamentals of time, frequency and z-plane analysis and to discuss the inter-relationships of these analytic method and to study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
III. Introduce a few real-world signal processing applications.
IV. Acquainting FFT algorithm, multi-rate signal processing techniques and finite word length effects.

MODULE - I	REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS	Classes: 10

Discrete time signal definition; Signal classification; Elementary signals; Transformation of elementary signals; Concept of digital frequency; Discrete time system definition; System classification; Linear time invariant(LTI) system; Properties of the LTI system; Time domain analysis of discrete time systems; Impulse response; The convolution sum; Methods of evaluating the convolution sum; Filtering using overlap-save and overlap-add method; Realization of digital filters: Concept of IIR and FIR filters; Realization structures for IIR and FIR filters using direct form-I and direct form-II, cascade, lattice and parallel.

MODULE - II	DISCRETE FOURIER TRANSFORM AND EFFICIENT COMPUTATION	Classes: 08

Introduction to discrete time Fourier transform (DTFT); Discrete Fourier transform (DFT) definition; Properties of DFT; Linear and circular convolution using DFT; Fast-Fourier-transform (FFT): Direct computation of DFT; Need for efficient computation of the DFT (FFT algorithms); Radix-2 FFT algorithm for the computation of DFT and IDFT using decimation-in-time and decimation-in-frequency algorithms; General Radix-N FFT.

MODULE - III	IIR FILTERS	Classes: 09

Analog filters: Butterworth filters; Chebyshev type-1 & type-2 filters; Analog transformation of prototype LPF to HPF/BPF/BSF.

Transformation of analog filters into equivalent digital filters using impulse invariant method and bilinear transform method; MATLAB programs of IIR filters.

MODULE - IV	SYMMETRIC AND ANTISYMMETRIC FIR FILTERS	Classes: 09

Characteristics of FIR Digital Filters, Frequency response, Design of FIR Filters: Fourier Method. Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters

MODULE - V	APPLICATIONS OF DSP	Classes: 09

Multirate signal processing; Decimation; Interpolation; Polyphase structures for decimation and interpolation filters; Structures for rational sampling rate conversion; Applications of multirate signal processing for design of phase shifters, interfacing of digital systems with different sampling rates, sub band coding of speech signals. Analysis of finite word length effects: Representation of numbers; ADC quantization noise, coefficient quantization error, product quantization error, truncation & rounding errors; Limit cycle due to product round-off error; Round-off noise power; Limit cycle oscillations due to overflow in digital filters; Principle of scaling; Dead band effects.

Text Books:

1. Digital signal processing, Principles, Algorithms and Applications, John G. Proakis, Dimitris G. Manolakis , Prentice Hall, 4th Edition,2007.
2. Digital signal processing, A computer base approach ,Sanjit K Mitra, McGraw-Hill Higher Education, 4th Edition,2011.
3. DSP-A Practical Approach Emmanuel C, Ifeacher, Barrie. W. Jervis, Pearson Education, 2nd Edition, 2002.
4. Discrete Time Signal Processing ,A.V. Oppenheim, R.W. Schaffer , PHI, 2nd Edition,2006.

Reference Books:

1. Digital signal processing: fundamentals and applications ,Li tan, Elsevier Science &.Technology Books, 2nd Edition, 2008.
2. FundamentalsofDigitalsignalprocessingusingMatlab ,RobertJ.schilling,Sandra.L.harris,Thomson Engineering, 2nd Edition,2005.
3. Digitalsignalprocessing ,Salivahanan,Vallavaraj,Gnanapriya,McGraw-HillHigherEducation,2nd Edition, 2009.

Web References:

1. https://nptel.ac.in/courses/117102060/
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

E-Text Books:

1. https://b-ok.cc/s/?q=ebook+for+digital+signal+processing
2. https://www.e-booksdirectory.com/details.php?ebook=4117
3. http://freecomputerbooks.com/Design-and-Architectures-for-Digital-Signal-Processing.html

MICROPROCESSORS AND MICROCONTROLLERS

VI Semester: ECE | V Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB24	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. Imbibe sound knowledge about architecture, instruction set and concepts of 8086 and 8051.
II. Demonstrate the ability to develop programmes for different applications using assembly language of 8086 and 8051.
III. Impart knowledge of different types of external peripherals like 8255,8259,8279,8251,8257.
IV. Proficient in Memory and I/O interfacing with 8086 and 8051.

MODULE -I	8086 MICROPROCESSORS	Classes : 08

Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, machine language instruction formats, addressing mode of 8086, instruction set off 8086,assembler directives and operators.

MODULE -II	PROGRAMMING WITH 8086 MICROPROCESSOR	Classes : 09

Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines. Interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

MODULE -III	INTERFACING WITH 8086/88	Classes: 08

Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255.

Programmable interrupt controller 8259A, the keyboard /display controller8279, programmable communication interface 8251 USART, DMA Controller 8257.

MODULE -IV	8051 MICROCONTROLLER	Classes: 10

8051 Microcontroller – Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

MODULE -V	SYSTEM DESIGN USING MICROCONTROLLER	Classes : 10

8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, Interrupt programming. Real world interfacing of 8051 with external memory, expansion of I/O ports, LCD, ADC, DAC, stepper motor interfacing.

Text Books:

1. Ray A.K, Bhurchandi K.M, "Advanced Microprocessor and Peripherals", TMH, 2nd Edition, 2012
2. Muhammad Ali Mazidi, J.G. Mazidi, R.D McKinlay," The 8051 Microcontroller and Embedded systems using Assembly and C", Pearson education, 2nd Edition, 2009.
3. Douglas V. Hall, "Microprocessors and Interfacing Programming and Hardware", TMGH,
4. 2nd Edition, 1994.

Reference Books

1. Kenneth J. Ayala, "The 8051 Microcontroller", Thomson Learning, 3rd edition, 2005.
2. Manish K. Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 1st Edition, 2014.
3. Ajay V Deshmukh, "Microcontrollers", TATA McGraw Hill publications, 2nd Edition, 2012.

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 Book:

1. https://books.google.co.in/books
2. http://www.www.jntubook.com
3. http://www.ebooklibrary.org/articles/mpmc

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.

Text Books:

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

DIGITAL SIGNAL PROCESSING LABORATORY

VI Semester: ECE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB25	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. Implementation of convolution in MATLAB.
II. Implementation of digital signal processing algorithms in MATLAB and C.
III. Understand the real-time operation of digital filters.
IV. Analyze the Multirate signal processing algorithms.

LIST OF EXPERIMENTS

WEEK-1	**LINEAR CONVOLUTION VS CIRCULAR CONVOLUTION**
Generation of linear convolution without using built in function and the function conv in MATLAB Generation of circular convolution without using built in function in MATLAB	
WEEK -2	**DFT AND IDFT**
Compute the Discrete Fourier Transform and IDFT with and without fft and ifft in MATLAB	
WEEK -3	**OVERLAPADD AND OVERLAP-SAVE METHODS**
Implementation of Linear convolution using DFT (Overlapadd and Overlap-Save methods).	
WEEK - 4	**DIT-FFT ALGORITHM**
Implementation of Decimation-in-time radix-2 FFT algorithm	
WEEK -5	**DIF-FFT ALGORITHM**
Implementation of Decimation-in-frequency radix-2 FFT algorithm	
WEEK-6	**IIR DIGITAL FILTERUSING BUTTERWORTH METHOD AND BILINEAR TRANSFORMATION**
Implementation of IIR digital filter using Butterworth method and bilinear transformation	
WEEK -7	**IIR Digital Filter Using Chebyshev (Type I And II) Method**
Implementation of IIR digital filter using Chebyshev (Type I and II) method	
WEEK -8	**FIR DIGITAL FILTER USING WINDOWS**
Implementation of FIR digital filter using window (Rectangular, Hamming, Hanning, Bartlett) methods.	
WEEK -9	**FIR DIGITAL FILTER USING FREQUENCY SAMPLING METHOD**
Implementation of FIR digital filter using frequency sampling method	

WEEK 10	**OPTIMUM EQUIRIPPLE FIR DIGITAL FILTER**
Implementation of optimum equiripple FIR digital filter using window methods	
WEEK 11	**DTMF TONE GENERATION AND DETECTION**
DTMF Tone Generation and Detection Using Goertzel Algorithm	
WEEK 12	**SAMPLING RATE CONVERSION**
Implementation of sampling rate conversion by decimation, interpolation and a rational factor using MATLAB	
WEEK 13	**SINE WAVE GENERATION**
a) Implementation of DFT b) Sine wave generation using lookup table with values generated from MATLAB	
WEEK 14	**IIR AND FIR FILTERS USING DSP KITS**
IIR and FIR Filter Implementation using DSP Kits	

Reference Books:

1. RobertJ.schilling,Sandra.L.harris, "Fundamentals of Digital Signal Processing using MATlab" , Thomson Engineering, 2nd Edition,2005.
2. Vinay K. Ingle , John G. Proakis, "Digital Signal Processing Using MATlab", Cengage 4th Edition, 2009.
3. DSK Donald Reay, Rulph Chassaing, "Digital Signal Processing and Applications with the TMS 320C6713 and TMS 320C6416" Wiley 2nd Edition.

Web References:

1. http://www.ece.iit.edu/~biitcomm/Yarmouk/Digital%20Signal%20Processing%20Using%20Matlab%20v4.0%20(John%20G%20Proakis).pdf
2. http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf
3. https://www.mathworks.com/solutions/dsp.html
4. http://www.iare.ac.in

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 nos and TMS 320C6713 DSP kits

SOFTWARE : MATLAB, CCStudio_v3.1

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

VI Semester: ECE | V Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB26	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. Develop assembly level programs and providing the basics of the microprocessors.
II. Understanding the interfacing of external devices to the processor and controller for various applications.
III. Learn assemble language programming using 8051 microcontroller.
IV. Develop ability in programming using microprocessor and microcontroller.

LIST OF EXPERIMENTS

WEEK - l **DESIGN A PROGRAM USING WIN862**

Design and develop an Assembly language program using 8086 microprocessor and to show the following aspects.

a) Programming
b) Execution
c) Debugging

To Demonstrate the win 862 software and Trainer kit for 8086 Microprocessor

WEEK-2 **16 BITARITHMETIC AND LOGICAL OPERATIONS**

Write an ALP program to perform 16 Bit arithmetic and logical operations using WIN862 software

WEEK-3 **MULTIBYTE ADDITION AND SUBRACTION**

a) Write an ALP program to perform multi byte addition and subtraction
b) Write an ALP program to perform 3*3 matrix multiplication and addition

WEEK -4 **PROGRAMS TO SORT NUMBERS**

a) Write an ALP program to perform ascending order using 8086
b) Write an ALP program to perform descending order using 8086

WEEK -5 **PROGRAMS FOR STRING MANIPULATIONS OPERATIONS**

a) Write an ALP program to insert or delete a byte in the given string
b) Write an ALP program to search a number/character in a given string
c) Write an ALP program to move a block of data from one memory location to the othe
d) Write an ALP program for reverse of a given string.

WEEK -6 **CODE CONVERSIONS**

a) Write an ALP program to convert packed BCD to Unpacked BCD
b) Write an ALP program to convert packed BCD to ASCII
c) Write an ALP program to convert hexadecimal to ASCII

WEEK -7	**INTERFACING STEPPER MOTOR**
a) Write an ALP program to rotate stepper motor in clockwise direction b) Write an ALP program to rotate stepper motor in anti clockwise direction	
WEEK -8	**INTERFACING ADC & DAC DEVICES**
a) Write an ALP program to convert analog to digital using 8086 b) Write an ALP program to convert digital to analog using 8086	
WEEK-9	**INTERFACING KEYBOARD TO 8086**
Write an ALP program to interface keyboard to 8086	
WEEK-l0	**SERIAL AND PARALLEL COMMUNICATION**
a) Parallel communication between two microprocessors using 8255 b) Serial communication between two microprocessor kits using 8251	
WEEK-l1	**INTERFACING TRAFFIC LIGHT CONTROLLER AND TONE GENERATOR**
a) Write a program to interface traffic light controller b) Write an ALP program to interface tone generator	
WEEK-l2	**ARITHMETIC AND LOGICAL OPERATIONS USING 8051**
Write an ALP program to perform 16 Bit arithmetic and logical operations using 8051 microcontroller	
WEEK-l3	**TIMER/COUNTER**
Write an ALP Program and verify Timer/Counter using 8051	
WEEK-l4	**INTERFACING KEYBOARD TO 8051**
Write an ALP program to interface keyboard to 8051	

Reference Books:

1. Ray A.K, Bhurchandi K.M, –Advanced Microprocessor and Peripherals‖, 2/e TMH, 2012
2. Muhammad Ali Mazidi, J.G. Mazidi and R.D McKinlay, –The 8051 Microcontroller and Embedded systems using Assembly and C‖, 2nd Edition, Pearson education, 2009.

Web References:

1. http://www.nptel.ac.in/downloads/106108100/
2. http://www.the8051microcontroller.com/web-references
3. http://www.iare.ac.in

Course Home Page:

HARDWARE AND SOFTWARE REQUIRED FOR A BATCH OF 24 STUDENTS

HARDWARE: Desktop Computer Systems 24 nos

SOFTWARES: win 862

VLSI DESIGN

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB27	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. Analyze MOS Transistors, CMOS Fabrication and design aspects
II. Develop ability to analyze MOS circuits in super-threshold and sub-threshold regions of operation
III. Explore the design metrics of circuits like power, power dissipation static and dynamic powers.
IV. Design SRAM, DRAM, Serial access and Content Addressable memory circuits

MODULE-I	INTRODUCTION TO MOS TRANSISTORS	Classes:09

MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning, Fabrication, Packaging, and Testing, MOS transistor Theory, Long Channel I-V Characteristics, C-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics

MODULE-II	PRINCIPLES OF CIRCUIT DESIGN	Classes:09

CMOS Processing Technology, CMOS Technologies, Layout Design Rules, CMOS Process Enhancements, Technology-Related CAD Issues, Manufacturing Issues, Circuit Simulation, A SPICE Tutorial, Device Models, Device Characterization, Circuit Characterization, Interconnect Simulation. Combinational Circuit Design, Circuit Families, Silicon-On-Insulator Circuit Design, Sub Threshold Circuit Design. Sequential Circuit Design, Circuit Design of Latches and Flip-Flops, Static Sequencing Element Methodology, Sequencing Dynamic Circuits, Synchronizers, Wave Pipelining

MODULE-III	DESIGN METRICS AND SUB SYSTEM DESIGN	Classes: 10

Power, Sources of Power Dissipation, Dynamic Power, Static Power, Energy-Delay Optimization, Low Power Architectures, Robustness, Variability, Reliability, Scaling, Statistical Analysis of Variability, Variation-Tolerant Design. Delay, Transient Response, RC Delay Model, Linear Delay Model, Logical Effort of Paths, Timing Analysis Delay Models,
Datapath Subsystems, Addition/Subtraction, One/Zero Detectors, Comparators, Counters, Boolean Logical Operations, Coding, Shifters, Multiplication

MODULE-IV	ROBUST DESIGN OF MEMORIES	Classes: 09

Array Subsystems, SRAM, DRAM, Read-Only Memory, Serial Access Memories, Content-Addressable Memory, Programmable Logic Arrays, Robust Memory Design, Special-Purpose Subsystems.

MODULE-V	TESTING	Classes: 08

Packaging and Cooling, Power Distribution, Clocks, PLLs and DLLs, I/O, High-Speed Links, Random Circuits, Design Methodology and Tools, Testing, Debugging, and Verification.

Text Books:

1. Neil H.E. Weste, David Money Harris, “CMOS VLSI Design –A Circuits and Systems Perspective,”

Addision –Wesley, 2011

2. Jan M Rabey, “Digital Integrated Circuits,” 2nd Edition, Pearson Education, 2003.
3. John F.Wakerly, “Digital Design Principles & Practices”, 3rd Edition, 2005, PHI/ Pearson Education Asia,

Reference Books:

1. Wang Alice, Calhoun Benton High smith, Chandrakasan Anantha P., “Sub-threshold Design for Ultra Low-Power Systems,” Springer 2006
2. Pucknell, Kamran Eshraghian, “Basic VLSI Design,” Third Edition, Prentice Hall of India, 2007.
3. R. Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Wiley-IEEE Press, USA, 2005. ISBN: 978-0-470-88132-3
4. Calhoun, B., C. Schurgers, A. Wang, A. Chandrakasan, "Low Energy Digital Circuit Design," in *Hardware Technology Drivers of Ambient Intelligence*, editors Satyen Mukherjee, 2006 Springer.
5. Park, Synghyun, "Towards Low-Power yet High-Performance Networks-on-Chip," *Ph.D. Thesis*, Massachusetts Institute of Technology, September 2014.
6. Sinangil, Mahmut, "Low-Power and Application-Specific SRAM Design for Energy-Efficient Motion Estimation," *Ph.D. Thesis* Massachusetts Institute of Technology, June 2012
7. Amirtharajah, Rajeevan, "Design of Low Power VLSI Systems Powered by Ambient Mechanical Vibration," *Ph.D. Thesis*, Massachusetts Institute of Technology, May 1999.

Web References:

1. http://dspace.mit.edu/handle/1721.1/93776
2. http://dspace.mit.edu/handle/1721.1/75650
3. https://engineering.purdue.edu/~vlsi/ECE559_Fall09/?_ga=2.120672008.1227662350.1573631317316737531.1573631317
4. Class Notes: http://cobweb.ecn.purdue.edu/~vlsi/ECE559_Fall09

E-Text Books:

1. https://www.springer.com/gp/book/9780387335155
2. http://swarm.cs.pub.ro/~mbarbulescu/SMPA/CMOS-VLSI-design.pdf

SATELLITE AND MICROWAVE ENGINEERING

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB28	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. Be Proficient in the concept of Satellite communication and understand placement of communication satellite in GEO.
II. Analyze the Satellite link budget and explain the satellite subsystems like telemetry, tracking and command system.
III. Perceive the concepts of waveguides and analyze the field components in different types of Waveguides.
IV. Categorize different types of microwave components based on their applications.
V. Imbibe knowledge to use microwave oscillators & amplifiers in microwave communication and Compare their characteristics.

MODULE -I	INTRODUCTION TO SATELLITE COMMUNICATION AND ORBITAL MECHANICS	Classes: 08

Overview of present and future trends of satellite communications introduction to satellite systems; Orbital mechanics: Orbital elements; Locating the satellite with respect to the earth; Coverage angle; Slant range; Inclined orbits; Orbital perturbations; Eclipse of GEO satellite; Placement of a communication satellite in GEO satellite sub systems; Satellite link; Propagation effects.

MODULE -II	SATELLITE SUB-SYSTEMS &MODULATION AND MULTIPLE ACCESS SCHEMES	Classes: 09

Multiple Access: Frequency division multiple access (FDMA), Time division multiple access (TDMA, demand assignment multiple access (DAMA). Code Division Multiple Access (CDMA) / Spread Spectrum Multiple Access (SSMA); Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception, adjacent channel interference, inter modulation, handover, satellite diversity. Earth Station: Transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods, lower orbit considerations, VSAT (Very Small Aperture Terminal) Systems and Problems

MODULE -III	INTRODUCTION,WAVEGUIDE COMPONENTS AND APPLICATIONS	Classes: 09

Introduction, Analysis of rectangular waveguide ; Wave impedance in rectangular waveguide: Wave impedance for a TM and TE wave in rectangular waveguide, Dominant mode and degenerate modes, mode characteristics of phase velocity, group velocity, wavelength and impedance relations; Cavity resonators; illustrative problems.

Wave guide multiport junctions: Analysis; Ferrites: Faraday rotation principle, gyrator, isolator, circulator

MODULE -IV	MICROWAVE LINEAR BEAM AND CROSS FIELD TUBES (O TYPE AND M TYPE):	Classes: 10

Microwave linear beam tubes (O type): Limitations of conventional tubes at microwave frequencies; Klystron; Multicavity Klystron amplifiers; Reflex Klystron; Helix Traveling Wave tube: Slow wave structures; Microwave cross field tubes (M type): Introduction, cross-field effects; Magnetrons

MODULE -V	MICROWAVE SOLID-STATE DEVICES & MICROWAVE MEASUREMENTS	Classes: 09

Microwave solid-state devices: Microwave tunnel diode; Transferred electron devices: Gunn-effect diodes, Avalanche transit time devices: IMPATT diode, TRAPATT diode, BARITT diode, Pin diodes, varactor diodes, crystal detectors. Description of microwave bench: Different blocks and their features, precautions; Microwave power measurement: Bolometer; Measurement of attenuation; Frequency standing wave measurements: measurement of low and high VSWR; Cavity Q; Impedance measurements.

Text Books:

1. Dennis roddy, "Satellite Communications", 4th Edition, 2004.
2. Pratt. Bostian, Allnutt, "Satellite Communications", Wiley India, 2nd Edition, 2006.
3. Gérard Maral, "Satellite Communication Systems", 1993.
4. Tri T. Ha, "Digital Satellite Communications", TMH, 2nd Edition, 1990.
5. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson, 3rd Edition, 2003.
6. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi, 1st Edition, 2004.
7. F.E. Terman, "Electronic and Radio Engineering", Tata McGraw-Hill Publications, 4th Edition,1955.

Reference Books:

1. Rappaport T.S., "Wireless communications", Pearson Education, 2nd Edition, 2010.
2. Bruce Elbert, "Introduction to Satellite Communications", 1987.
3. M Richharia, "Satellite Communication Systems", R.E. Collin MacMillan, 2nd Edition, 2005.

Web References:

1. http://nptel.ac.in/courses/106105082/33
2. http://onlinecourses.nptel.ac.in/noc16_ec10/preview
3. https://onlinecourses.nptel.ac.in/noc16_ec10/preview http://nptel.ac.in/courses/117101119/1
4. http://www-group.slac.stanford.edu/kly/Lecture_Series/slac_klystron_lecture_series.htm
5. https://books.google.co.in/books?id=ZU19Uemy83YC&printsec=frontcover&dq=microwave+ engineering & hl=en & redir_esc=y#v=onepage & q&f =false

E-Text Books:

1.https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf
2.http://www.faadooengineers.com/threads/11621-Microwave-engineering-ebook-pdf-Free-Download
3.http://www2.electron.frba.utn.edu.ar/~jcecconi/Bibliografia/Ocultos/Libros/Microwave_Engineering_David_M_Pozar_4ed_Wiley_2012.pdf.

VLSI DESIGN LABORATORY

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB29	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. Understand the basic concepts about MOS device and inverter characteristics
II. Understand the fabrication steps of IC design and design flow of VLSI circuits
III. Design the stick diagram and layout of a circuit
IV. Design the different MOSFET amplifier circuits

LIST OF EXPERIMENTS

WEEK - I **MOSFET**

To plot the (i) Output characteristics of an n-channel and p-channel MOSFETs.
(ii) Transfer characteristics of an n-channel and p-channel MOSFETs.

Find Drain current of an n-channel and p-channel MOSFETs.

WEEK-2 **CMOS INVERTER**

To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter.

Find V_M and Noise Margin of CMOS inverter at β ratio of 1, 1.5, and 2 respectively.

WEEK-3 **RING OSCILLATOR**

To design and plot the output characteristics of a 9-stage ring oscillator.

Find frequency of oscillations, phase noise and power of 9-stage ring oscillator.

WEEK -4 **LOGIC GATES**

To design 2-input NAND, NOR, XOR and XNOR logic gates using static CMOS logic family.
Find static power, dynamic power, total power, propagation delay, power delay product (PDP), and energy delay product (EDP) of 2-input NAND, NOR, XOR and XNOR logic gates

WEEK -5 **4×1 MULTIPLEXER**

To design and plot 4×1 multiplexer using pass transistor and transmission gate logic families.

Find and compare static power, dynamic power, total power, propagation delay, power delay product (PDP), and energy delay product (EDP) of 4x1 multiplexer in both logic families.

WEEK -6 **LATCHES**

To design and plot the characteristics of a positive and negative latch based on multiplexers.
Find static power, dynamic power, total power, propagation delay, power delay product (PDP), and energy delay product (EDP) of both latches.

WEEK -7	**REGISTERS**
To design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers. Find static power, dynamic power, total power, propagation delay, power delay product (PDP), and energy delay product (EDP)	
WEEK -8	**DIFFERENTIAL AMPLIFIER**
Design and simulation of a simple 5 transistor differential amplifier. Find out gain, transconductance (g_m) ICMR, and CMRR.	
WEEK-9	**NMOS INVERTER AND CMOS INVERTER**
To design layout of NMOS and CMOS inverter. Verify Design Rule Check (DRC) Layout versus Schematic (LVS)	
WEEK-10	**LAYOUT OF 2-INPUT NAND, NOR GATES**
To design the layout of 2-input NAND, NOR gates. Verify Design Rule Check (DRC) Layout versus Schematic (LVS)	
WEEK-11	**COMMON SOURCE AMPLIFIER**
Analysis of Frequency response of Common source amplifiers. Find out gain, transconductance (g_m) ICMR, and CMRR.	
WEEK-12	**COMMON DRAIN AMPLIFIER**
Analysis of Frequency response of Common drain amplifiers. Find out gain, transconductance (g_m) ICMR, and CMRR.	
WEEK-13	**SINGLE STAGE CASCODE AMPLIFIER**
Design and Simulation of Single Stage Cascode Amplifier. Find out gain, transconductance (g_m) ICMR, and CMRR.	
WEEK-14	**BASIC CURRENT MIRROR, CASCODE CURRENT MIRROR AMPLIFIER**
Design and Simulation of Basic Current Mirror, Cascode Current Mirror Amplifier. Find out gain, transconductance (g_m) ICMR, and CMRR.	
Reference Books	
1. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill Publications, 2002. 2. Allen Holberg, CMOS Analog Circuit Design, Oxford Publications, 2002. 3. Baker, Li, Boyce, CMOS Mixed Circuit Design, Wiley Publications, 2002.	
Web References:	
1. http://ee.usc.edu/~redekopp/ee209/virtuoso/setup/USCVLSI-VirtuosoTutorial.pdf	
SOFTWARE AND HARDWARE REQUIREMENTS FOR 36 STUDENTS **HARDWARE:** Desktop Computer Systems: 36 **SOFTWARE:** Cadence Virtuoso Tools	

ANTENNAS AND MICROWAVE ENGINEERING LABORATORY

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB30	Core	0	0	3	1.5	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Measure the parameters using microwave components.
II. Evaluate scattering parameters of different microwave junctions.
III. Design and Evaluate the microwave antennas performance.
IV. Analyze the performance of an antenna in 3D plots.

LIST OF EXPERIMENTS

Week-1	**STUDY OF MICROWAVE COMPLONENTS**
To study the different wave guide components in the microwave bench setup.	
Week-2	**MODE CHARACTERISTICS OF REFLEX KLYSTRON**
To study the characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.	
Week-3	**GUNN DIODE CHARACTERISTICS**
To study the characteristics of Gunn diode oscillator.	
Week-4	**DIRECTIONAL COUPLER CHARACTERISTICS**
To measure coupling factor, insertion loss, isolation and directivity of a Directional coupler.	
Week-5	**MEASUREMENT OF VSWR**
To measure the low and high VSWR's of matched terminals.	
Week-6	**CIRCULATOR CHARACTERISTICS**
To measure the isolation and insertion loss of a three port circulator.	
Week-7	**MEASURMENT OF SCATTERING PARAMETERS OF MAGIC TEE**
To find the scattering parameters of a four port Magic Tee.	
Week-8	**INTRODUCTION TO HFSS**
Introduction To HFSS Tool	
Week -9	**MONOPOLE ANTENNA DESIGN**
To find the gain of Monopole Antenna	

Week-10	**DIPOLE ANTENNA DESIGN**
To draw the Radiation Pattern of Dipole Antenna Design	
Week-11	**MICROSTRIP FEED ANTENNA DESIGN**
To find the gain and radiation pattern of Microstrip Feed Antenna Design	
Week-12	**PROBE FEED PATCH ANTENNA DESIGN**
To draw the 3D polar plot of Probe Feed Patch Antenna Design	
Week-13	**SLOT COUPLED PATCH ANTENNA**
To draw the 3D rectangular plot of Slot Coupled Patch Antenna	
Week-14	**MICROSTRIP LINE DESIGN**
To find the gain of Microstrip Line Design	

Reference Books

1. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson, 3rd Edition, 2003.
2. HerbertJ.Reich, J.G.Skalnik, P.F.Ordungand H.L.Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi, 1st Edition, 2004.
3. F.E. Terman, "Electronic and Radio Engineering", Tata McGraw-Hill Publications, 4th Edition, 1955.
4. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, "Antennas and Wave Propagation", TMH, 4th Edition, 2010.

Web References:

1. http://www.ee.iitkgp.ac.in
2. http://www.citchennai.edu.in
3. http://www.ansys.com

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 24 STUDENTS

HARDWARE: Desktop Computer Systems 24 nos

SOFTWARE : ANSYS HFSS TOOL

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 24 STUDENTS

S. No	Name of the Equipment	Range/Model
1	Klystron Based Microwave Bench Setup	--
2	Gunn diode Based Microwave Bench Setup	--
3	VSWR Meter	--
4	FUNCTION GENERATOR	0-1 MHz
5	Slotted Line	--
6	Magic Tee	--
7	Circulator	--
8	Directional Coupler	--
9	Variable Attenuator	--
10	Matched Terminator	--
11	Cathode Ray Oscilloscope	(0-30) MHz
12	Dc Regulated Power Supply	(0-30) V

PROJECT WORK - I

VII Semester: Common for all branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB61	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
AECB62	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.

INTRODUCTION TO MEMS

PE - I: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB31	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. Acquire the knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
II. Educate on the rudiments of Micro fabrication techniques.
III. Understand the importance of various sensors and actuators
IV. Understand and analyze different materials used for MEMS
V. Educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

MODULE -I	INTRODUCTION	Classes: 08

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

MODULE -II	SENSORS AND ACTUATORS II	Classes: 12

Electrostatic sensors – Parallel plate capacitors – Applications – Inter digitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

MODULE -III	SENSORS AND ACTUATORS II	Classes: 08

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors.

Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

MODULE -IV	MICROMACHINING	Classes: 08

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

MODULE -V	POLYMER AND OPTICAL MEMS	Classes: 09

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses

and Mirrors – Actuators for Active Optical MEMS.

Text Books:

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc.,2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication,2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi,2002.

Reference Books:

1. Nadim Maluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House,2000.
2. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton,2000
3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & SonLTD,2002
4. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher,2010
5. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer2012.

Web References:

1. http://www.http//mail.vdivde-it.de/ut/EMSTO
2. https://nptel.ac.in/courses/117105082/
3. http://me.umn.edu/courses/me8254/lectnotes.html

E-Text Books:

1. https://www.sanfoundry.com/best-reference-books-introduction-mems/
2. http://www.thegreenbook.com/four-types-of-actuators.htm
3. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470611807

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

PE - I: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB32	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. Acquire a sound understanding theory and performance characteristics of instruments and errors in measurement and apply to DC voltmeters, ammeters, ohmmeters.
II. Provide concepts and operation of different signal generators and wave form analyzers.
III. Compare and contrast different types of oscilloscopes.
IV. Select different types of D.C and A.C bridges for measurement of passive components and physical parameters.

MODULE -I	INTRODUCTION TO MEASURING INSTRUMENTS	Classes: 08

Block schematics of measuring systems, performance characteristics, Static characteristics: Accuracy, resolution, precision, gauss error, types of errors, Dynamic characteristics : Repeatability, reproducibility, fidelity, lag; Analog measuring instruments: D' Arsonval movement, DC voltmeters and ammeter, AC voltmeters and current meters, ohmmeters, multimeters, meter protection, extension of range, digital voltmeters: Ramp type, staircase, dual slope integrating type, successive approximation type, specifications of instruments.

MODULE -II	OSCILLOSCOPE	Classes: 09

Oscilloscopes: CRT, block schematic of CRO, time base circuits, delay lines, high frequency CRO considerations, applications, specifications, special purpose oscilloscopes: Dual trace, dual beam CROs, sampling oscilloscopes, storage oscilloscopes, digital storage CROs, Lissajous figures, frequency measurement, phase measurement, CRO probes.

MODULE -III	SIGNAL GENERATOR AND SIGNAL ANALYZERS	Classes: 09

Signal Generators: AF and RF signal generators, sine and square wave generators, function generators arbitrary waveform generator, sweep frequency generators, video signal generators, and specifications.

Signal Analyzers: AF, HF wave analyzers, heterodyne wave analyzers, harmonic distortion, spectrum analyzers, power analyzers

MODULE -IV	AC AND DC BRIDGES	Classes: 10

Measurements using DC and AC bridges: Wheat stone bridge, Kelvin bridge, AC bridges, Maxwell, Hay, Schering, Wien, Anderson bridges, wagner & ground connection.

MODULE -V	TRANSDUCERS	Classes: 09

Transducers: Classification, strain gauges, force and displacement, tranducers, resistance thermometers, hotwire anemometers, LVDT, themocouples, synchros; Piezoelectric transducers, variable capacitance transducers; Magneto strictive transducers, measurement of physical parameters: Flow measurement, displacement meters, liquid level measurement, measurement of humidity and moisture, velocity, force, pressure, high pressure, vacuum level, temperature measurements.

Text Books:

1. K.Lal Kishore, "Electronic Measurements and Instrumentation", Pearson Education, 2nd Edition, 2010.
2. H.S.Kalsi, "Electronic Instrumentation", TMH, 2nd Edition, 2004.
3. A. K. Sawhney, "Electrical and Electronics Measurements and Instrumentation", 19th Edition, 2011.

Reference Books:

1. David A. Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 1st Edition, 2007.
2. A.D.Helbincs,W.D.Cooper,"Modern Electronic Instrumentation and Measurement Techniques", PHI, 56th Edition,2003.
3. B.M.Oliver, J.M.Cage, "Electronic Measurements and Instrumentation",TMH, Reprint,2009.
4. T.R.Padmanabham, "Industrial Instrumentation", Springer, 1st Edition, 2009.

Web References:

1. https://www.scribd.com/
2. https://www.worldcat.org/
3. https://www.infibeam.com/
4. https://www.abebooks.co.uk

E-Text Books:

1. https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf
2. fmcet.in/ECE/EC2351_uw.pdf
3. https://books.askvenkat.com/tag/measurement-and-instrumentation-lecture-notes-pdf
4. https://www.jntubook.com/electronics-measurements-instrumentation-textbook-free-d

NANO ELECTRONICS: DEVICES AND MATERIALS

PE - I: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB33	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. Present the state of the art in the areas of semiconductor device physics and materials technology to enable the Nanoelectronics.
II. Understand the fundamentals of classical CMOS technology will be discussed and the issue in scaling MOSFET in the sub-100nm regime will be elaborated.
III. Analyze the context that needed for non classical transistors with new device structure and nano materials will be elucidated.
IV. Understand the issues in realizing Germanium and compound semiconductor MOSFET will be presented.

MODULE -I	**OVERVIEW: NANO DEVICES, NANO MATERIALS, NANO CHARACTERIZATION**	**Classes: 09**

Overview: Nano devices, Nano materials, Nano characterization. Definition of Technology node, Basic CMOS Process flow. MOS Scaling theory, Issues in scaling MOS transistors: Short channel effects, Description of a typical 65 nm CMOS technology.

MODULE -II	**REQUIREMENTS FOR NON CLASSICAL MOS TRANSISTOR**	**Classes: 09**

Requirements for Non classical MOS transistor. MOS capacitor, Role of interface quality and related process techniques, Gate oxide thickness scaling trend, SiO2 vs High-k gate dielectrics. Integration issues of high-k. Interface states, bulk charge, band offset, stability, reliability – Qbd high field, possible candidates, CV and IV techniques.

MODULE -III	**METAL GATE TRANSISTOR**	**Classes: 09**

Metal gate transistor: Motivation, requirements, Integration Issues. Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot. SOI - PDSOI and FDSOI. Ultrathin body SOI – double gate transistors, integration issues.

Vertical transistors - FinFET and Surround gate FET. Metal source/drain junctions - Properties of schotky junctions on Silicon, Germanium and compound semiconductors –Work function pinning.

MODULE -IV	**GERMANIUM NANO MOSFETS**	**Classes: 09**

Germanium Nano MOSFETs: strain, quantization, Advantages of Germanium over Silicon, PMOS versus NMOS. Compound semiconductors – material properties, MESFETs Compound semiconductors MOSFETs in the context of channel quantization and strain , Hetero structure MOSFETs exploiting novel materials, strain, quantization. Synthesis of Nanomaterials: CVD, Nucleation and Growth, ALD, Epitaxy, MBE.

MODULE -V	**COMPOUND SEMICONDUCTOR HETERO-STRUCTURE GROWTH AND CHARACTERIZATION**	**Classes: 09**

Compound semiconductor hetero-structure growth and characterization: Quantum wells and Thickness measurement techniques: Contact - step height, Optical - reflectance and ellipsometry. AFM. Characterization techniques for nanomaterials: FTIR, XRD, AFM, SEM, TEM, EDAX etc. Applications and interpretation of results. Emerging nano materials: Nanotubes, nanorods and other nano structures, LB technique, Soft lithography etc. Microwave assisted synthesis, Self assembly etc.

Text Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th Edition, 2002.
3. W.H. Gothmann, "Digital Electronics - An Introduction to Theory and Practice", PHI, 2nd Edition, 2006.

Reference Books:

1. Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press.
2. Silicon VLSI Technology, Plummer, Deal , Griffin , Pearson Education India.
3. Encyclopedia of Materials Characterization, Edited by: Brundle, C.Richard; Evans, Charles A. Jr.; Wilson, Shaun ; Elsevier.

Web References:

1. http://home.iitk.ac.in/~anandh/MSE694/Introduction_to_Nanomaterials-3.pdf
2. https://dl.acm.org/citation.cfm?id=291188
3. https://iopscience.iop.org/article/10.1088/0268-1242/26/1/014035/meta
4. http://ece.iisc.ernet.in/~navakant/nano/2007/course.html

E-Text Books:

1. https://arxiv.org/pdf/1812.04939.pdf
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5905289/
3. https://www.intel.com/pressroom/kits/advancedtech/doodle/ref_HiK-MG/high-k.htm
4. https://warwick.ac.uk/fac/sci/physics/research/condensedmatt/silicon/research/ge/
5. https://iopscience.iop.org/article/10.1088/0268-1242/26/1/014035/meta

RF CIRCUIT DESIGN

PE - I: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB34	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 fundamental RF circuit and system design skills
II. Understand the basic transmission line theory, single and multiport networks, RF component modeling.
III. Know matching and biasing networks & RF transistor amplifier design.

MODULE -I	INTRODUCTION	Classes: 10

Importance of RF Design-Dimensions and Units-Frequency Spectrum-RF Behaviour of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors.-Chip Components, and Circuit Board Considerations: Chip Resistors, Chip Capacitors, and Surface Mount Inductors. Review of Transmission Lines: Types of Transmission Lines-Equivalent Circuit representation-R, L, C, G parameters of Different Line configurations-Terminated Lossless Transmission Lines-Special Terminations: Short Circuit, Open Circuit and Quarter Wave Transmission Lines- Sourced and Loaded Transmission Lines: Power Considerations, Input Impedance Matching, Return Loss and Insertion Loss.

MODULE -II	SINGLE AND MULTI-PORT NETWORKS	Classes: 09

The Smith Chart: Reflection Coefficient, Normalized Impedance-Impedance Transformation: Standing wave Ratio, Special Transformation Conditions-Admittance Transformation-Parallel and Series RL & RC Connections-Basic Definitions of Single and Multi-Port Networks-Interconnecting Networks.

RF Filter Design: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion Between S- and Z-parameters, Signal Flow Chart Modeling, Generalization Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations-Coupled Filters.

MODULE -III	ACTIVE RF COMPONENT MODELLING	Classes: 08

RF Diode Models: Nonlinear and Linear Models Transistor Models: Large Signal and Small Signal BJT Models.

Large Signal and Small Signal FET Models- Scattering Parameter, Device Characterization.

MODULE -IV	MATCHING AND BIASING NETWORKS	Classes: 08

Impedance Matching Using Discrete Components: Two Component Matching Networks, Forbidden Regions, Frequency Response and Quality Factor, T and Pi Matching Networks-Amplifier Classes of Operation and Biasing Networks: Classes of Operation and Efficiency of Amplifiers, Biasing Networks for BJT, Biasing Networks for FET.

MODULE -V	RF TRANSISTOR AMPLIFIER DESIGN	Classes: 10

Characteristics of Amplifiers- Amplifier Power Relations: RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, And Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles. RF Oscillators and Mixers: Basic Oscillator Model: Negative Resistance Oscillator, Feedback

Oscillator Design, Design steps, Quartz Oscillators- Fixed Frequency High Frequency Oscillator -Basic Characteristics of Mixers: Concepts, Frequency Domain Considerations, Single Ended Mixer Design, Single, and Double Balanced Mixers.

Text Books:

1. Reinhold Ludwig, Pavel Bsetchko, "RF Circuit Design – Theory and Applications", "Pearson Education India", 2000.
2. Devendra K. Misra, "Radio Frequency and Microwave Communication Circuits – Analysis and Design", Wiley Student Edition – John Wiley & Sons, Inc.

Reference Books:

1. Matthew M. Radmanesh, "Radio Frequency and Microwave Electronics", Illustrated by– PEI.
2. Christopher Bowick, Cheryl Aljuni and John Biyler, "RF Circuit Design", Elsevier Science, 2008.
3. Joseph J.Carr, "Secrets of RF Circuit Design", Mc Graw Hill Education, 2000.
4. Peter L.D. Abrif, "Design of RF and Microwave Amplifiers and Oscillators", Artech House, 2000.
5. Thomas H.Lee, "The Design of CMOS Radio Frequency Integrated Circuits", Cambridge University Press, 2nd Edition, 2004.

Web References:

1. http://twanclik.free.fr/electricity/electronic/pdfdone12/Radio%20Frequency%20Circuit%20Design.pdf
2. https://www.highfrequencyelectronics.com/index.php?...rf-circuit-design-references..
3. eecs.oregonstate.edu/~karti/ece621/ece621.pdf

E-Text Books:

1. https://ieeexplore.ieee.org/book/5628344
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118309940
3. https://www.amazon.in/Radio-Frequency-Integrated-Circuits-Systems/.../0521190797

DIGITAL IMAGE PROCESSING

PE - II: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB35	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. Evaluate the image restoration procedures.
IV. Analyze the image compression procedures.
V. Design the image segmentation and representation techniques.

MODULE -I	**INTRODUCTION**	**Classes: 10**

Digital image fundamentals and image transforms digital image fundamentals, sampling and quantization, relationship between pixels; Image transforms: 2-D FFT, properties, Walsh transform, Hadamard transform, discrete cosine transform, Haar transform, Slant transform, Hoteling transform.

MODULE -II	**IMAGE ENHANCEMENT**	**Classes: 09**

Introduction, image enhancement in spatial domain, enhancement through point processing, types of point processing, histogram manipulation, linear and non-linear gray level transformation, local or neighbor hood operation, median filter processing; Spatial domain high pass filtering, filtering in frequency domain, obtaining frequency domain filters from spatial filters, generating filters directly in the frequency domain, low pass (smoothing) and high pass (sharpening) filters in frequency domain.

MODULE -III	**IMAGE RESTORATION**	**Classes: 08**

Image restoration degradation model, algebraic approach to restoration, inverse filtering.

Least mean square filters, constrained least square restoration, interactive restoration.

MODULE -IV	**IMAGE SEGMENTATION**	**Classes: 08**

ıge segmentation detection of discontinuities, edge linking and boundary detection, threshold, region ented segmentation morphological image processing dilation and erosion, structuring element omposition, the Strel function, erosion; Combining dilation and erosion: Opening and closing the hit and miss transformation.

MODULE -V	**IMAGE COMPRESSION**	**Classes: 10**

Image compression: Redundancies and their removal methods, fidelity criteria, image compression models, source encoder and decoder, error free compression, lossy compression, JPEG 2000 standard.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3rd Edition, 2008.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, "Digital Image Processing", TMH, 3rd Edition, 2010.

Reference Books:

1. Rafael, C. Gonzalez, Richard E woods, Stens L Eddings, "Digital Image Processing using MAT LAB", Tata McGraw Hill, 2nd Edition, 2010.
2. A.K. Jain, "Fundamentals of Digital Image Processing", PHI, 1st Edition, 1989.
3. Somka, Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning, 1st Edition, 2008.
4. Adrain Low, "Introductory Computer vision Imaging Techniques and Solutions", Tata McGraw-Hill, 2nd Edition, 2008.
5. John C. Russ, J. Christian Russ, "Introduction to Image Processing & Analysis", CRC Press, 1st Edition, 2010.

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/
5. http://web.stanford.edu/class/ee368/
6. https://sisu.ut.ee/dev/imageprocessing/book/1
7. https://in.mathworks.com/discovery/digitalimageprocessing.html?requestedDomain=www.mathworks.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
4. http://bookboon.com/en/digital-image-processing-part-one-ebook

SPEECH AND AUDIO PROCESSING

PE - II: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB36	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course is expected to enable the students to:

I. Understand the acoustic modelling of speech and analyze the speech in time domain
II. Analyze the speech using Linear Prediction modelling.
III. Explore the homomorphic analysis of speech signal.
IV. Understand the speech and speaker recognition techniques.
V. Study the perceptual modeling of audio for compression

MODULE -I	FUNDAMENTALS OF DIGITAL SPEECH PROCESSING	Classes: 09

Mechanism of speech production, The Acoustic theory of speech production- Uniform lossless tube model, losses in vocal tract, effect of radiation at lips, Digital models for speech signals, Speech Parameters: Short time energy, average magnitude, average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using short time autocorrelation function, and average magnitude difference function.

MODULE -II	LINEAR PREDICTIVE (LP) ANALYSIS	Classes: 09

Basic principles of LP Analysis: The Autocorrelation Method, The Covariance method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, comparison of methods, Pitch Detection using LP analysis, Formant Analysis using LP analysis, Preemphasis of the Speech Waveform, Frequency domain interpretation of LP analysis, Applications of LP in Speech Analysis: Pitch Estimation, Formant Estimation and Glottal Waveform Deconvolution

MODULE -III	HOMOMORPHIC SPEECH PROCESSING	Classes: 09

Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder.

Speech Enhancement:

Speech enhancement techniques: Single Channel Approach, Spectral Subtraction, Enhancement by re-synthesis, Comb filtering, Wiener filtering, subspace algorithms

MODULE -IV	AUTOMATIC SPEECH AND SPEAKER RECOGNITION	Classes: 09

Speech Recognition:

Basic pattern recognition approaches, parametric representation of Speech, Evaluating the similarity of Speech patterns, Isolated digit Recognition System, Continuous word Recognition system. Elements of HMM, Training & Testing of Speech using HMM.

Speaker Recognition:

Recognition techniques, Features that distinguish speakers, MFCC, delta MFCC, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System, Performance Metrics.

MODULE -V	AUDIO CODING	Classes: 09

Speech Perception mechanism, Psychoacoustic model, Temporal and spectral masking, Critical bands, Lossless Audio Coding, Lossy Audio coding, ISO-MPEG-1 Audio coding, MPEG - 2 Audio coding, MPEG - 2 Advanced Audio Coding, MPEG - 4 Audio Coding.

TEXTBOOKS:

1. Lawrence R. Rabiner and Ronald W. Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978
2. Digital Audio Signal Processing – Udo Zolzer, 2nd Edition, Wiley, 2008
3. Philipos C. Loizou, Speech Enhancement – Theory and Practice, CRC Press, 2013

REFERENCE BOOKS:

1. O'Shaughnessy, D, Speech Communication, Human and Machine, Addison-Wesley, 1987
2. John N. Holmes, Wendy J. Holmes, Speech Synthesis and Recognition, Taylor and Francis, 2nd Edition, 2003.
3. Tokunbo Ogunfunmi, Roberto Togneri, Madihally Narasimha, Speech and Audio Processing for Coding, Enhancement and Recognition, Springer, 2015
4. John R. Deller, Jr.,John H. L. Hansen ANDJohn G. Proakis, Discrete-Time Processing of Speech Signals, IEEE Signal Processing Society.
5. Thomas F. Quatieri , Discrete-Time Speech Signal Processing: Principles and Practice, Prentice Hall, Signal Processing Series, 2002
6. Lawrence R. Rabiner and Ronald W. Schafer, Introduction to Digital Speech Processing, now publishers, 2006
7. L. R. Rabiner and R. W. Schafer, Introduction to Digital Speech Processing, Foundations and Trends in Signal Processing, vol 1, no 1–2, pp 1–194, 2007

ONLINE RESOURCES

1. Speech and Audio Processing 1: Introduction to Speech Processing -Professor E. Ambikairajah https://www.youtube.com/watch?v=Xjzm7S__kBU
2. Speech and Audio Processing 3: Linear Predictive Coding (LPC) -Professor E. Ambikairajah https://www.youtube.com/watch?v=lWH-Oh5KnNY

VIDEO PROCESSING

PE - II: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB37	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. Beyond the obvious applications in entertainment and scientific visualization, digital images and video have become a central component of net-centered computing,
II. Human/computer interfaces, and databases, as well as data analysis for domains such as biometrics, surveillance and remote sensing.
III. This course offers fundamentals of digital image and video processing and algorithms for most of the work currently underway in this field.
IV. Through this course, students will get a clear impression of the breadth and practical scope of digital image and video processing
V. Develop conceptual understanding which will enable them to undertake further study, research and/or implementation work in this area.

MODULE – I	FUNDAMENTALS OF VIDEO PROCESSING	Classes: 10

Representation of digital video: Introduction and fundamentals, Time-varying image formation models: Motion models, Geometric image formation. Spatio-temporal sampling: Sampling of analog and digital video, Two-dimensional rectangular and periodic sampling, Sampling of 3-D structures, Reconstruction from samples.

MODULE – II	VIDEO MOTION ESTIMATION	Classes: 09

Video Motion estimation**:** Two dimensional, Optical flow, General methodologies, Pixel based motion estimation, Block matching algorithm, Deformable block matching algorithm, Mesh based motion estimation, Global motion estimation, Region based motion estimation, Multi resolution motion estimation Feature based Motion Estimation, Direct motion Estimation, Iterative model.

MODULE – III	2-D MOTION ESTIMATION	Classes: 09

Video coding: Basics of video coding, Content dependent video coding, Two dimensional shape coding, Texture coding for arbitrarily shaped region, Joint shape and texture coding, Region based video coding,

Object based video coding, Knowledge based video coding, Semantic video coding, Layered coding system, Scalable video coding, Basic modes of scalability, Object based scalability, Wavelet transform based coding, Application of motion estimator in video coding.

MODULE – IV	VIDEO COMPRESSION	Classes: 08

Video Compression Standards; MPEG-4 Visual and H.264/AVC: Standards for Modern Digital Video; H.265/ HEVC, HEVC Coding tools and extensions, Synthesis, Inverse Laplace Transform

MODULE – V	VIDEO PROCESSING AND SEGMENTATION	Classes: 09

Stereo and multi view sequence processing: Depth perception Stereo imaging principle Disparity estimation Intermediate view synthesis Stereo sequence coding. Video Segmentation: Motion Segmentation; Tracking; Motion Tracking in Video: 2D and 3D Motion Tracking in Digital Video, Methods using Point Correspondences, Optical Flow and Direct Methods, Applications

Text Books:

1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing",Pearson Education, 3rd Edition, 2009..
2. Yao Wang, Joem Ostermann and Ya–quin Zhang, "Video Processing and Communication, PH Int, 1st Edition, 2002.

Reference Books:

1. A. Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2015.
2. Alan C. Bovik, "The Essential Guide to Video Processing", Elsevier Science, 2nd Edition, 2009.
3. Iain E. Richardson, "H.264 and MPEG-4 Video Compression: Video Coding for Next-generation Multimedia", John Wiley & Sons, 2nd Edition, 2003.
4. J.W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", Academic Press, 2nd Edition, 2012.

Web References:

1. http://eeweb.poly.edu/~yao/EL6123_s16/index.htm
2. http://eeweb.poly.edu/~yao/EL6123_s16/Color_ContrastEnhancement.pdf
3. http://eeweb.poly.edu/~yao/EL6123_s16/FT_filtering_2016.pdf
4. http://eeweb.poly.edu/~yao/EL6123_s16/GlobalMotionStabilization.pdf

E-Text Books:

1. http://eeweb.poly.edu/~yao/videobook/
2. http://www.imageprocessingplace.com/DIP-3E/dip3e_main_page.htm
3. https://booksite.elsevier.com/9780123814203/

WAVELETS

PE - II: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB38	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. Apply the mathematical basis of the wavelet transform and its performance in the analysis of non-stationary
II. Apply the concepts, theory and algorithms behind wavelet transform and wavelet packet transform from an interdisciplinary perspective.
III. Build the concept of dyadic multi resolution analysis and relate it to filter banks
IV. Construct Wavelets using the time domain and frequency domain approaches
V. Explore the applications of wavelets and wavelet packets in transient analysis, biomedical signal processing, speech, audio, image and video coding, signal denoising, pattern recognition etc.

MODULE – I	INTRODUCTION TO WAVELETS AND FILTER BANKS	Classes: 09

Introduction - Stationary and non-stationary signals - Signal representation using basis and frames- Brief introduction to Fourier transform and Short time Fourier transform - Time frequency analysis- The uncertainty principle and its implications- Piecewise Constant Approximation – The Haar Wavelet – Building up the concept of Multi resolution Analysis (MRA) and Relating it to filter banks.

MODULE – II	CONTINUOUS AND DISCRETE WAVELET TRANSFORMS	Classes: 09

Continuous wavelet transform (CWT) - Condition of admissibility and its implications – Inverse Continuous Wavelet Transform - Discrete Wavelet Transform And Filter banks - Construction of wavelets using time domain and frequency domain approaches - Computation of the discrete wavelet transform using Mallat Algorithm and Lifting Scheme - Two dimensional wavelet transforms and Extensions to higher dimensions.

MODULE – III	ALTERNATIVE WAVELET REPRESENTATIONS	Classes: 09

Biorthogonal Wavelets: biorthogonality in vector space, biorthogonal wavelet bases

signal representation using biorthogonal wavelet system, advantages of biorthogonal wavelets, biorthogonal analysis and synthesis.

MODULE – IV	WAVELET TRANSFORMS AND APPLICATIONS	Classes: 09

Wavelet Packet Transform – Signal representation using wavelet packet analysis – selection of best basis. Applications of Wavelets and Wavelet Packets in Signal and Image compression.

MODULE – V	DETECTION OF SIGNALS	Classes: 09

Detection of signal changes - analysis and classification of audio signals - Wavelet based signal de-noising and energy compaction - Image fusion, Edge Detection and object isolation – Biomedical Signal Processing Applications.

Text Books:

1. M. Vetterli, J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall Inc, 1995.
2. Gilbert Strang and Truong Q. Nguyen, "Wavelets and Filter banks", 2nd Edition, Wellesley- Cambridge Press,1998.

Reference Books:

1. Raghuvir Rao and Ajit S. Bopardikar, "Wavelet Transforms : Introduction, Theory and Applications", Pearson Education , 2000.
2. J.C. Goswami and A.K. Chan, "Fundamentals of Wavelets: Theory, Algorithms and Applications",
3. 2nd Ed, WILEY, 2011.
4. K. P.Soman and K L Ramachandran, "Insight into wavelets from theory to practice", PHI, 2008

Web References:

1. https://www.youtube.com/watch?v=C5Z_AEhiov0
2. http://www.ifp.illinois.edu/minhdo/teaching/wavelets.html

E-Text Books:

1. http://web.stanford.edu/class/files/scribes/lecture_notes.pdf
2. http://www.everythingwtu.wordpress.com

CELLULAR AND MOBILE COMMUNICATIONS

PE - III: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB39	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. Analyze and design wireless and mobile cellular systems.
II. Understand impairments due to multipath fading channel and be able simulate standard stochastic channel models for various environments.
III. Evaluate the fundamental techniques to overcome the different fading effects.
IV. Interpret current and proposed cellular technologies.
V. Able to work in advanced research wireless and mobile cellular programs.

MODULE -I	CELLULAR MOBILE RADIO SYSTEMS	Classes: 10

Introduction to cellular mobile System, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, hexagonal shaped cells, analog and digital Cellular systems, General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

MODULE -II	INTERFERENCE AND CELL COVERAGE FOR SIGNAL AND TRAFFIC	Classes: 09

Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-cochannel interference-different types, Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.

MODULE -III	CELL SITE AND MOBILE ANTENNAS	Classes: 08

Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas, Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units

Channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment, Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

MODULE -IV	WIRELESS SYSTEMS AND STANDARDS	Classes: 08

Second generation and Third generation Wireless Networks and Standards, WLL, Bluetooth, GSM, IS95, DECT, GSM architecture, GSM channels, multiplex access scheme, TDMA, CDMA

MODULE -V	INTELLIGENT NETWORK FOR WIRELESS COMMUNICATIONS	Classes: 10

Intelligent cell concept, advanced intelligent network, SS7 network and ISDN for AIN, AIN for mobile communication, asynchronous transfer mode technology, future public land mobile telecommunication system, wireless information superhighway.

Text Books:

1. W.C.Y. Lee, "Mobile Cellular Telecommunications", Tata McGraw-Hill, 2nd Edition, 2006.
2. Gordon L. Stuber, "Principles of Mobile Communications", Springer International, 2nd Edition, 2007.
3. Yi-Bing Lin and Imrich chlantae, “Wireless and Mobile Network Architecture”, John Wiley, 1st Edition, 2006.

Reference Books:

1. Theodore. S. Rapport, "Wireless Communications", 3rd Edition, Pearson Education, 2003.
2. Lee, "Wireless and Mobile Communications", McGraw Hill, 3rd Edition, 2006.
3. Jon W. Mark and Weihua Zhqung, "Wireless Communication and Networking", PHI, 1st Edition, 2005.
4. R. Blake, "Wireless Communication Technology", Thompson Asia Pvt. Ltd., 1st Edition 2004.

Web References:

1. https://accessengineeringlibrary.com
2. http:// www.radio-electronics.com
3. https://www.jntubook.com
4. http://www.iare.ac.in

E-Text Books :

1. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/EC632.pdf
2. https://books.google.co.in/books/about/Cellular_and_Mobile_Communications
3. https://technicalpublications.org/.../books/ Cellular_and_Mobile_Communications

MOBILE ADHOC NETWORKS

PE - III: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB40	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. Interpret mathematical model and network protocol design in wireless multi-hop networks
II. understand network protocols and their cross layer interactions
III. Understand active research areas in wireless multi-hop networks.
IV. Interpret IEEE 802.11 wireless LAN and their Bluetooth standards

MODULE -I	**INTRODUCTION TO ADHOC NETWORKS**	**Classes: 10**

Introduction to ad-hoc networks, definition, characteristics features, applications, characteristics of wireless channel, Ad-hoc mobility models, indoor and outdoor models

MODULE -II	**MEDIUM ACCESS PROTOCOLS**	**Classes: 09**

MAC Protocols: design issues, goals and classification, contention based protocols with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

MODULE -III	**NETWORK PROTOCOLS**	**Classes: 08**

Routing Protocols: Design issues, goals and classification; Proactive vs reactive routing, unicast routing algorithms, multicast routing algorithms,

Hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

MODULE -IV	**END-END DELIVARY AND SECURITY**	**Classes: 08**

Transport layer: Issues in designing, transport layer classification, ad-hoc transport protocols; Security issues in ad-hoc networks: issues and challenges, network security attacks, secure routing protocols.

MODULE -V	**CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G**	**Classes: 10**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective; Integration of ad-hoc with mobile IP networks.

Text Books:

1. C.Siva Ram Murthy, B.S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", Pearson Education, 2nd edition,2007.
2. Prasant Mohapatra, Srikanth Krishnamurthy, "Adhoc Networks Technologies and Protocols", Springer, 1st Edition, 2005.
3. Stefano Basagni, MarcoConti, "Mobile AdHoc Networking", John wiley & sons,1st Edition, 2004.

Reference Books:

1. GeorgeAggelou,"Mobile Adhoc Networks from wireless LAN'sto 4G networks" ,Tata McGraw-Hill, 1st Edition, 2009.
2. AzzedineBoukerche, "Algorithms and Protocols for wireless and mobile ad-hoc networks", John Wiley & Sons, 1st Edition, 2009.

3. RaminHekmat, “Ad-hoc Networks: Fundamental Properties and Network Topologies” Springer, 2006.

Web References:

1. https://en.wikipedia.org/wiki/Mobile_ad_hoc_network
2. http://people.ee.duke.edu/~romit/group/paper-collection.html
3. https://arxiv.org/ftp/arxiv/papers/1503/1503.03233.pdf
4. http://www.iare.ac.in/sites/default/files/lecture_notes/asn%20notes.pdf

E-Text Books:

1. https://books.google.co.in/books?id=izNUbXbK7e4C
2. https://books.google.co.in/books?id=cegpBdUxk_EC
3. https://books.google.co.in/books?id=4sa--GE8OGEC
4. https://books.google.co.in/books?id=GnkcHEsxAigC

OPTICAL COMMUNICATIONS

PE - III: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB41	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. Realize the significance of optical fiber communications.
II. Understand the construction and characteristics of optical fiber cable.
III. Develop the knowledge of optical signal sources and power launching.
IV. Identify and understand the operation of various optical detectors.
V. Understand the design of optical systems and WDM.

MODULE -I	OVERVIEW OF OPTICAL FIBER COMMUNICATION	Classes: 10

Historical development, The general system, Advantages of Optical Fiber Communications, Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod; rays and modes; different types of optical fibers, modal analysis of a step index fiber, linearly polarized modes, single mode fibers and graded - index fiber

MODULE -II	SIGNAL DISTORTION IN OPTICAL FIBERS	Classes: 09

Attenuation- Absorption, scattering losses, bending losses, core and cladding losses; signal distortion in optical waveguides; Material Dispersion, Waveguide Dispersion; Optical sources; Semiconductor device fabrication, LED and LASER diode; Principles of operation, concepts of line width, phase noise, switching and modulation characteristics

MODULE -III	OPTICAL DETECTORS	Classes: 08

PIN detector, avalanche photodiode - Principles of operation, concepts of responsively, sensitivity and quantum efficiency, noise in detection.

Multichannel Transmission Technique-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components

MODULE -IV	FIBER SPLICING AND CONNECTORS	Classes: 08

Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints. Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers. Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss

MODULE -V	OPTICAL NETWORKS AND DISPERSION COMPENSATION	Classes: 10

Optical networks: SONET/SDH, ATM, IP, wavelength routed networks, Transmission Distance, soliton communication system, fiber soliton, soliton based communication system design, high capacity and WDM soliton, Measurement of Attenuation and Dispersion, Eye Pattern.

Text Books:

1. Gerd Keiser, "Optical Fiber Communications" TMH, 4th Edition, 2008.
2. Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Ediition, 2004
3. Emmanuel C, Ifeacher, Barrie. W. Jervis, DSP-A Practical Approach, Pearson Education,
4. 2nd Edition, 2002

Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
2. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.
3. Karminvov, T. Li "Optical Fibre Telecommunications", Vol A & B, Academic Press, 2002.
4. Introduction to Fiber Optics by Donald J.Sterling Jr. – Cengage learning, 2004.
5. Optical Communication Systems – John Gowar, 2nd Edition, PHI,2001.

Web References:

1.http://www.ocw.nthu.edu.tw
2.http://www.uotechnology.edu.iq

E-Text Books:

1.https://www.jntubook.com/optical-communications-textbook
2.http://tradownload.com/results/neamen-optical-communications-.html
3.http://www.everythingvtu.wordpress.com

WIRELESS COMMUNICATIONS AND NETWORKS

PE - III: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB42	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 fundamental treatment of wireless communications and the Cellular Concept-System Design, Fundamental concepts like frequency reuse, Radio Wave Propagation Basic Propagation Mechanisms and Diffraction Models.
II. Equip the students with various kinds of wireless networks and its operation
III. Understand the concept of frequency reuse and be able to apply it in the design of mobile cellular system
IV. Understand the various modulation schemes and multiple access techniques that are used in wireless communications.
V. Remember the analytical perspective on the design and analysis of the traditional and emerging wireless networks and discuss the nature of and solution methods to the fundamental problems in wireless networking.

MODULE -I	THE CELLULAR CONCEPT SYSTEM DESIGN FUNDAMENTALS	Classes: 10

Introduction, frequency reuse, channel assignment strategies, handoff strategies; Prioritizing handoffs, practical handoff considerations, interference and system capacity; Co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference, trunking
and grade of service, improving coverage & capacity in cellular systems; Cell splitting, sectoring.

MODULE -II	MOBILE RADIO PROPAGATION	Classes: 09

Large-Scale Path Loss: Introduction to radio wave propagation, free space propagation model, relating power to electric field, the three basic propagation mechanisms; Reflection: Reflection from dielectrics, Brewster angle, reflection from prefect conductors, Longley-Ryce model, Okumura Model, Hata Model, PCS extension to hata Model, indoor propagation models-partition losses (Same Floor), partition losses between floors, log- distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings, ray tracing and site specific modeling.

MODULE -III	CELLULAR SYSTEM DESIGN FUNDAMENTALS	Classes: 08

Small-scale fading and multipath: Small scale multipath propagation; Factors influencing small scale fading, Doppler shift, impulse response model of a multipath channel; Relationship between bandwidth and received power, small; Scale multipath measurements.

Fading effects due to multipath time delay spread, flat fading, frequency selective fading, fading effects due to Doppler Spread-Fast fading, slow fading, statistical models for multipath fading channels; Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model.

MODULE -IV	EQUALIZATION AND DIVERSITY	Classes: 08
Introduction, fundamentals of equalization, training a generic adaptive equalizer, equalizers in a communication receiver, linear equalizers, non-linear equalization; Decision feedback equalization (DFE), maximum likelihood sequence estimation (MLSE) equalizer, algorithms for adaptive equalization; Zero forcing algorithm, least mean square algorithm, recursive least squares algorithm.		
MODULE -V	**WIRELESS NETWORKS**	**Classes: 10**
Introduction to wireless networks, advantages and disadvantages of wireless local area networks, WLAN topologies, WLAN standard IEEE 802.11, IEEE 802.11 medium access control, comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, wireless PANs, Hipper LAN, WLL.		

Text Books:

1. Theodore .S. Rapport, "Wireless Communications", Pearson Education, 2nd Edition, 2010.
2. Upen Dalal, "Wireless communication", Oxford University press, 2010.
3. Kaveh Pahlvan, Prashant Krishnamurthy, "Principle of wireless networks", A United Approach‖, Pearson Education, 2004.
4. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

Reference Books:

1. P.Nicopolitidis, M.S. Obaidat, G.I.Papadimitria, A.S. Pomportsis,"Wireless Networks" John Wiley & sons, 1st Edition, 2003.
2. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian Reprint).
3. Mark Ciampa Jorge Olenewa, "wireless communication and Networking", IE, 2009.
4. X.Wang, H.V.Poor,Wireless communication system, Pearson Education, 2004.
5. Jochen Schiller,"Mobile Communication", Pearson Education, 2nd Edition, 2003.

Web References:

1. http://keshi.ubiwna.org/2017IoTCOMM/Wireless_Communications_&_Networking_Stallings_2nd.
2. https://www.google.com/wirelesscommunicationnetwork.
3. https://www3.nd.edu/~mhaenggi/ee598q/books/stallings_jagadish.pdf

E-Text Books:

1. https://www.oreilly.com/library/view/wireless-communications-principles/0130422320/
2. https://groups.google.com/forum/#!topic/kluecm2010-2014/7Q5gRhqh51g.

ADVANCED PROGRAMMABLE LOGIC DEVICE ARCHITECTURES

PE - IV: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB43	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. Classify different ASICs.
II. Analyze the structure of PLDs
III. Understand the architectures of FPGAs
IV. Understand the operation of memory elements

MODULE-I	INTRODUCTION TO ASICS	Classes:09

ASIC design flow, types of ASICs, full custom ASIC's, standard cell based ASIC's, Gate array based ASIC's, programmable logic devices, introduction to programmable logic, fixed versus programmable logic, programmable logic devices, types of programmable logic devices, PROMs, PLA, PAL, CPLD & FPGA

MODULE-II	MEMORY AND PROGRAMMABLE LOGIC	Classes:09

Random Access Memory, Programmable Logic, PLD'S, ROM, Programmable Logic Array, Programmable Array Logic

MODULE-III	DIGITAL DESIGN WITH SM CHARTS	Classes: 10

State Machine charts, Derivation of SM Charts, Realization of SM Charts.

Implementation of Dice Game, Alternative realization for SM charts using microprogramming, Linked State Machines

MODULE-IV	DESIGN WITH FIELD PROGRAMMABLE GATE ARRAYS	Classes: 09

Field Programmable Gate Arrays – Logic blocks, routing architecture, Design flow. Xilinx 3000 Series, 4000series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment.

MODULE-V	MEMORIES	Classes: 08

ROMs: Internal structure, 2D-decoding commercial types, timing and applications. Static RAM: Internal structure, SRAM timing, standard SRAMS, synchronous SRAMS. Dynamic RAM: Internal structure, timing, synchronous DRAMs.

Text Books:

1. Stephen. Trimberger , —Field Programmable Gate Array Technology —, Kluwer Academic Publications, 1 st Edition, 1994 2.
2. Charles H Roth, Jr. "Digital System Design using VHDL", Cengage Learning, 2006.
3. John F.Wakerly, "Digital Design Principles & Practices", 3rd Edition, 2005, PHI/ Pearson Education Asia,

Reference Books:

1. Parag.K.Lala, "Digital System Design using Programmable Logic Devices", BS Publications, 1st Edition,2003.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic Design with Verilog Design", TMH, 2nd Edition, 2010.
3. Charles.H.Roth,Jr., Lizy Kurian John "Digital System Design using VHDL" , Thomson, 2nd Edition, 2008.
4. Zainalabdien Navabi, "Verilog Digital System Design", TMH, 2nd Edition, 2008.
5. Cypress Semiconductors Data Book (Download from website).
6. John V.Oldfield, Richard C Dore, ―Field Programmable Gate Arrays‖, Wiley Publications, 1st Edition, 1995.

Web References:

1. http://www.igniteengineers.com
2. http://www.eecg.toronto.edu
3. http://www.ece.uic.edu
4. http://www.iare.ac.in

E-Text Books:

1. https://books.google.co.in
2. http://www.www.jntubook.com
3. http://www.allaboutcircuits.com
4. http://www.archive.org

DIGITAL DESIGN THROUGH VERILOG

PE - IV: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB44	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 the constructs in Verilog HDL.
II. Design gate level models in Verilog HDL.
III. Design behavioral level models in Verilog HDL.
IV. Analyze sequential logic and synthesize

MODULE-I	INTRODUCTION TO VERILOG HDL	Classes:09

History of HDL, Verilog HDL, Language Elements : Comments, Identifiers, Keywords, Value Set, Data Types, Memory Element, Constant, Parameter, Operators
Dataflow Modeling: Continuous Assignment, Implicit Continuous Assignment, Delays, Design examples using data flow modeling

MODULE-II	GATE-LEVEL MODELING	Classes:09

Multiple-Input Gates, Gate Delays, Design Examples, User-Defined Primitives: Combinational User-Defined Primitives, Sequential User-Defined Primitives

MODULE-III	BEHAVIORAL MODELING	Classes: 10

Procedural Constructs, Procedural Assignments, Conditional Statements, Case Statement Design examples using behavioral modeling

Loop Statements: For Loop, While Loop, Repeat Loop, Forever Loop, Block Statements4 Procedural Continuous Assignment, Design examples using behavioral modeling

MODULE-IV	SWITCH LEVEL MODELLING	Classes: 09

Basic Transistor Switches, CMOS Switch, Bi – directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets.

MODULE-V	SEQUENTIAL LOGIC	Classes: 08

Analysis of Synchronous Sequential Machines, Synthesis of Synchronous Sequential Machines, Analysis of Asynchronous Sequential Machines, Synthesis of Asynchronous Sequential Machines

Text Books:

1. Joseph Cavanagh, “Verilog HDL: Digital Design and Modeling”, CRC Press, 1st Edition, 2007.
2. Michael D. Ciletti, “Advanced Digital Design with Verilog HDL”, PHI, 2005.
3. Joseph Cavanagh, “Digital Design and Verilog HDL Fundamentals”, CRC Press, 1st Edition, 2008

Reference Books:

1. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic design with Verilog Design", TMH, 2nd Edition, 2010.
2. Sunggu Lee "Advanced Digital Logic Design using Verilog, State Machine & Synthesis for FPGA", Cengage Learning, 2012.
3. Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition, 2009.
4. T. R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL", Wiley, 2009.
5. Zainalabdien Navabi, "Verilog Digital System Design", TMH, 2nd Edition, 2009.

Web References:

1. https://www.crcpress.com/Verilog-HDL-Digital-Design-and-Modeling/Cavanagh/p/book/9781420051544
2. https://www.uotechnology.edu.iq
3. https://www.iare.ac.in

E-Text Books:

1. https://www.www.jntubook.com
2. https://www.allaboutcircuits.com
3. https://www.archive.org

SCRIPTING LANGUAGES FOR VLSI DESIGN

PE - IV: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB45	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. Usage of scripting lanuages in IC design.
II. Differences between scripting and non scripting languages.
III. Creation of programs in LINUX environment.
IV. Learn the concept of TCL phenomena and advanced TCL9 concepts.
V. Understanding basic concepts of Javascripts and Python.

MODULE -I	INTRODUCTION TO LINUX	Classes: 10

Linux utilities: A brief history of LINUX, architecture and features of LINUX, introduction to vi editor. General purpose utilities, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands; Text processing and backup utilities: Text processing utilities and backup utilities; SED: Scripts, operation, addresses, commands; AWK: Execution, fields and records, scripts, operation, patterns, actions, associative arrays, string and mathematical functions, system commands in awk, applications.

MODULE -II	TCL9	Classes: 09

The TCL phenomena, Philosophy, Structure, Syntax, Parser, Variables and data in TCL, Control flow, Data structures, Simple input/output, Procedures, Working with Strings, Patterns, Files and Pipes, Example code.

MODULE -III	ADVANCED TCL9	Classes: 08

The eval, source, exec and up-level commands, Libraries and packages, Namespaces, trapping errors, Event-driven programs.

Making applications 'Internet-aware', 'Nuts-and-bolts' internet programming, Security issues, running un trusted code, The C interface.

MODULE -IV	TK AND JAVA SCRIPTS	Classes: 08

Visual tool kits, Fundamental concepts of TK, TK by example, Events and bindings, Geometry managers, PERL-TK. JavaScript – Object models, Design Philosophy, Versions of JavaScript, The Java Script core language

MODULE -V	INTRODUCTION TO PYTHON	Classes: 10

Basic concepts of Python. Object Oriented Programming Concepts (Qualitative Concepts Only): Objects, Classes, Encapsulation, Data Hierarchy.
Logical design using Python: Installing Python, Python data types and data structures, control flow, functions, modules, packages, file handling.

Text Books:

1. Guido Van Rossum, Fred L. Drake Jr., “Python Tutorial” by editor , Release 2.6.4
2. Brent Welch, “Practical Programming in Tcl and Tk”, Updated for Tcl 7.4 and Tk4.0.

Reference Books:

1. Brent Welch,"Practical Programming in Tcl and Tk", 4th Edition, 2003.
2. David Barron, "The World of Scripting Languages", Wiley Publications, 2000.
3. Guido van Rossum, and Fred L. Drake ", Python Tutorial, Jr., editor, Release 2.6.4.
4. Neil Mathew, Richard Stones, Beginning Linux Programming, Wrox, Wiley India, 4th Edition, 2011.

Web References:

1. https://doc.uments.com/s-**vlsi**-technology.pdf
2. https://www.quora.com/Why-are-Perl-and-TCL-**scripting-languages**-used-in-the-**VLSI**...
3. https://www.jntubook.com
4. https://**www.reddit.com**/r/Python/comments/37xs5j/**python_in_vlsi_scripting**

E-Text Books :

1. http://vic.gedris.org/Manual-ShellIntro/1.2/ShellIntro.pdf
2. http://www.freeos.com/guides/lsst/ https://technicalpublications.org/.../books/
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming/

DESIGN FOR TESTABILITY

PE - IV: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB46	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:

1. Apply the concepts in testing which can help them design a better yield in IC design.
2. Tackle the problems associated with testing of semiconductor circuits at earlier design
3. Analyse the various test generation methods for static & dynamic CMOS circuits.
4. Identify the design for testability methods for combinational & sequential CMOS circuits
5. Recognize the BIST techniques for improving testability.

MODULE -I	INTRODUCTION TO TESTABILITY	Classes: 09

Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

MODULE -II	LOGIC AND FAULT SIMULATION	Classes: 09

Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation, ATPG

MODULE -III	TESTABILITY MEASURES	Classes: 10

SCOAP Controllability and Observability, High Level Testability Measures.

Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

MODULE -IV	BUILT -IN -SELF-TEST	Classes: 08

The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-PerScan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

MODULE -V	BOUNDARY SCAN STANDARD	Classes: 09

Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description .

Text Books:

1. M.L. Bushnell, V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits" Kluwer Academic Publishers
2. Miron Abramovici, Melvin Breuer ,Arthur Friedman "Digital Systems Testing and Testable Design" Publisher: Jaico Publishing House
3. Wayne Needham "Designer's Guide to Testable Asic Devices "Publisher: Kluwer Academic Publishers Group
4. N. Jha & S.D. Gupta, "Testing of Digital Systems", Cambridge, 2003
5. W. W. Wen, "VLSI Test Principles and Architectures Design for Testability", Morgan Kaufmann Publishers. 2006

Reference Books:

1. M. Abramovici, M. A. Breuer and A.D Friedman, "Digital Systems and Testable Design", Jaico Publishing House
2. P.K. Lala, "Digital Circuits Testing and Testability", Academic Press
3. Michael L. Bushnell &Vishwani D. Agrawal," Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwar Academic Publishers. 2000.

Web References:

1. http://www.iare.ac.in
2. https://www.researchgate.net/publication/236154999_Test_and_Testability
3. https://www.cambridge.org/core/books/testing-of-digital-systems/combinational-logic-and-fault-simulation
4. https://www.springer.com/gp/book/9781402070501
5. https://www.researchgate.net/publication/257947095_Implementation_of_Algorithm_For_Testability_Measures_Using_MATLAB

E-Text Books :

1. https://www.barnesandnoble.com/w/designers-guide-to-built-in-self-test-charles-e-stroud/1100325085
2. https://dl.acm.org/citation.cfm?id=2588270
3. https://link.springer.com/book/10.1007/b117406

ADVANCED DIGITAL SIGNAL PROCESSING

PE - V: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB47	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. Auto correlation and power spectrum estimation techniques.
II. Linear prediction Wiener filters, LMS adaptive filters, and applications.
III. Determine coefficients for perfect reproduction filter banks.
IV. Apply the above tools to real world problems including spectral analysis, filter design

MODULE -I	POWER SPECTRAL ESTIMATIONS	Classes: 10

Estimation of spectra from finite duration observation of signals, the Periodogram; Use DFT in power Spectral Estimation; Non-Parametric Methods: Bartlett, Welch, Blackman and Tukey methods; Performance characteristics of nonparametric power spectrum estimators; Computational requirements of nonparametric power spectrum estimates.

MODULE -II	PARAMETRIC METHODS OF POWER SPECTRAL ESTIMATION	Classes: 09

Parametric methods for power spectrum estimation; Relationship between Auto-correlation and model parameters; AR (Auto-Regressive) process and linear prediction, Yule-Walker, Burg and unconstructrained least squares methods; Sequential estimation; Moving average(MA) and ARMA models; Minimum variance method, Piscaranko‘s harmonic decomposition methods; MUSIC method.

MODULE -III	LINEAR PREDICTION AND OPTIMUM LINEAR FILTERS	Classes: 08

Innovations representation of a stationary random process; Forward and backward linear prediction.

Solution of the normal equations; Properties of linear prediction-Error Filter; AR lattice and ARMA lattice-ladder Filters.

MODULE -IV	DSP ALGORITHMS	Classes: 08

Fast DFT algorithms based on index mapping; Sliding discrete fourier transform; DFT computation over a narrow frequency band; Split Radix FFT; Linear filtering approach to computation of DFT using chirp Z-transform.

MODULE -V	APPLICATIONS OF DIGITAL SIGNAL PROCESSING	Classes: 10

Digital cellular mobile telephony; Adaptive telephone echo cancellation; High quality A/D conversion for digital audio; Efficient D/A conversion in compact wifi systems; Acquisition of high quality data; Multirate narrow band digital filtering; High resolution narrowband spectral analysis.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, Principles, Algorithms and Applications”, Prentice Hall, 4th Edition, 2007.
2. Sanjit K Mitra, “Digital signal processing, A computer base approach”, McGraw-Hill Higher Education, 4th Edition, 2011.

3. Emmanuel C, Ifeacher, Barrie. W. Jervis, "DSP-A Practical Approach", Pearson Education, 2nd Edition, 2002.
4. A.V. Oppenheim, R.W. Schaffer, "Discrete Time Signal Processing", PHI, 2nd Edition, 2006.

Reference Books:

1. Li tan Elsevier, "Digital signal processing: fundamentals and applications" Elsevier Science &. Technology Books, 2nd Edition, 2008.
2. Robert J.schilling, Sandra.L.harris, "Fundamentals of Digital Signal Processing using Matlab", Thomson Engineering, 2nd Edition, 2005.
3. Salivahanan, Vallavaraj, Gnanapriya, "Digital Signal Processing", McGraw-Hill Higher Education, 2nd Edition, 2009.

Web References:

1. https://en.wikipedia.org/wiki/Digital_signal_processing
2. http://www.algorithmix.com/
3. http://www.ti.com/lsds/ti/processors/dsp/overview.page
4. http://www.iare.ac.in

E-Text Books:

1. http://www.springer.com/in/book/9783642155901
2. https://www-elec.inaoep.mx/~jmram/Digital_Signal_Processing__LI_TAN.pdf
3. http://www.elcom-hu.com/ Electrical/ Digital% 20Singnal% 20Proccessing/ 4th/4th% 20Digital% 20Signal%20Processing%20-%20Proakis%20and%20Manolakis.pdf

INFORMATION THEORY AND CODING

PE - V: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB48	**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. Acquire knowledge about information and entropy.
II. Acquire knowledge about Hamming weight, minimum distance decoding and different types of codes. They also learn about syndrome calculation and design of an encoder and decoder.
III. Gain knowledge about convolution coding. They also learn about sequential search and Viterbi algorithm.
IV. Gain knowledge about text compression techniques. They also learn about speech and audio coding.
V. Know about, image compression, graphics interchange format, JPEG and MPEG standards.

MODULE-I	**INFORMATION THEORY**	**Classes: 09**

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon- Fano coding, Huffman coding, Extended Huffman coding – Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

MODULE-II	**ERROR CONTROL CODING: BLOCK CODES**	**Classes: 09**

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding, Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes – Syndrome calculation, Encoder and decoder - CRC

MODULE -III	**ERROR CONTROL CODING: CONVOLUTIONAL CODES**	**Classes: 09**

Convolutional codes – code tree, trellis, state diagram - Encoding

Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

MODULE -IV	**SOURCE CODING: TEXT, AUDIO AND SPEECH**	**Classes: 09**

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

MODULE -V	**SOURCE CODING: IMAGE AND VIDEO**	**Classes: 09**

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

Text Books:

1. R Bose, "Information Theory, Coding and Cryptography", TMH 2007.
2. Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002.

Reference Books:

1. K Sayood, “Introduction to Data Compression” 3/e, Elsevier 2006
2. S Gravano, “Introduction to Error Control Codes”, Oxford University Press 2007
3. Amitabha Bhattacharya, “Digital Communication”, TMH 2006

Web References:

1. https://www.youtube.com/watch?v=Uk9zFrEGguM
2. https://lecturenotes.in/subject/540/information-theory-coding-itc

E-Text Books:

1. http://web.stanford.edu/class/ee376a/files/scribes/lecture_notes.pdf
2. http://www.everythingvtu.wordpress.com

ERROR CORRECTION CODES

PE - V: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB49	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. Acquire the knowledge in measurement of information and errors.
II. Understand the importance of various codes for communication systems.
III. Design encoder and decoder of various codes.
IV. Know the applicability of source and channel codes.

MODULE-I	**CODING FOR RELIABLE DIGITAL TRANSMISSION AND STORAGE**	**Classes: 10**

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Source Codes: Shannon-fano coding, Huffman coding.

MODULE -II	**LINEAR BLOCK CODES**	**Classes: 09**

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system.

MODULE -III	**CYCLIC CODES**	**Classes: 09**

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding
for cyclic codes.

MODULE -IV	**CONVOLUTION CODES**	**Classes: 09**

Encoding of Convolution Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolution codes in ARQ system.

MODULE -V	**BCH CODES**	**Classes: 08**

Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Text Books:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J. Costello, Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing, 1989.

Reference Books:

1. John G. Proakis, “Digital Communications, TMH, 5th Edition, 2008.
2. Todd K. Moon, "Error Correction Coding – Mathematical Methods and Algorithms”, Wiley India, 2006.
3. Ranjan Bose, “Information Theory, Coding and Cryptography”, TMH, 2nd Edition, 2009.

Web References:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

E-Text Books:

1. https://www.jntubook.com/dgital-communications-textbook
2. http://tradownload.com/results/neamen-digital-communications-.html
3. http://www.everythingvtu.wordpress.com

RADAR SYSTEMS AND PROCESSING

PE - V: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB50	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 principle of radar.
II. Analyze and compare different types of radars.
III. Compare the performance of different types of tracking radars in noise environment.
IV. Classify different components of radar receiver and analyze their utilization.

MODULE -I	INTRODUCTION	Classes: 10

Introduction to Radar - Radar frequency bands and Applications; Radar Range equation; Pulse Radar: Block diagram and Operation; Maximum unambiguous range; Radar wave forms; Prediction of Target range; Minimum detectable signal; Receiver noise, Receiver Bandwidth, SNR; Probability of False alarm, Probability of Target Detection, Integration of echo pulses- SNR improvement; Radar Cross Section (RCS) of targets; RCS fluctuation models, transmitter power, PRF and Range ambiguities; system losses

MODULE -II	CW AND FREQUENCY MODULATED RADAR	Classes: 09

Moving Targets and Doppler Frequency; CW Radar: Introduction, Block Diagram, Isolation between transmitter and receiver, Non-zero IF receiver, Receiver bandwidth requirements, Applications; Frequency Modulated CW radar: Range and Doppler measurement, Mathematical Analysis, Block Diagram and characteristics, FM-CW altimeter, multiple frequency CW radar, Ambiguity Diagram & its application, Concept of pulse compression, Pulse Compression Radars: FM & Phase Coded Radars.

MODULE -III	MOVING TARGET INDICATION AND PULSE DOPPLER RADAR	Classes: 08

Moving target indication (MTI) on A scope, butterfly effect, MTI using delay line canceller (DLC), Doppler measurement using Pulse radar, MTI radar (with power amplifier transmitter), MTI radar (with power oscillator transmitter), filter characteristics of DLC, blind speeds, double DLCs, Blind speeds, Staggered PRFs,

Range gated doppler filters, MTI radar parameters, moving target detector; MTI radar performance: Parameter Definitions, limitations to MTI performance, non-coherent MTI. Pulse doppler radar; MTI radar versus Pulse Doppler radar

MODULE -IV	TRACKING RADAR AND RADAR DETECTION IN NOISE	Classes: 08

Search and Tracking radars, track while scan (TWS) radar, Angle/Bearing Tracking: Sequential Lobing, Conical scan, Monopulse methods; Monopulse Tracking: Amplitude comparison (1D, 2D), Phase comparison, Bearing errors (without mathematical treatment), Glint Noise and Frequency Agility, Tracking in range, Acquisition, Comparison of trackers, Tracking with Surveillance Radar. Matched Filter (MF) receiver, MF response characteristics; Correlation Receiver, Efficiency of non matched filters, Matched filter with non-white noise, Automatic Detection of radar signals: Tapped Delay Line (TDL) detection, CFAR receiver, Radar Clutter: Land and Sea clutter (without mathematical treatment)

MODULE -V	RADAR TRANSMITTERS & RECEIVERS	Classes: 10

Advantages and Disadvantages of Magnetron Oscillator, Klystron Amplifier, Traveling wave tube (TWT) Amplifier, Hybrid Linear-Beam Amplifier and Crossed-Field Amplifiers, Solid State Sources & Amplifiers, Methods for employing solid-state transmitters. Receiver Noise Figure (NF) - Noise Temperature; Measurement of NF, NF of Mixers, Basics of Radar Displays and Duplexers; Phased array antennas: Current and Radiation pattern, Beam steering and effects, Basics of Antenna feeds and Phase shifters.

Text Books:

1. Merrill I Skolnik , "Introduction to Radar Systems", TMH Special Indian Edition, 2nd Edition, 2007.

Reference Books:

1. Merrill I Skolnik , "Radar Handbook", McGraw-Hill Professional Publishing, 3nd Edition, 2008.

Web References:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq
4. http://www.iare.ac.in

E-Text Books:

1. http://www.bookboon.com/en/concepts-in-electric-circuits-ebook
2. http://www.www.jntubook.com
3. http://www.allaboutcircuits.com
4. http://www.archive.org

EMBEDDED C

PE - VI: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB51	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 embedded C and use it for programming embedded system.
II. Apply techniques for data transfer between I/O ports and memory.
III. Apply object oriented programming for designing embedded system.
IV. Analyze and understand the usage of timers to generate time delays.

MODULE -I	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 10

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption ,conclusions.

MODULE -II	SWITCHES	Classes: 09

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: Counting goats, conclusions.

MODULE -III	ADDING STRUCTURE TO THE CODE	Classes: 08

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H).

Example: Restructuring the "Hello Embedded World" example, Example: Restructuring the goat-counting example, further examples and conclusions.

MODULE -IV	MEETING REAL-TIME CONSTRAINTS	Classes: 08

oduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms ay, example: Creating a portable hardware delay, Why not use Timer 2, The need for timeout chanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

MODULE -V	CASE STUDY: INTRUDER ALARM SYSTEM	Classes: 10

Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.

Text Books:

Michael J. Pont, “Embedded C”, Pearson Education, 2nd Edition, 2008.

Reference Books:

Nigel Gardner, “The Microchip PIC in CCS C”, Ccs Inc, 2nd Revision Edition, 2002.

Web References:

1. http://www.keil.com/forum/5973/
2. http://nptel.ac.in/courses/Webcourse,contents/IIT%20Kharagpur/Embedded%20systems/New_index1.html
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5

E-Text Books:

1. http://teachers.teicm.gr/kalomiros/Mtptx/ebooks/eBook%20%20PIC%20Programming%20with%20C.pdf
2. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf
3. http://dsp-book.narod.ru/CPES.pdf
4. http://staff.ustc.edu.cn/~shizhu/WinCE/winCE6%20Fundamentals.pdf
5. http://read.pudn.com/downloads167/ebook/769402/Wrox.Professional.Microsoft.Windows.Embedded.CE.6.0.Nov.2008.eBook-DDU.pdf

REAL TIME SYSTEMS

PE - VI: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB52	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 principles behind the structure and operation of real-time operating systems.
II. Design the Real time operating system by using the concept of Timers, I/O subsystem and Memory Management.
III. Understand the concept of Communication and Synchronization among the Tasks.
IV. Design Real Time Operating System applications in different domains.

MODULE -I	REAL TIME OPERATING SYSTEM PRINCIPLES	Classes: 10

History of operating systems, defining RTOS, classification of real-time systems; The scheduler, objects, services and key characteristics of RTOS; Tasks: Defining a task, task states and scheduling, typical task operations, typical task structure.

MODULE -II	REAL TIME KERNEL OBJECTS	Classes: 09

Semaphores: Defining semaphores, typical semaphore operations, typical semaphore use; Message Queues: Defining message queues, message queue states, message queue content, message queue storage, typical message queue operations; Typical message queue use other kernel objects: Pipes, event registers, signals, condition variables.

MODULE -III	RTOS DESIGN CONSIDERATIONS	Classes: 08

Timer and Timer Services: Real-time clocks and system clocks, programmable interval timers, timer interrupt service routines, model for implementing the soft-timer handling facility, timing wheels.

I/O sub system: Basic I/O concepts, the I/O sub system; Memory management: Dynamic memory allocation, fixed-size memory management, blocking vs. Non-blocking memory functions, hardware memory management units.

MODULE -IV	TASKS COMMUNICATION AND SYNCHRONIZATION	Classes: 08

Synchronization and Communication: Synchronization, communication, resource synchronization methods, common practical design patterns; common design problems: Resource classification, deadlocks, priority inversion.

MODULE -V	RTOS APPLICATION DOMAINS	Classes: 10

Comparison and study of RTOS: Vxworks and µCOS, Case studies: RTOS for image processing, embedded RTOS for voice over IP, RTOS for fault tolerant applications, RTOS for control systems.

Text Books:

1. Andrew Troelsen ,"Pro C# and the .NET 4 Platform", Springer (India) Private Limited, New Delhi, India, 5th Edition, 2010.

2. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2nd Edition, 2002.
3. S. Thamarai Selvi, R. Murugesan , "A Textbook on C#", Pearson Education, 1st Edition, 2003.

Reference Books:

1. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI, 1st Edition, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Kindle Publishers, 2nd Edition, 2005.
3. Tanenbaum, "Modern Operating Systems", Pearson Edition, 3rd Edition, 2007.

Web References:

1. http:// www.jntumaterials.co.in
2. http://www.inf.ed.ac.uk/teaching/courses/es/PDFs/RTOS.pdf
3. http://nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf
4. http://www.iare.ac.in

E-Text Books:

1. http://www.bookzz.org/
2. http://www.www.jntubook.com
3. http:// www.4shared.com/web/preview/pdf/BhrrT3m0
4. http://www.archive.org

EMBEDDED NETWORKING

PE - VI: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB53	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 embedded communication protocols to implement in embedded networking.
II. Design of CAN network based systems.
III. Understand the fundamental usage of UDP, TCP and FTP in design of embedded networks.

MODULE -I	**EMBEDDED COMMUNICATION PROTOCOLS**	**Classes: 10**

Embedded Networking: Introduction, serial/parallel communication, serial communication protocols, RS232 standard, RS485, synchronous serial protocols, serial peripheral interface, inter integrated circuits I ^{2}C– pc parallel port programming.

MODULE -II	**USB AND CAN BUS**	**Classes: 09**

USB bus, introduction, speed identification on the bus, USB states, USB bus communication: Packets ,data flow types, enumeration, descriptors, PIC 18 microcontroller USB interface, C programs; CAN bus: Introduction, frames, bit stuffing, types of errors, nominal bit timing, PIC microcontroller CAN interface, simple application with CAN

MODULE -III	**ETHERNET BASICS**	**Classes: 08**

Elements of a network, inside Ethernet, building a network: Hardware options, cables, connections and network speed.

Design choices: Selecting components, Ethernet controllers, using the internet in local and communications, inside the Internet protocol.

MODULE -IV	**EMBEDDED ETHERNET**	**Classes: 08**

changing messages using UDP and TCP: Serving web pages with dynamic data, serving web pages that respond to user Input, email for embedded systems, using FTP, keeping devices and network secure

MODULE -V	**WIRELESS EMBEDDED NETWORKING**	**Classes: 10**

Wireless sensor networks: Introduction, applications, network topology, localization, time synchronization, energy efficient MAC protocols, SMAC, energy efficient and robust routing, data centric routing.

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded Systems Design: A Unified Hardware/Software Introduction", John & Wiley Publications, 1st Edition, 2002.
2. Jan Axelson, "Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port", Penram Publications, 1st Edition, 1996.

Reference Books:

1. Dogan Ibrahim, "Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series", Elsevier, 1st Edition, 2008.
2. Jan Axelson, "Embedded Ethernet and Internet Complete", Penram publications, 2nd Edition, 2003.
3. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge press, 1st Edition, 2005.

Web References:

1. http://nptel.ac.in/courses/108102045/26
2. http://freevideolectures.com/Course/2341/Embedded-Systems/27
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm

E-Text Books:

1. www.nptel.ac.in/courses/108105057/Pdf/Lesson-26.pdf
2. www.nptel.ac.in/courses/108105057/Pdf/Lesson-3.pdf
3. emanager.srmuniv.ac.in/elibrary/temp/CAN_and_CANopen.pdf
4. https://www.crcpress.com/Embedded-and-Networking-Systems-Design-Software-andImplementation/Khan-Iniewski/p/book/9781466590656

ADVANCED RISC MACHINE ARCHITECTURES

PE - VI: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB54	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 Impart knowledge about ARM Architecture and its instruction set.
II Learn about Instructions, Addressing modes and conditional instructions.
III Understand about Assembly programming of ARM.
IV Explain the system development using ARM target boards.

MODULE-I	ARM ARCHITECTURE	Classes: 08

ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families.

MODULE -II	ARM PROGRAMMING MODEL – I	Classes: 09

Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions

MODULE -III	ARM PROGRAMMING MODEL – II	Classes: 09

Thumb Instruction Set: Register Usage, Other Branch Instructions Data Processing Instructions.

Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

MODULE -IV	ARM PROGRAMMING USING HIGH LEVEL LANGUAGE	Classes: 09

Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.

MODULE -V	MEMORY MANAGEMENT	Classes: 10

The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Coprocessor 15 and Caches, Flushing and Cleaning Cache Memory**.** Moving from an MPU to an MMU, Page Tables, The Translation Lookaside Buffer, The Caches and Write Buffer, Access Permissions, Context Switch.

Text Books:

1. ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier.
2. ARM System-on-chip Architecture by Steve Furber, Pearson Education,ISBN978-81-317-0840-8, 2E,2012.

Reference Books:

1. Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning
2. The AVR Microcontroller and Embedded Systems: Using Assembly and C by M.A. Mazidi, Second Edition, Pearson Education Limited,2011
3. ARM Assembly Language – William Hohl, CRC Press, ISBN:978-81-89643-04-1.

Web References:
https://developer.arm.com/ https://www.arm.com/ https://electronicsforu.com/resources/learn-electronics/introduction-arm-processor https://www.scribd.com/document/90853471/Advanced-RISC-Machine-ARM-Notes-Bhurchandi
E-Text Book:
https://www.arm.com/resources/education/textbooks https://www.quora.com/Which-book-is-most-suitable-to-learn-ARM-Processor www.keil.com/books/armbooks.asp

COMPUTER ARCHITECTURE

OE – I

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 - I

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

MOOC Course:

1. https://www.coursera.org/learn/algorithm-design-analysis
2. http://www.online.stanford.edu/course/algorithms-design-and-analysis-part-1
3. https://www.onlinecourses.nptel.ac.in/noc16_cs04/preview

RELATIONAL DATABASE MANAGEMENT SYSTEMS

OE – I

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 - I

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:

VI. Understand the basic data structures and techniques of algorithm analysis.
VII. Understand dictionaries, hashing mechanisms and skip lists for faster data retrieval.
VIII. Comprehension of heaps, priority queues and its operations.
IX. Understand balanced trees and their operations.
X. Illustration of tries and pattern matching algorithms.

UNIT - 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.

UNIT - 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.

UNIT - 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.

UNIT - VI	**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.

UNIT - 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 - I

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 - I

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

ENERGY FROM WASTE

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB52	Elective	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I. Understand the principles associated with effective energy management and to apply these principles in the day to day life.
II. Develop insight into the collection, transfer and transport of municipal solid waste.
III. Explain the design and operation of a municipal solid waste landfill.
IV. Evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities and device key processes involved in recovering energy from wastes.

MODULE - I	INTRODUCTION TO WASTE AND WASTE PROCESSING	Classes: 08

Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration .

MODULE - II	WASTE TREATMENT AND DISPOSAL	Classes: 10

Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration; Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leach ate and gases, environmental monitoring system for land fill gases.

MODULE - III	BIO-CHEMICAL CONVERSION	Classes: 09

Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion.

MODULE - IV	THERMO-CHEMICAL CONVERSION	Classes: 10

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion.

MODULE - V	E-WASTE MANAGEMENT	Classes: 08

E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; Management of e-waste: E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

Text Books:

1. Nicholas P Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", An Imprint of Elsevier, New Delhi, 2003.
2. P Aarne Vesilind, William A Worrell and Debra R Reinhart, "Solid Waste Engineering", 2nd Edition 2002.
3. M Dutta , B P Parida, B K Guha and T R Surkrishnan, "Industrial Solid Waste Management and Land filling practice", Reprint Edition New Delhi, 1999.
4. Rajya Sabha Secretariat, "E-waste in India: Research unit", Reprint Edition, June, 2011.

Reference Books:

1. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
2. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
3. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997.

Web References:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. & Engg.-2013 (Publisher: Earthscan 2013
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: Sairudeen Pattazhy

E-Text Books:

1. https://www.unep.org
2. https://www.outledge.com
3. https://www.bookdepository.com
4. https://www.ecoactiv.com

DISASTER MANAGEMENT

OE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB53	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 the major disaster types and develop an understanding of modern disaster management.
II. Recognize and develop awareness of the chronological phases of natural disaster response and refugee relief operations.
III. Understand the key concepts of disaster management related to development and the relationship of different disaster management activities.
IV. Categorize the organizations that are involved in natural disaster assistance and relief system

MODULE - I	ENVIRONMENTAL HAZARDS AND DISASTERS	Classes: 09

Environmental hazards and disasters: meaning of environmental hazards, environmental disasters and environmental stress; concept of environmental hazards, environmental stress and environmental disasters, different approaches and relation with human ecology, landscape approach, ecosystem approach, perception approach, human ecology and its application in geographical researches.

MODULE - II	TYPES OF ENVIRONMENTAL HAZARDS AND DISASTERS	Classes: 09

Types of environmental hazards and disasters: Natural hazards and disasters, man induced hazards and disasters, natural hazards, planetary hazards/ disasters, extra planetary hazards/ disasters, planetary hazards, endogenous hazards, exogenous hazards.

MODULE - III	ENDOGENOUS HAZARDS	Classes: 09

Endogenous hazards, volcanic eruption, earthquakes, landslides, volcanic hazards/ disasters, causes and distribution of volcanoes, hazardous effects of volcanic eruptions, environmental impacts of volcanic eruptions.

Earthquake hazards/ disasters, causes of earthquakes, distribution of earthquakes, hazardous effects of, earthquakes, earthquake hazards in India, human adjustment, perception and mitigation of earthquake.

MODULE - IV	EXOGENOUS HAZARDS	Classes: 09

Exogenous hazards/ disasters, infrequent events, cumulative atmospheric hazards/ disasters; Infrequent events: Cyclones , lightning , hailstorms; Cyclones: Tropical cyclones and local storms, destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation); Cumulative atmospheric hazards/ disasters: Floods, droughts, cold waves, heat waves floods; Causes of floods, flood hazards India, flood control measures (human adjustment, perception and mitigation); Droughts: Impacts of droughts, drought hazards in India, drought control measures, extra planetary hazards/ disasters, man induced hazards /disasters, physical hazards/ disasters, soil erosion, Soil erosion: Mechanics and forms of soil erosion, factors and causes of soil erosion, conservation measures of soil erosion; Chemical hazards/ disasters: Release of toxic chemicals, nuclear explosion, sedimentation processes; Sedimentation processes: Global sedimentation problems regional sedimentation problems, sedimentation and environmental problems, corrective measures of erosion and sedimentation, biological hazards/ disasters, population explosion.

MODULE - V	EMERGING APPROACHES IN DISASTER MANAGEMENT	Classes: 09

Emerging approaches in Disaster Management, Three Stages

1. Pre, disaster stage(preparedness)
2. EmergencyStage
3. Post Disaster stage,Rehabilitation.

Text Books:

1. Pardeep Sahni, "Disaster Mitigation: Experiences and Reflections", PHI Learning Pvt. Ltd., 1st Edition, 2001.
2. J.Glynn,GaryW.HeinKe,"EnvironmentalScienceandEngineering",PrenticeHallPublishers, 2nd Edition, 1996.

Reference Books:

1. R.B.Singh (Ed), "Environmental Geography", 2nd Edition, 1990.
2. R.B. Singh (Ed), "Disaster Management", 2nd Edition, 2006.

Web References:

1. https://www.google.co.in/?gfe_rd=cr&ei=,iAwWLiDIazv8we8_5LADA#q=disater+mangement
2. http://ndma.gov.in/images/policyplan/dmplan/National%20Disaster%20Management%20Plan%20 May%202016.pdf
3. http://www.eib.europa.eu/attachments/pipeline/20080021_eia_en.pdf
4. http://www.ndmindia.nic.in/

E-Text Books:

1. https://www.google.co.in/?gfe_rd=cr&ei=,iAwWLiDIazv8we8_5LADA#q=disaster+management + e+textbooks
2. http://cbse.nic.in/natural%20hazards%20&%20disaster%20management.pdf\
3. http://www.digitalbookindex.org/_search/search010emergencydisastera.asp
4. http://www.icbse.com/books/cbse,ebooks,download

ELEMENTS OF AERONAUTICS

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB55	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 of technical areas of aerospace engineering including mechanics and physics of fluids, structures and materials, instrumentation, control and estimation, humans and automation, propulsion and energy conversion, aeronautical and astronautical systems
II. Understand the methodology and experience of analysis, modeling, and synthesis
III. Understand the evolution of human space exploration with a brief introduction to the missions conducted by various countries
IV. Knowledge in satellite engineering and the systems involved in the operation of satellites.

MODULE-I	HISTORY OF FLIGHT AND SPACE ENVIRONMENT

Balloons and dirigibles, heavier than air aircraft, commercial air transport; Introduction of jet aircraft, helicopters, missiles; Conquest of space, commercial use of space; Different types of flight vehicles, classifications exploring solar system and beyond, a permanent presence of humans in space; Earth‘s atmosphere, the standard atmosphere; The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity; Environmental impact on spacecraft, space debris; Planetary environments

MODULE -II	INTRODUCTION TO AERODYNAMICS

Anatomy of the airplane, helicopter; Understanding engineering models; Aerodynamic forces on a wing, force coefficients; Generating lift, moment coefficients; Aerodynamic forces on aircraft – classification of NACA
airfoils, aspect ratio, wing loading, mach number, centre of pressure and aerodynamic centreaerofoil characteristics-lift, drag curves; Different types of drag..

MODULE -III	FLIGHT VEHIVLE PERFORMANCE AND STABILITY

Performance parameters, performance in steady flight, cruise, climb, range, endurance, accelerated flight symmetric maneuvers, turns, sideslips, takeoff and landing. Flight vehicle Stability, static stability, dynamic stability; Longitudinal and lateral stability; Handling qualities of the airplanes

MODULE -IV	INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS,POWER PLANT

General types of construction, monocoque, semi-monocoque; Typical wing and fuselage structure; Metallic & non-metallic materials, use of aluminum alloy, titanium, stainless steel and composite materials; Basic ideas about engines, use of propeller and jets for thrust production; Principles of operation of rocket, types of rockets.

MODULE -V	SATELLITE SYSTEMS ENGINEERING HUMAN SPACE EXPLORATION

Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems; Satellite structures, mechanisms and materials; Power systems; Communication and telemetry; Propulsion and station keeping; Space missions, mission objectives. Goals of human space flight missions, historical background, the Soviet and US missions; The mercury, Gemini, Apollo (manned flight to the moon), Skylab, apollo-soyuz, space Shuttle; International space station, extravehicular activity; The space suit; The US and Russian designs; Life support systems, flight safety; Indian effort in aviation, missile and space technology.

Text Books:

1. Newman D, “Interactive Aerospace Engineering and Design”, McGraw-Hill, 1st Edition, 2002.
2. Anderson J. D, “Introduction To Flight”, McGraw-Hill Education, 5th Edition,2002

Reference Books:

1. Kermode. A. C, “Flight without Formulae”, McGraw Hill, 4th Edition, 1997.
2. Barnard R.H and Philpot. D.R, “Aircraft Flight”, Pearson, 3rd Edition, 2004.
3. SwattonP.J, “Flight Planning”, Blackwell Publisher, 6th Edition, 2002.

Web References:

1. https://www.aerospaceengineering.es/book/
2. https://www.ne.nasa.gov/education/
3. https://nptel.ac.in

E-Text Books:

1. https://www.e-booksdirectory.com/
2. https://www.adl.gatech.edu/extrovert/Ebooks/ebook_Intro.pdf
3. https://www.academia.edu/7950378/Introduction_to_Flight_-_Anderson_5th_Ed

AVIATION MANAGEMENT

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB28	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 about the history of aviation, major player's airline industry, current trends and challenges.
II. Impart the knowledge on airport planning, airport operation and various authorities involved in airport management.
III. Understand and gain the knowledge on the meteorological services, environmental regulation and airport fee, rates and charges.
IV. Gain the in depth knowledge on safety regulation, economic regulation and aviation security.
V. Understand about the air traffic control, air space and navigational aid.

MODULE -I	**INTRODUCTION**	**Classes: 10**

History of Aviation- organization, global, social & ethical environment-history of aviation in India-Major players in Airline industry-Swot Analysis of different Airline companies in India- market potential of Airline industry in India- new airport development plans-current challenges in airline industry- competition in Airline industry- Domestic & International from an Indian perspective.

MODULE -II	**AIRPORT INFRASTRUCTURE AND MANAGEMENT**	**Classes: 10**

Airport planning – Terminal planning design & operation -Airport operations – Airport functions- organization structure in an Airline – Airport Authority of India- comparison of global & Indian Airport management- Role of AAI -Airline privatization – Full privatization- Gradual privatization- partial privatization.

MODULE -III	**AIR TRANSPORT SERVICES**	**Classes: 9**

Various Airport services- international air transport services – Indian Scenario- An overview of Airport in Delhi, Mumbai, Hyderabad & Bangalore. The role of private operators- Airport development fees, Rates & Tariffs.

MODULE -IV	**INSTITUTIONAL FRAMEWWORK**	**Classes: 8**

Role of DGCA-Slot allocation -Methodology followed by ATC & DGCA – management of bi-laterals – economic Regulations.

MODULE -V	**CONTROLLING**	**Classes: 8**

Role of air traffic control- airspace & navigational aids- control process – case study in airline industry- Mumbai-Delhi airport privatization-Navi Mumbai airport tendering process- six cases in the airline industry.

Text Books:

1. Graham. A Managing airports - an International Perspective butterworth-heinemann, oxford 2001.
2. Wells. A. Airport Planning and Management, 4th edition McGraw-Hill, London 2000.

Reference Books:

1. Alexander t. wells, seth young, Principles of Airport management, McGraw-hill 2003Y. V. C. Rao,
2. Richard de neufille, Airport systems: Planning, Design & Management, McGraw-hill London 2007.

Web References:

1. https://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports &source=gbs_similarbooks

E-Text Books:

1. https://accessengineeringlibrary.com/browse/airport-planning-and-management-sixth-edition
2. https://www.only4engineer.com/2014/10/planning-and-design-of-airports-by.html

INTRODUCTION TO ROBOTICS

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB56	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 with the automation and brief history of robot and applications.
II. Understand the kinematics of robots and knowledge about robot end effectors and their design.
III. Apply robot actuators and feedback components to automation.

MODULE-I	**INTRODUCTION TO ROBOTICS**	**Classes : 09**

Introduction: Automation and robotic, an over view of robotics, classification by coordinate system and control systems; Components of the industrial robotics: Degrees of freedom, end effectors: Mechanical gripper, magnetic, vacuum cup and other types of grippers, general consideration on gripper selection and design.

MODULE-II	**MOTION ANALYSIS AND KINEMATICS**	**Classes : 09**

Motion analysis: Basic rotation matrices, composite rotation matrices, Euler angles, equivalent angle and axis, homogeneous transformation, problems; Manipulator kinematics: D-H notations, joint coordinates and world coordinates, forward and inverse kinematics, problems.

MODULE-III	**KINEMATICS AND DYNAMICS**	**Classes: 09**

Differential kinematics: Differential kinematics of planar and spherical manipulators, Jacobians, problems.
Robot dynamics: Lagrange, Euler formulations, Newton-Euler formulations, problems on planar two link manipulators.

MODULE-IV	**TRAJECTORY PLANNING AND ACTUATORS**	**Classes: 09**

Trajectory planning: Joint space scheme, cubic polynomial fit, and avoidance of obstacles, types of motion: Slew motion, joint interpolated motion, straight line motion, problems; Robot actuators and feedback components; Actuators: pneumatic and hydraulic actuators.

MODULE-V	**ELECTRIC ACTUATORS AND ROBOTIC APPLICATIONS**	**Classes : 09**

Electric actuators: DC servo motors, stepper motors, feedback components: position sensors, potentiometers, resolvers and encoders, velocity sensors, tactile sensors; Robot application in manufacturing: Material handling, assembly and inspection.

Text Books:

1. Groover M. P, "Industrial Robotics", Tata McGraw-Hill, 1st Edition, 2013.
2. J. J Craig, "Introduction to Robotic Mechanics and Control", Pearson, 3rd Edition, 2013.

Reference Books:

1. Richard D. Klafter, "Robotic Engineering", Prentice Hall, 1st Edition, 2013.
2. Fu K S, "Robotics", McGraw-Hill, 1st Edition, 2013.

Web References:
1. https://www.doc.ic.ac.uk/~ajd/Robotics/RoboticsResources/lecture1.pdf. 2. http://opencourses.emu.edu.tr/course/view.php?id=32 3. https://www.researchgate.net/publication/277712686_Introduction_to_Robotics_class_notes_UG_level
E-Text Book:
1. http://www.robot.bmstu.ru/ 2. http://www.robotee.com/index.php/download-free-robotic-e-books/

RAPID PROTOTYPING

OE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB57	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 suitable time compression techniques for rapid product development.
II. Interpret the concept, process details with respect to different processes.
III. Describe the significance of each process parameter of various prototyping systems.
IV. Interpret the advantages, limitations and applications of various prototyping Systems.
V. Identify the various tooling required for rapid prototyping systems and reverse engineering & augmented reality.

MODULE -I	INTRODUCTION TO RAPID PRORTOTYPING	Classes : 09

Introduction: Prototype Fundamentals, Types and Roles of Prototype, Fundamentals of Rapid Prototyping, Phases of Development Leading to Rapid Prototyping, Advantages of Rapid Prototyping and Classifications of Rapid Prototyping System, Generic RP process. Rapid Product Development: An Overview virtual prototyping and testing technology, Physical Prototyping and Rapid Manufacturing technologies and Synergic Integration Technologies.

MODULE -II	LIQUID-BASED RAPID PROTOTYPING SYSTEMS	Classes : 09

Liquid-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Stereolithography Apparatus (SLA), Solid Ground Curing (SGC), Solid Object Ultraviolet-Laser Printer (SOUP), Rapid Freeze Prototyping and Microfabrication

MODULE -III	SOLID-BASED RAPID PROTOTYPING SYSTEMS	Classes: 09

Solid-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Paper Lamination Technology (PLT), Multi-Jet Modeling System (MJM) andCAM-LEM.

MODULE -IV	POWDER-BASED RAPID PROTOTYPING SYSTEMS	Classes: 09

Powder-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Selective Laser Sintering (SLS), Laser Engineered Net Shaping (LENS), Multiphase Jet Solidification (MJS), Electron Beam Melting (EBM) and Three-Dimensional Printing (3DP) – Hands on Session

MODULE -V	RAPID TOOLING	Classes : 09

Rapid Tooling: Introduction to rapid tooling (RT),Indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, and 3D Keltool process, Direct rapid tooling methods: DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP. Reverse engineering: Acquiring Point Data, Constructing 3D model and Applications. Virtual Augmented Reality: Requirement of devices and technologies and applications. Case Studies: Applications of Rapid Prototyping in Aerospace Industry, Automotive Industry, Biomedical Industry, Jewellery Industry, Coin Industry, Tableware Industry and Sports Field.

Text Books:

1. Chua C K, Leong K F, Chu S L, "Rapid Prototyping: Principles and Applications in Manufacturing", World Scientific, 3rd Edition, 2008.
2. Liou W L, Liou F W, "Rapid Prototyping and Engineering applications: A Tool Box for Prototype Development", CRC Press, 1st Edition, 2007.

Reference Books:

1. Gibson D W Rosen, Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 1st Edition, 2014.
2. Kamrani A K, Nasr E A, "Rapid Prototyping: Theory and practice", Springer, 1st Edition, 2006.
3. Rafiq I. Noorani, "Rapid Prototyping: Principles and Applications", John Wiley & Sons, 1st Edition, 2005.

Web References:

1.https://nptel.ac.in/courses/112102103/16
2.https://nptel.ac.in/courses/112107078/37

E-Text Book:
1.https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf

EMBEDDED SYSTEMS

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB58	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. Imbibe knowledge about the basic functions, structure, concepts and applications of Embedded Systems.
II. Understand Real time operating system concepts.
III. Analyze different tools for development of embedded software.
IV. Be acquainted the architecture of advanced processors.

MODULE -I	EMBEDDED COMPUTING	Classes: 08

Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, characteristics and quality attributes of embedded systems, formalisms for system design, design examples

MODULE -II	INTRODUCTION TO EMBEDDED C AND APPLICATIONS	Classes: 09

C looping structures, register allocation, function calls, pointer aliasing, structure arrangement, bit fields, unaligned data and endianness, inline functions and inline assembly, portability issues; Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware; Basic techniques for reading and writing from I/O port pins, switch bounce; Applications: Switch bounce, LED interfacing, interfacing with keyboards, displays, D/A and
A/D conversions, multiple interrupts, serial data communication using embedded C interfacing

MODULE -III	RTOS FUNDAMENTALS AND PROGRAMMING	Classes: 09

Operating system basics, types of operating systems, tasks and task states, process and threads, multiprocessing and multitasking, how to choose an RTOS ,task scheduling, semaphores and queues, hard real-time scheduling considerations, saving memory and power.

Task communication: Shared memory, message passing, remote procedure call and sockets; Task synchronization: Task communication synchronization issues, task synchronization techniques, device drivers.

MODULE -IV	EMBEDDED SOFTWARE DEVELOPMENT TOOLS	Classes: 09

Host and target machines, linker/locators for embedded software, getting embedded software into the target system; Debugging techniques: Testing on host machine, using laboratory tools, an example system.

MODULE -V	INTRODUCTION TO ADVANCED PROCESSORS	Classes: 10

Introduction to advanced architectures: ARM and SHARC, processor and memory organization and instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-EnAnalyzed systems, design example-Elevator controller.

Text Books

1. Shibu K.V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education, 2nd Edition, 2011.
3. Andrew Sloss, Dominic Symes,Wright, "ARM System Developer's Guide Designing and Optimizing System Software", 1st Edition, 2004.

Reference Books

1. Wayne Wolf, "Computers as Components, Principles of Embedded Computing Systems Design", Elsevier, 2nd Edition, 2009.
2. Dr. K. V. K. K. Prasad, "Embedded / Real-Time Systems: Concepts, Design & Programming", Dreamtech publishers, 1st Edition, 2003.
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, 3rd Edition, 2006.
4. Lyla B Das, "Embedded Systems" , Pearson Education, 1st Edition, 2012.
5. David E. Simon, "An Embedded Software Primer", Addison-Wesley, 1st Edition, 1999.
6. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

Web References

1. https://www.smartzworld.com/notes/embedded-systems-es/
2. http://notes.specworld.in/embedded-systems-es/
3. http://education.uandistar.net/jntu-study-materials
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

E-Text Books

1. https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv
2. http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf
3. https://www.scribd.com/doc/55232437/Embedded-Systems-Raj-Kamal
4. https://docs.google.com/file/d/0B6Cytl4eS_ahUS1LTkVXb1hxa00/edit
5. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf

COGNITIVE RADIO

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB59	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 the basics of the software defined radios.
II. Learn the design of the wireless networks based on the cognitive radios.
III. Understand the concepts of wireless networks and next generation networks.

MODULE -I	**INTRODUCTION TO SOFTWARE DEFINED RADIO**	**Classes: 08**

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

MODULE -II	**SDR ARCHITECTURE**	**Classes: 09**

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

MODULE -III	**INTRODUCTION TO COGNITIVE RADIOS**	**Classes: 09**

Marking radio self-aware, cognitive techniques, position awareness.

Environment awareness in cognitive radios, optimization of radio resources, artificial intelligence techniques.

MODULE -IV	**COGNITIVE RADIO ARCHITECTURE**	**Classes: 09**

Cognitive Radio: Functions, components and design rules, cognition cycle: orient, plan, decide and act phases, inference hierarchy, architecture maps, building the cognitive radio architecture on software defined radio architecture.

MODULE -V	**NEXT GENERATION WIRELESS NETWORKS**	**Classes: 10**

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Text Books:

1. Joseph Mitola III, “Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering”, John Wiley & Sons Ltd, 2000.
2. Thomas W.Rondeau, Charles W. Bostain, “Artificial Intelligence in Wireless Communication”, Artech House, 2009.
3. Bruce A. Fette, “Cognitive Radio Technology”, Elsevier, 2009.
4. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, “Next generation / Dynamic Spectrum access / Cognitive Radio Wireless Networks: A Survey”, Elsevier Computer Networks, May 2006.

Reference Books:

1. Simon Haykin, ―Cognitive Radio: Brain –Empowered Wireless Communications‖, IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, ―Enabling Location and Environment Awareness in Cognitive Radios‖, Elsevier Computer Communications, Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, ―Software Defined Radio‖, John Wiley, 2003.
4. Huseyin Arslan, ―Cognitive Radio, SDR and Adaptive System‖, Springer, 2007.
5. Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, ―Cognitive Radio Communication and Networks‖, Elsevier, 2010

Web References:

1. wcsp.eng.usf.edu/cognitive_radio_links.htm
2. https://en.wikipedia.org/wiki/Cognitive_radio
3. https://www.researchgate.net/.../261021527_Cognitive_radio_networks_for_Internet.
4. www.informationvine.com/Cognitive+Radio.

E-Text Books:

1. omidi.iut.ac.ir/...CognitiveRadio/.../ebook/Fette%20B.A.(ed)%20Cognitive%20Radio.
2. www.supelec.fr/d2ri/flexibleradio/pub/leonardo09.pd.
3. www.qsl.net/.../Cognitive%20Radio%20Communications%20and%20Networks%20-%2

IOT AND APPLICATIONS

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB60	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 Internet of Things and connected world.
II. Explore on use of various hardware and sensing technologies to build IoT applications.
III. Illustrate the real time IoT applications to make smart world.
IV. Understand the available cloud services and communication API's for developing smart cities

MODULE -I	**INTRODUCTION TO INTERNET OF THINGS (IoT)**	**Classes: 10**

Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.

MODULE -II	**IoT AND M2M**	**Classes: 09**

Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

MODULE -III	**IOT ARCHITECTURE AND PYTHON**	**Classes: 08**

IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. Logical design using Python: Installing Python, Python data types and data structures, control flow, functions, modules, packages, file handling

MODULE -IV	**IoT PHYSICAL DEVICES AND ENDPOINTS**	**Classes: 08**

Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.

MODULE -V	**IoT PHYSICAL SERVERS AND CLOUD OFFERINGS**	**Classes: 10**

Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud for IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd Edition, 2014.

Reference Books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons, 1st Edition, 2014.
2. Francis Da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st Edition, 2013.

Web References:
1. https://www.upf.edu/pra/en/3376/22580. 2. https://www.coursera.org/learn/iot. 3. https://bcourses.berkeley.edu. 4. www.innovianstechnologies.com.
E-Text Books:
1. https://mitpress.mit.edu/books/internet-things 2. http://www.apress.com

INDUSTRIAL AUTOMATION AND CONTROL

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB58	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:

Learn the fundamental concepts about introduction to industrial automation and control and devices.

Study the performance of each system in detail along with practical case studies.

Develop various types of industrial automation and control and devices.

Understand the process control of PLC automation.

MODULE-I	INTRODUCTION TO INDUSTRIAL AUTOMATION AND CONTROL	Classes: 08

Introduction to Industrial Automation and Control: Introduction to industrial automation and control architecture of industrial automation system, measurement systems specifications, temperature measurement, pressure and force measurement, displacement and speed measurement, signal conditioning circuits, errors and calibration.

MODULE - II	PROCESS CONTROL	Classes: 10

Process control: Introduction to process control, PID control, controller tuning, implementation of PID controllers, special control structures, feed forward and ratio control special control structures: predictive control, control of systems with inverse response.

MODULE - III	PROGRAMMABLE LOGIC CONTROL SYSTEMS	Classes: 09

Programmable logic control systems**:** introduction to sequence or logic control and programmable logic controllers, the software environment and programming of PLCs, formal modeling of sequence control specifications.

Programming , programming of PLCs: sequential function charts, the PLC hardware environment

MODULE - IV	CNC MACHINES AND ACTUATORS	Classes: 10

CNC machines and actuators: Introduction to computer numerically controlled machines, control valves, hydraulic actuation systems, principle and components, directional control valves, switches and gauges, industrial hydraulic circuits.

MODULE - V	ELECTRICAL MACHINE DRIVES	Classes: 08

Electrical machine drives: Energy savings with variable speed drives, step motors: principles, construction and drives, electrical actuators, DC motor drives, electrical actuators: induction motor drives, electrical actuators, BLDC motor drives.

Text Books:

1. Madhu Chanda Mitra, Samarjit Sen Gupta**, "**Programmable Logic Controllers and Industrial Automation: An Introduction", Penram International Publishing (India) Pvt. Ltd**.**, 1st Edition, 2008.
2. K Krishnaswamy, S Vijayachitra, "Industrial Instrumentation", New Age Publications, 1st Edition, 2010.
3. Rajesh Mehra, Vikrant Vij**, "**PLCs & SCADA: Theory and Practice", Laxmi publications, 2nd Edition, 2016.

Reference Books:

1. AK Gupta, S K Arora**, "**Industrial Automation and Robotics", Laxmi Publications, 2nd Edition, 2013.
2. Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall, 1st Edition, 2002.

Web References:

1. https://www.google.co.in/search?q=INTRODUCTION+TO+INDUSTRIAL+AUTOMATION+AND+CONTROL&ie=utf-8&oe=utf-8&client=firefox-b-ab&gfe_rd=cr&ei=PUocWOXVL67v8weKwZngAw
2. https://www.noorropidah.files.wordpress.com/2012/01/plc-1-3.pdf
3. https://www.radix.co.in/families/automation?gclid=CJfW24PbjtACFUYeaAodiCQGHQ

E-Text Books:

1. https://www.plc-scada-dcs.blogspot.com/p/downloads.html
2. https://www.megawatt.com.gr/files/uploads/KATALOGOS%20PLC%20ABB.pdf

ARTIFICIAL NEURAL NETWORKS

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB59	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 biological neural network and to model equivalent neuron models
II. Realise the architecture, learning algorithm and issues of various feed forward and feedback neural networks.
III. Create different neural networks of various architectures both feed forward and feedbackward.
IV. Perform the training of neural networks using various learning rules.
V. Operate the testing of neural networks and do the perform analysis of these networksfor various pattern recognition applications.

MODULE-I	INTRODUCTION TO ANN	Classes: 09

A Neural Network, Human Brain, Models of a Neuron, Neural Networksviewed as Directed Graphs, Network Architectures, Knowledge Representation, ArtificialIntelligence and Neural Networks; Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning,Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption,Statistical Nature of the Learning Process

MODULE-II	PERCEPTRON	Classes: 09

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained OrganizationTechniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves,Learning Rate Annealing Techniques, Perceptron: convergence theorem, Relation BetweenPerceptron and Bayes Classifier for a Gaussian Environment; Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output, Representation and Decision Rule, Computer Experiment, Feature Detection

MODULE-III	BACK PROPAGATION	Classes: 09

Back Propagation:Back Propagation and Differentiation, Hessian Matrix, Generalization,Cross Validation, Network Pruning Techniques, Virtues, and Limitations.

BackPropagation Learning, Accelerated Convergence, Supervised Learning

MODULE-IV	SELF-ORGANIZATION MAPS	Classes: 09

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

MODULE-V	DYNAMICAL SYSTEMS	Classes: 09

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment

Text Books:

1. Simon Haykin, "Neural Networks a Comprehensive Foundations", Prentice Hall India, 2nd Edition, 2003

Reference Books:

1. B. Yegnanarayana, "Artificial Neural Networks", Prentice Hall of India Private Limited, 2005
2. Li Min Fu,"Neural Networks in Computer Intelligence", Tata McGraw Hill, 3rd Edition, 2003
3. James A Freeman David M S Kapura, "Neural Networks", Pearson Education, 2004.
4. Jacek M. Zurada,"Introduction to Artificial Neural Systems", JAICO Publishing House,1stEdition, 2006.

Web References:

1. https:// www.en.wikipedia.org/wiki/ neural networks
2. https://www.jaicobooks.com/j/PDF%20HED/J-878%20Artificial%20Neural%20Systems.pdf
3. https://www.abebooks.co.uk/book-search/title/an-introduction-to-fuzzy-control/system.pdf

E-Text Books:

1. https://www.books.google.com / Computers/ Software Development & Engineering.pdf
2. https://www.springer.com/us/book/9783319046921.pdf
3. https://www .bookboon.com/en/introduction-to-soft-computing-ebook.pdf

RENEWABLE ENERGY SOURCES

OE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB60	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OUTCOMES:

The course should enable the students to:

I. Gain advanced knowledge on role of power electronics for renewable energy.
II. Analyze the power conditioning schemes for grid connected systems.
III. Develop skills in designing wind, solar systems and their integration.

MODULE- I	INTRODUCTION	Classes: 10

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications

MODULE - II	SOLAR SYSTEMS	Classes: 10

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.

Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems

MODUEL - III	HYDROGEN, WIND AND GEO-THERMAL SYSTEMS	Classes: 09

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy. Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.

Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.
Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics.

MODULE- IV	BIOMASS SYSTEMS	Classes: 08
Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers. Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics. Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy		
MODULE- V	**PV WATER PUMPING AND GRID INTERFACE**	**Classes: 08**
Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power. Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC		
Text Books:		
1. G.D Rai, "Non conventional Energy Sources", Khanna Publications, 3nd Edition, 2008. 2. John Twidell and Tony Weir / E & F.N.Spon, "Renewable Energy Resources", Special Indian Edition, 3rd Edition, 2007. 3. G.N.Tiwari and M.K.Ghosal , "Renewable Energy Resources Basic Principles and Applications", Narosa Edition, 2nd Edition, 2004. 4. S.P. Sukhatme, "Solar Energy - Principles of Thermal Collection and Storage," TMH, 4th Edition, 2017.		
Reference Books:		
1. Daniel, Hunt. V, "Wind Power – A Hand Book of WECS", Van Nostrend Co., Newyork, 1998. 2. K.Khendelwal & S.S. Mahdi, "Biogas Technology - A Practical Hand Book", McGraw-Hill 3. Mukund. R. Patel, "Wind and Solar Power Systems", CRC Press, 1999.		
Web References:		
NPTEL video lectures.		
E-Text Books:		
G.D. Rai, Non- Conventional Energy Resources, Khanna Publishers, 2002.		

SOFT SKILLS AND INTERPERSONAL COMMUNICATION

OE - IV

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:

III. Communicate in a comprehensible English accent and pronunciation.
IV. Use the four language skills i.e., Listening, Speaking, Reading and Writing effectively.
V. Develop the art of interpersonal communication skills to avail the global opportunities
VI. 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 - IV

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 - IV

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 - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB21	OEC	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

VI. Understand the importance of Ozone layer in the atmosphere.
VII. Comprehend composition of atmosphere.
VIII. Understand impacts of climate change on ecosystem.
IX. 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: IV

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 - IV

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.

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	MCC	-	-	-	-	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	MCC	-	-	-	-	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 ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

A graduate of the Electronics and Communication Engineering Program should:

PEO – I: To be successful in professional career by acquiring the knowledge in the fundamentals of Electronics and Communication Engineering principles and professional skills.

PEO – II: To be in a position to analyze real life problems and design socially accepted and economically feasible solutions in the respective fields.

PEO – III: To involve themselves in lifelong learning and professional development by pursuing higher education and participation in research and development activities.

PEO – IV: To exhibit good communication skills in their professional career, lead a team with good leadership traits and good interpersonal relationship with the members related to other engineering streams.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: **Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

PSO – II: **Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO – III: **Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

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