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
ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2016- 2017)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2017 - 2018)

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

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

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.

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.

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, Biology 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.

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.

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

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

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.

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

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

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

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 the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before 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.

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

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

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

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

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, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/ 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 the 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 R-16" 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. The odd Semester starts usually in July and even semester in December.

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 the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the 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 like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. 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 and thus awards degrees on behalf of the college. 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 like Academic Council and Boards of Studies 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 to 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 with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(for the batches admitted from the academic year 2016 - 17)
&
B.Tech. (Lateral Entry Scheme)
(for the batches admitted from the academic year 2017 - 18)

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

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at 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 of lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / 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.

2.0 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.

3.0 TYPES OF COURSES

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

3.1 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.

3.2 Core Course:

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 programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications 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 discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as "Open Elective".

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

4.0 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. However, the following cases are exempted:

4.1 Students admitted under Lateral Entry Scheme in the subjects 'Audit Course', 'Advanced Programming Lab' and 'Value Added Course'.

4.2 Students admitted under Lateral Entry Scheme shall register 'Environmental Studies' course in supplementary semester and pass the subject by the end of VI semester for the award of the degree. This is a non-credit and mandatory course for students admitted under Lateral Entry Scheme.

4.3 Students admitted on transfer from JNTU 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'.

4.4 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.

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

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

4.7 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.

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

4.0.1 The registration for the Summer Semester (May – July) 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) for some reason.

Students will not be permitted to register for more than 15 credits (both I and II Semester) in the Summer Semester. Students are required to register for Summer Semester courses are to pay a nominal fee in within the stipulated time.

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

The students who have earlier taken an SEE Examination and register afresh for the Summer Semester will revoke the CIA marks secured by them in their regular/earlier attempt in the same course. Once revoked, the students shall not seek restoration of the CIA marks.

Summer Semester will be at an accelerated pace and will be at double the rate of normal semester e.g. one credit of course shall require two hours/week so that the total contact hours are maintained same as in normal semester.

Instructions and guidelines for the summer semester course:

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

4.0.2 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

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 absolutely 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 circumstance.

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

5.4. The student has to normally register for a minimum of 20 credits and may register up to a maximum of 30 credits, in consultation with HOD/faculty mentor. On an average, a student is expected to register for 25 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 nine 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
8	Humanities and Basic Sciences	HS
9	Miscellaneous	MS

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Comprehensive Examination, Ideation and Product Development, Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

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, 2 credits for 3 or 4 practical hours per week.
- **Project Work:** 1 credit for 4 hours of project work per week.
- **Ideation and Product Development:** 1 credit for 2 hours per week

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core and Foundation)	3 / 4	3 / 4
2	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	2 / 3	1 / 2
5	Audit Course / Mandatory Course	-	0
6	Comprehensive Examination	-	1
7	Ideation and Product Development	-	1
8	Summer Internship	-	0
9	Full Semester Internship (FSI) Project Work	-	16
10	Project Work	-	10

7.2 Course Structure

Every program of study shall be designed to have 38 - 42 theory courses and 20 - 26 laboratory courses. 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. In addition, a student has to carry out a Ideation and Product Development, project work and comprehensive Examination.

Table 4: Category Wise Distribution of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	HS (05% to 10%)	10
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	BS (15% to 20%)	28
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	ES (15% to 20%)	28
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	PC (30% to 40%)	96
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	PE (10% to 15%)	12
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	OE (05% to 10%)	06
7	Project Work or Full Semester Internship, Ideation and Product Development, Comprehensive Examination.	10% to 15%	12 - 18
8	Mandatory Courses / Audit Courses.	MC / AC	Non-Credit
TOTAL			**192**

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.

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.

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation	4	24
II Semester	5 Foundation	4	24
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (5 Core + 1 Professional Elective)	3	29
VI Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Foundation)	3 + Ideation and Product Development	28
VII Semester	Full Semester Internship (FSI)		16
VIII Semester	4 (3 Core + 1 Professional Elective)	3 + Comprehensive Examination	21
Total	**36 (16 Foundation + 16 Core + 3 Professional Electives + 1 Open Electives) + Mandatory Course + Audit course**	**22 + Comprehensive Examination + Ideation and Product Development + FSI**	**192**

7.5 For Four year regular program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation	4	24
II Semester	5 Foundation	4	24
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (4 Core + 1 Skill 1 Professional Elective)	3	25
VI Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3 + Ideation and Product Development	25
VII Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3	24
VIII Semester	3 (2 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	20
Total	**39 (15 Foundation + 01 Skill + 17 Core + 4 Professional Electives + 2 Open Electives) + Mandatory Course + Audit Course**	**23 + Ideation and Product Development + Comprehensive Examination + Project work**	**192**

7.6 For Three year lateral entry program (FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit course (3 Core + 2 Foundation)	3	25
V Semester	6 (5 Core + 1 Professional Elective)	3	29
VI Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Foundation)	3 + Ideation and Product Development	28
VII Semester	Full Semester Internship (FSI)		16
VIII Semester	4 (3 Core + 1 Professional Elective)	3 + Comprehensive Examination	21
Total	**26 (6 Foundation + 16 Core + 3 Professional Electives + 1 Open Electives) + Mandatory Course + Audit Course**	**14 + Comprehensive Examination + Ideation and Product Development + FSI**	**144**

7.7 For Three year lateral entry program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (4 Core + 1 Skill + 1 Professional Elective)	3	25
VI Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3 + Ideation and Product Development	25
VII Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3	24
VIII Semester	3 (2 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	20
Total	**29 (05 Foundation + 17 Core + 4 Professional Electives + 2 Open Electives + 1 Skill) + Mandatory Course + Audit Course**	**15 + Ideation and Product Development + Comprehensive Examination + Project work**	**144**

7.8 Course wise break-up for the total credits (FSI Model):

Total Theory Courses (36) Core Courses (16) + Foundation Courses (11+ 5) + Professional Electives (03) + Open Elective (01)	16 @ 4 credits + 11 @ 4 credits + 05 @ 3 credits + 03 @ 3 credits + 01 @ 3 credits	134
Total Laboratory Courses (16 + 08)	16 @ 2 credits + 08 @ 1 credit	40
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Full Semester Internship (FSI)	1 @ 16 credits	16
TOTAL CREDITS		**192**

7.9 For Four year regular program (Non FSI Model):

Total Theory Courses (38) Core Courses (16) + Foundation Courses (11+ 5) + Professional Electives (04) + Open Electives (02) + Skill (01)	14 @ 4 credits + 02 @ 3 credits + 11 @ 4 credits + 05 @ 3 credits + 04 @ 3 credits + 02 @ 3 credits + 01 @ 3 credits	142
Total Laboratory Courses (15 + 08)	15 @ 2 credits + 08 @ 1 credit	38
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Project work	1 @ 10 credits	10
TOTAL CREDITS		**192**

7.10 For three year lateral entry program (FSI Model):

Total Theory Courses (26) Core Courses (16) + Foundation Courses (5+2) + Professional Electives (03) + Open Electives (01)	14 @ 4 credits + 02 @ 3 credits + 05 @ 4 credits + 02 @ 3 credits + 03 @ 3 credits + 01 @ 3 credits	100
Total Laboratory Courses (11 + 04)	11 @ 2 credits + 04 @ 1 credit	26
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Full Semester Internship	1 @ 16 credits	16
TOTAL CREDITS		**144**

7.11 For three year lateral entry program (Non FSI Model):

Total Theory Courses (28) Core Courses (16) + Foundation Courses (5+1) + Professional Electives (04) + Open Electives (02) + Skill (01)	14 @ 4 credits + 02 @ 3 credits + 05 @ 4 credits + 01 @ 3 credits + 04 @ 3 credits + 02 @ 3 credits + 01@ 3 credits	106
Total Laboratory Courses (11 + 04)	11 @ 2 credits + 04 @ 1 credit	26
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Project work	1 @ 10 credits	10
TOTAL CREDITS		**144**

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 sessional examinations or the marks scored in the make-up examination conducted.

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 units and each unit 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 unit. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz / Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Quiz / AAT	
Max. CIA Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five 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 Internal Examination.

8.1.2.2 Quiz / Alternative Assessment Tool (AAT)

Two Quiz exams shall be online examination consisting of 20 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in the testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quizzes for every course.

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT) in place of two quizzes. This AAT enables faculty to design own assessment patterns during the CIA. However, the usage of AAT is completely optional. 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 seminars, assignments, term paper, open ended experiments, micro-projects, 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 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 for 10 marks in each semester.

8.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and in compliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

8.3.1 The proposed MOOC courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment & Evaluation of the courses shall be done by the department.

8.3.2 There shall be one Mid 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.

8.3.3 Two credits will be awarded upon successful completion of each MOOC courses. Students need to complete three such MOOC courses to compensate any two elective courses (one open and one professional) having three credits.

8.3.4 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.

8.4 Audit Courses (AC) / Mandatory Courses (MC):

These courses are among the compulsory courses and do not carry any credits.

a) Gender Sensitivity is a mandatory course in III semester for all the students.

b) The student has to choose one audit course at the beginning of IV semester under self study mode. By the end of VI semester, all the students (regular and lateral entry students) shall complete the audit course.

c) The students will have four chances in total to clear the audit / mandatory course. Further, the student has an option to change the audit course in case if s/he is unable to clear the audit course in the first two chances. However, the audit course should be completed by VI semester and its result will be given in the VI semester grade sheet.

d) Audit / Mandatory courses will not carry any credits; but, a pass in each such course after attaining required CIE and SEE requirements during the programme shall be necessary requirement for the student to qualify for the award of Degree. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

8.5 Value Added Courses:

The value added courses are audit courses in nature offered through joint ventures with various organizations provide ample scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen field of studies. A plenty of value added programs will be proposed by the departments one week before the commencement of classwork. 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.

8.6 Comprehensive Examination

The comprehensive Examination is aimed at assessing the students understanding of various Foundation, Skill and Core courses studied till the end of VII semester and is intended to test the students' grasp of the chosen field of study.

The Comprehensive Examination consists of two parts. Part A is a written examination and part B is the oral examination. The written examination shall be objective type of one hour duration and shall have 50 marks and is to be conducted by the concerned department under the supervision of Dean Academics. Oral examination shall be conducted by the department and carry 50 marks. The examination shall be conducted during the VIII semester.

8.7 Ideation and Product Development

The Ideation and Product Development shall be carried out either during VI semester along with other lab courses by having regular weekly slots. Students will take Ideation and Product Development batch wise and the batches will be divided as per the guidelines issued. The topic of Ideation and Product Development 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 Ideation and Product Development could 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. Ideation and Product Development report will be evaluated for 100 marks in total. Assessment will be done by the supervisor/guide for 30 marks based on the work and presentation/execution of the Ideation and Product Development. Subdivision for the remaining 70 marks is based on report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the Ideation and Product Development 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.

8.8 Project work

In the non-FSI Model, 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, exploring the research bent of the mind of the student. A project batch shall comprise not more than three students.

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, 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.

8.9 Full Semester Internship (FSI)

FSI is a full semester internship programme carries 16 credits. During the FSI, student has to spend one full semester in an identified industry / firm / organization and has to carry out the internship as per the stipulated guidelines of that industry / firm / organization and the institute.

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 MAKE-UP 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 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 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.

10.2 For cases 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 Head of the department if their attendance is between 75% to 65% in every course, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments.

10.3 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.

10.4 A candidate shall put in a minimum required attendance at least three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.5 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.

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

10.7 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 fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

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

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

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

11.2 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.

11.3 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.

11.4 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.

11.5 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.

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

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 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.

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Comprehensive Examination / Ideation and Product Development / Project, if s/he secures

i. Not less than 40% marks for each Lab / Comprehensive Examination / Ideation and Product Development / Project course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Comprehensive Examination / Ideation and Product Development / Project course considering both internal and semester end examination.

12.3 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.

13.0 LETTER GRADES AND GRADE POINTS

13.1 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

13.2 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”.

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

13.4 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.

13.5 “SA” denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.6 “W” denotes **withdrawl** from the exam for the particular course.

13.7 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.

14.0 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.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 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**

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

15.2 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		

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

16.0 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.

17.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 10.

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

17.1.1 A student will not be promoted from II semester to III semester unless s/he fulfills the academic requirement of securing 24 credits from I and II semesters examinations, whether or not the candidate takes the examinations.

17.1.2 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 37 credits upto III semester **or** 49 credits upto IV semester, from all the examinations, whether or not the candidate takes the examinations.

17.1.3 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 62 credits upto V semester **or** 74 credits upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.1.4 A student shall register for all the 192 credits and earn all the 192 credits. Marks obtained in all the 192 credits shall be considered for the award of the Grade.

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

17.2.1 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 25 credits upto IV semester, from all the examinations, whether or not the candidate takes the examinations.

17.2.2 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 38 credits upto V semester **or** 50 credits upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.2.3 A student shall register for all the 144 credits and earn all the 144 credits. Marks obtained in all the 144 credits shall be considered for the award of the Grade.

18.0 GRADUATION REQUIREMENTS

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

18.1 Student shall register and acquire minimum attendance in all courses and secure 192 credits for regular program and 144 credits for lateral entry program.

18.2 A student of a regular program, who fails to earn 192 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.

18.3 A student of a lateral entry program who fails to earn 144 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.

19.0 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.

20.0 AWARD OF DEGREE

20.1 Classification of degree will be as follows:

CGPA $\geq$ 7.5	CGPA $\geq$ 6.5 and < 7.5	CGPA $\geq$ 5.0 and < 6.5	CGPA $\geq$ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

20.2. 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).

20.3 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.

20.4 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.

20.5 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.

21.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

21.1 A candidate is normally not permitted to break 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 apply to 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.

21.2 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.

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

21.4 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 18.0. The maximum period includes the break period.

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

22.0 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.

23.0 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 of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

24.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to 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.

25.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor 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.

26.0 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.

27.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in 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 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 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, 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 upto 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 upto 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 upto 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.

28.0 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 shall come into force 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

ELECTRICAL AND ELECTRONICS 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										
AHS002	Linear Algebra and Ordinary Differential Equations	BS	Foundation	3	1	-	4	30	70	100
AHS003	Computational Mathematics and Integral Calculus	BS	Foundation	3	1	-	4	30	70	100
AHS006	Engineering Physics	BS	Foundation	3	1	-	4	30	70	100
AHS005	Engineering Chemistry	BS	Foundation	3	-	-	3	30	70	100
ACS001	Computer Programming	ES	Foundation	3	-	-	3	30	70	100
PRACTICAL										
AHS104	Engineering Physics and Chemistry Laboratory	BS	Foundation	-	-	3	2	30	70	100
ACS101	Computer Programming Laboratory	ES	Foundation	-	-	3	2	30	70	100
AME103	Computer Aided Engineering Drawing	ES	Foundation	-	-	2	1	30	70	100
AHS102	Computational Mathematics Laboratory	BS	Foundation	-	-	2	1	30	70	100
TOTAL				**15**	**03**	**10**	**24**	**270**	**630**	**900**

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										
AHS001	English for Communication	BS	Foundation	3	-	-	3	30	70	100
AHS011	Mathematical Transform Techniques	BS	Foundation	3	1	-	4	30	70	100
AHS009	Environmental Studies	HS	Foundation	3	-	-	3	30	70	100
ACS002	Data Structures	ES	Foundation	3	1	-	4	30	70	100
AEE002	Electrical Circuits	PC	Foundation	3	1	-	4	30	70	100
PRACTICAL										
AHS101	Communication Skills Laboratory	BS	Foundation	-	-	2	1	30	70	100
ACS102	Data Structures Laboratory	ES	Foundation	-	-	3	2	30	70	100
AEE102	Electrical Circuits Laboratory	PC	Foundation	-	-	3	2	30	70	100
ACS112	Engineering Practice Laboratory	ES	Foundation	-	-	2	1	30	70	100
TOTAL				**15**	**03**	**10**	**24**	**270**	**630**	**900**

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										
AEE003	Power Generation Systems	PC	Core	3	1	-	4	30	70	100
AEE004	DC Machines and Transformers	PC	Core	3	1	-	4	30	70	100
AEE005	Network Analysis	ES	Foundation	3	1	-	4	30	70	100
AEE006	Electromagnetic Field Theory	ES	Foundation	3	1	-	4	30	70	100
AEC001	Electronic Devices and Circuits	ES	Foundation	3	1	-	4	30	70	100
AHS017	Gender Sensitivity	MC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
AEE104	DC Machines Laboratory	PC	Core	-	-	3	2	30	70	100
AEE105	Electrical Engineering Simulation Laboratory	PC	Core	-	-	3	2	30	70	100
AEC113	Electronic Circuits Laboratory	ES	Core	-	-	2	1	30	70	100
TOTAL				**15**	**05**	**08**	**25**	**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										
AEE007	AC Machines	PC	Core	3	1	-	4	30	70	100
AEE008	Electrical Measurements and Instrumentation	PC	Core	3	1	-	4	30	70	100
AEC019	Digital and Pulse Circuits	ES	Foundation	3	-	-	3	30	70	100
AEE009	Control Systems	PC	Core	3	1	-	4	30	70	100
AHS004	Complex Analysis and Probability Distributions	ES	Foundation	3	1	-	4	30	70	100
	Audit Course	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
AEE106	AC Machines Laboratory	PC	Core	-	-	3	2	30	70	100
AEE107	Electrical Measurements and Instrumentation Laboratory	PC	Core	-	-	3	2	30	70	100
AEE115	Control Systems and Simulation Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**15**	**04**	**09**	**25**	**240**	**560**	**800**

V SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week L	T	P	Credits	Scheme of Examination Max. Marks CIA	SEE	Total
THEORY										
AEC008	Integrated Circuits Applications	PC	Core	3	-	-	3	30	70	100
AEE010	Power Electronics	PC	Core	3	1	-	4	30	70	100
AHS012	Optimization Techniques	BS	Foundation	3	-	-	3	30	70	100
AEE011	Transmission and Distribution Systems	PC	Core	3	1	-	4	30	70	100
AHS015	Business Economics and Financial Analysis	HS	Skill	3	-	-	3	30	70	100
	Professional Elective – I	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
AHS106	Research and Content Development	HS	Skill	-	-	2	1	30	70	100
PRACTICAL										
AEE108	Power Electronics and Simulation Laboratory	PC	Core	-	-	3	2	30	70	100
AEC106	Integrated Circuits Applications Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**18**	**02**	**08**	**25**	**270**	**630**	**900**

VI SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week L	T	P	Credits	Scheme of Examination Max. Marks CIA	SEE	Total
THEORY										
AEE012	Power System Analysis	PC	Core	3	1	-	4	30	70	100
AEE013	Solid State Electric Motor Drives	PC	Core	3	1	-	4	30	70	100
AEC022	Microcontrollers and Digital Signal Processing	PC	Core	3	1	-	4	30	70	100
	Professional Elective - II	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
	Open Elective - I	OE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
	Value Added Course - I	AC	Skill	-	-	-	-	-	-	-
AEE201	Ideation and Product Development	-	Skill	-	-	2	1	30	70	100
PRACTICAL										
AEE109	Solid State Electric Motor Drives Laboratory	PC	Core	-	-	3	2	30	70	100
AEE110	PLC and Automation Laboratory	PC	Core	-	-	3	2	30	70	100
AEC114	Microcontrollers and Digital Signal Processing Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**15**	**03**	**11**	**25**	**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										
AEE014	Power System Protection	PC	Core	3	1	-	4	30	70	100
AEE015	High Voltage Engineering	PC	Core	3	1	-	4	30	70	100
AEE016	Power System Operation and Control	PC	Core	3	1	-	4	30	70	100
	Professional Elective - III Available and Selected MOOC Courses	PE	Elective	3	-	-	3	30	70	100
	Open Elective – II Available and Selected MOOC Courses	OE	Elective	3	-	-	3	30	70	100
	Value Added Course - II	AC	Skill	-	-	-	-	-	-	-
PRACTICAL										
AEE111	High Voltage Engineering and Solar Laboratory	PC	Core	-	-	3	2	30	70	100
AEE112	Power System Protection Laboratory	PC	Core	-	-	3	2	30	70	100
AEE113	Power System Computer Aided Design Laboratory	PC	Core	-	-	3	2	30	70	100
AEE301	Project Work (Phase - I)	PC	Core	-	-	-	-	-	-	-
TOTAL				**15**	**03**	**09**	**24**	**240**	**560**	**800**

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										
AEC024	Embedded Systems Design and Programming	PC	Core	3	-	-	3	30	70	100
AEE019	Hybrid Electric Vehicles	PC	Core	3	-	-	3	30	70	100
	Professional Elective - IV Available and Selected MOOC Courses	PE	Elective	3	-	-	3	30	70	100
PRACTICAL										
AEE401	Comprehensive Examination	PC	Skill	-	-	-	1	-	100	100
AEE302	Project Work (Phase - II)	PC	Core	-	-	4	10	30	70	100
TOTAL				**09**	**00**	**04**	**20**	**120**	**380**	**500**

PROFESSIONAL ELECTIVES

GROUP - I: POWER SYSTEMS ENGINEERING

Course Code	Course Title
AEE501	Real Time Control of Power Systems
AEE502	Power System Transients
AEE503	Energy Audit and Management
AEE504	Extra High Voltage AC Transmission
AEE505	Advanced Power System Protection

GROUP - II: POWER ELECTRONICS

Course Code	Course Title
AEE506	Power Electronics for Renewable Energy Systems
AEE507	Power Electronic Applications in Power Systems
AEE508	Power Electronics and Distributed Generation
AEE509	Power Quality
AEE510	Micro / Nano Processing Technology

GROUP - III: POWER SYSTEMS CONTROL

Course Code	Course Title
AEE511	Industrial Automation and Control
AEE512	Motion Control
AEE513	Power Systems Stability
AEE514	Solid State Relays
AEE515	Smart Grid Technology

GROUP - IV: CONTROL SYSTEMS AND INDUSTRIAL ELECTRONICS

Course Code	Course Title
AEE516	Power Plant Control and Instrumentation
AEE517	Distributed Control and Communication Networks
AEE518	Industrial Electronics
AEE519	Digital Image Processing
AEE520	Modern Control Theory

GROUP - V: ADVANCED POWER SYSTEMS

Course Code	Course Title
AEE521	Electrical Insulation in Power Apparatus and Systems
AEE522	Energy Management Systems and SCADA
AEE523	Illumination Engineering
AEE524	Flexible Alternating Current Transmission Systems
AEE525	HVDC Transmission

GROUP - VI: ADVANCED ELECTRICAL ENGINEERING

Course Code	Course Title
AEE526	Special Electrical Machines
AEE527	Advanced Control Systems
AEE528	Modeling and Analysis of Electrical Machines
AEE529	Electromagnetics and Applications
AEE530	Digital Control Systems

OPEN ELECTIVE-I

Course Code	Course Title
AME551	Elements of Mechanical Engineering
ACE551	Disaster Management
ACE552	Geospatial Techniques
ACS551	Principles of Operating System
ACS552	JAVA Programming
AEC551	Embedded System Design
AME552	Introduction to Automobile Engineering
AME553	Introduction to Robotics
AAE551	Aerospace Propulsion and Combustion
Note: * indicates that subject not offered to the students of Electrical and Electronics Engineering department.	

OPEN ELECTIVES- II

Course Code	Course Title
AEC552	Fundamentals of Image Processing
ACS553	Fundamentals of Database Management Systems
AIT551	Basics of Information Security and Cryptography
AHS551	Modeling and Simulation
AHS552	Research Methodologies
AEE551	Energy from Waste*
AAE552	Finite Element Analysis
AME554	Basic Refrigeration and Air-Conditioning
AAE553	Launch Vehicles and Controls
Note: * indicates that subject not offered to the students of Electrical and Electronics Engineering department	

AUDIT COURSES

Course Code	Course Title
AHS601	Intellectual Property Rights
AHS602	Total Quality Management
AHS603	Professional Ethics and Human Values
AHS604	Legal Sciences
AHS605	Clinical Psychology
AHS606	English for Special Purposes
AHS607	Entrepreneurship
AHS608	Any Foreign Language
AHS609	Design History
AHS017	Gender Sensitivity

VALUE ADDED COURSES - I

Course Code	Course Title
AEE801	Embedded Programming Using Aurdino / Raspberry PI
AEE802	Course on Solar Energy
AEC802	IoT & Applications
AEC803	Artificial Intelligence

VALUE ADDED COURSES - II

Course Code	Course Title
AEE805	Distributed Generation and Microgrid
AEC806	Nano Technology
AEE806	Optimization In Electrical Engineering
AEE807	Electrical Safety Engineering

SYLLABUS
(Semesters: I - VIII)

LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

<table>
<tr><td colspan="10">I Semester: Common for all Branches</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AHS002</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Analyze and solve linear system of equations by using elementary transformations.
II. Apply differential equations on real time applications
III. Determine the maxima and minima of functions of several variables by using partial differential coefficients.

UNIT - I	THEORY OF MATRICES	Classes: 08

Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew-Hermitian and unitary matrices; Elementary row and column transformations, elementary matrix, finding rank of a matrix by reducing to Echelon form and normal form; Finding the inverse of a matrix using elementary row/column transformations: Gauss-Jordan method; Solving of linear system of equations by LU decomposition method.

UNIT - II	LINEAR TRANSFORMATIONS	Classes: 10

Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Linear transformation; Eigen values and Eigen vectors of a matrix; Properties of Eigen values and Eigen vectors of real and complex matrices; Diagonalization of matrix.

UNIT - III	DIFFERENTIAL EQUATIONS OF FIRST ORDER AND THEIR APPLICATIONS	Classes: 08

Solution of first order linear differential equations by exact, non exact, linear equations; Bernoulli equation.

Applications of first order differential equations: Orthogonal trajectories; Newton's law of cooling; Law of natural growth and decay.

UNIT - IV	HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS	Classes: 10

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 $f(x) = x^n, e^{ax}v(x), x^n v(x)$; Method of variation of parameters; Applications to electrical circuits and simple harmonic motion.

UNIT - V	FUNCTIONS OF SINGLE AND SEVERAL VARIABLES	Classes: 09
Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, chain rule, total derivative, Euler's theorem, functional dependence, Jacobian, maxima and minima of functions of two variables without constraints and with constraints; Method of Lagrange multipliers.		
Text Books:		
1. E Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014. 2. B S Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013.		
Reference Books:		
1. R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016. 2. Ravish R Singh, Mukul Bhatt, "Engineering Mathematics-1", Tata McGraw-Hill Education, 1st Edition, 2009. 3. Srimanthapal, Suboth C. Bhunia, "Engineering Mathematics", Oxford Publishers, 3rd Edition, 2015.		
Web References:		
1. https://www.efunda.com/math/math_home/math.cfm 2. https://www.ocw.mit.edu/resources/#Mathematics 3. https://www.sosmath.com/ 4. https://www.mathworld.wolfram.com/		
E-Text Books:		
1. https://www.e-booksdirectory.com/details.php?ebook=10166 2. https://www.e-booksdirectory.com/details.php?ebook=7400re		
Course Home Page:		

COMPUTATIONAL MATHEMATICS AND INTEGRAL CALCULUS

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

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS003	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of solving algebraic, transcendental and differential equation by numerical methods.
II. Apply multiple integration to evaluate mass, area and volume of the plane.
III. Analyze gradient, divergence and curl to evaluate the integration over a vector field.
IV. Understand the Bessel's equation to solve them under special conditions with the help of series solutions.

UNIT - I	ROOT FINDING TECHNIQUES AND INTERPOLATION	Classes: 09

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

UNIT - II	CURVE FITTING AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	Classes: 08

Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares; Taylor's series method; Step by step methods: Euler's method, modified Euler's method and Runge-Kutta method for first order differential equations.

UNIT - III	MULTIPLE INTEGRALS	Classes: 10

Double and triple integrals: Change of order of integration.

Transformation of coordinate system: Finding the area of a region using double integration and volume of a region using triple integration.

UNIT - IV	VECTOR CALCULUS	Classes: 08

Scalar and vector point functions: Gradient, divergence, curl and their related properties; Solenoidal and irrotational vector point functions; Scalar potential function; Laplacian operator; Line integral, surface integral and volume integral; Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.

UNIT - V	SPECIAL FUNCTIONS	Classes: 10
Gamma function, properties of gamma function; Ordinary point and regular singular point of differential equations; Series solutions to differential equations around zero, Frobenius method about zero; Bessel's differential equation: Bessel functions properties, recurrence relations, orthogonality, generating function, trigonometric expansions involving Bessel functions.		
Text Books:		
1. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014. 2. B S Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.		
Reference Books:		
1. R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016. 2. S S Sastry, "Introduction Methods of Numerical Analysis", Prentice-Hall of India Private Limited, 5th Edition, 2012.		
Web References:		
1. https://www.efunda.com/math/math_home/math.cfm 2. https://www.ocw.mit.edu/resources/#Mathematics 3. https://www.sosmath.com/ 4. https://www.mathworld.wolfram.com		
E-Text Books:		
1. https://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html 2. https://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks		
Course Home Page:		

ENGINEERING PHYSICS

I Semester: CSE / ECE / EEE / IT								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS006	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Develop strong fundamentals of nanomaterials.
II. Meliorate the knowledge of theoretical and technological aspects of lasers.
III. Correlate principles with applications of the quantum mechanics, dielectric and magnetic materials.
IV. Enrich knowledge in modern engineering materials like semiconductors.

UNIT - I	DIELECTRIC AND MAGNETIC PROPERTIES	Classes: 09

Dielectric properties: Basic definitions, electronic, ionic and orientation polarizations-qualitative; Internal field in solids; Magnetic properties: Basic definitions, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, domain theory of ferro magnetism on the basis of hysteresis curve.

UNIT - II	LASERS	Classes: 09

Lasers: Characteristics of lasers, spontaneous and stimulated emission of radiation, metastable state, population inversion, lasing action, Einstein's coefficients, ruby laser, He-Ne laser, semiconductor diode laser and applications of lasers.

UNIT - III	NANOMATERIAL	Classes: 09

Nanomaterial: Origin of nanomaterial, nano scale, surface to volume ratio, quantum confinement; Properties of nanomaterials: Physical, chemical, electrical, optical, magnetic and mechanical.

Bottom-up fabrication: Sol-gel; Top-down fabrication: Chemical vapour deposition; Applications of nanomaterials, characterization by XRD, TEM.

UNIT - IV	QUANTUM MECHANICS	Classes: 09

Quantum mechanics: Waves and particles, De Broglie hypothesis, matter waves, Heisenberg's uncertainty principle, Davisson and Germer experiment, Schrodinger's time independent wave equation, physical significance of the wave function, infinite potential well and its extension to three dimensions.

UNIT - V	SEMICONDUCTOR PHYSICS	Classes: 09

Semiconductor physics: Fermi level in intrinsic and extrinsic semiconductors, calculation of carrier concentration in intrinsic and extrinsic semiconductors, energy gap, direct and indirect band gap semiconductors, Hall effect.

Text Books:
1. Dr. K Vijaya Kumar, Dr. S Chandralingam, “Modern Engineering Physics”, S Chand & Co., New Delhi, 1st Edition, 2010. 2. P K Palanisamy, “Engineering Physics”, Scitech Publishers, 4th Edition, 2014.
Reference Books:
1. Rajendran, “Engineering Physics”, Tata McGraw-Hill Book Publishers, 1st Edition, 2010. 2. R K Gaur, S L Gupta, “Engineering Physics”, Dhanpat Rai Publications, 8th Edition, 2001. 3. A J Dekker, “Solid State Physics”, Macmillan India ltd, 1st Edition, 2000. 4. Hitendra K Malik, A K Singh, “Engineering Physics”, McGraw-Hill Education, 1st Edition, 2009.
Web References:
1. https://www.link.springer.com/book 2. https://www.thphys.physics.ox.ac.uk 3. https://www.sciencedirect.com/science 4. https://www.e-booksdirectory.com
E-Text Books:
1. https://www.peaceone.net/basic/Feynman 2. https://www.physicsdatabase.com/free-physics-books 3. https://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf 4. https://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html
Course Home Page:

ENGINEERING CHEMISTRY

I Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS005	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 electrochemical principles in batteries.
II. Understand the fundamentals of corrosion and development of different techniques in corrosion control.
III. Analysis of water for its various parameters and its significance in industrial applications.
IV. Improve the fundamental science and engineering principles relevant to materials.

UNIT - I	ELECTROCHEMISTRY AND BATTERIES	Classes: 10

Electrochemistry: Basic concepts of electrochemistry; Conductance: Specific, equivalent and molar conductance and effect of dilution on conductance; Electrochemical cells: Galvanic cell (daniel cell); Electrode potential; Electrochemical series and its applications; Nernst equation; Types of electrodes: Calomel electrode, quinhydrone electrode; Batteries: Classification of batteries, primary cells (dry cells) and secondary cells (lead-acid battery, Ni-Cd cell), applications of batteries, numerical problems.

UNIT - II	CORROSION AND ITS CONTROL	Classes: 08

Corrosion: Introduction, causes and effects of corrosion; Theories of corrosion: Chemical and electrochemical corrosion with mechanism; Factors affecting the rate of corrosion: Nature of the metal and nature of the environment; Types of corrosion: Waterline and crevice corrosion; Corrosion control methods: Cathodic protection- sacrificial anodic protection and impressed current cathodic protection; Surface coatings: Metallic coatings, methods of application of metallic coatings-hot dipping(galvanizing, tinning), electroplating(copper plating); Organic coatings: Paints, its constituents and their functions.

UNIT - III	WATER TECHNOLOGY	Classes: 09

Water: Sources and impurities of water, hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems; Estimation of temporary and permanent hardness of water by EDTA method; Determination of dissolved oxygen by Winkler's method; Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement.

Treatment of water: Internal treatment of boiler feed water- carbonate, calgon and phosphate conditioning, softening of water by Zeolite process and Ion exchange process; Potable water-its specifications, steps involved in the treatment of potable water, sterilization of potable water by chlorination and ozonization, purification of water by reverse osmosis process.

UNIT - IV	MATERIALS CHEMISTRY	Classes: 10

Materials chemistry: Polymers-classification with examples, polymerization-addition, condensation and co-polymerization; Plastics: Thermoplastics and thermosetting plastics; Compounding of plastics; Preparation, properties and applications of polyvinyl chloride, Teflon, Bakelite and Nylon-6, 6; Rubbers:

Natural rubber its process and vulcanization; Elastomers: Buna-s and Thiokol rubber; Fibers: Characteristics of fibers, preparation properties and applications of Dacron; Characteristics of fiber reinforced plastics; Cement: Composition of Portland cement, setting and hardening of Portland cement; Lubricants: Classification with examples; Properties: Viscosity, flash, fire, cloud and pour point; Refractories: Characteristics and classification with examples.		
UNIT - V	**FUELS AND COMBUSTION**	**Classes: 08**
Fuel: 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, 15th Edition, 2015.
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 1st Edition, 2011.

Reference Books:

1. B Siva Shankar, "Engineering Chemistry", Tata McGraw-Hill Publishing Limited, 3rd Edition, 2015.
2. S S Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co., New Delhi, 12th Edition, 2006.
3. C V Agarwal, C P Murthy, A Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.
4. R P Mani, K N Mishra, "Chemistry of Engineering Materials", Cengage Learning, 3rd Edition, 2015.

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

E-Text Books:

1. https://www.Corrosion.ksc.nasa.gov/electrochem_cells.htm
2. https://www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html
3. https://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html
4. https://www.darvill.clara.net/altenerg/fossil.htm
5. https://www.Library.njit.edu/research helpdesk/subject guides/chemistry.php

Course Home Page:

COMPUTER PROGRAMMING

I Semester: CSE / ECE / EEE / IT | II Semester: AE / CE / ME									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
ACS001	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		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 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.

UNIT-I	INTRODUCTION	Classes: 10

Introduction to computers: Computer systems, computing environments, computer languages, creating and running programs, algorithms, flowcharts; Introduction to C language: 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: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associativity, evaluation of expressions, type conversions in expressions, formatted input and output.

UNIT-II	CONTROL STRUCTURES, ARRAYS AND STRINGS	Classes: 10

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements; Arrays: Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi dimensional arrays; Strings concepts: String handling functions, array of strings.

UNIT-III	FUNCTIONS AND POINTERS	Classes: 09

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 directives.

Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers.

UNIT-IV	STRUCTURES AND UNIONS	Classes: 08

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; Dynamic memory allocation: Basic concepts, library functions.

UNIT-V	FILES	Classes: 08
Files: Streams, basic file operations, file types, file opening modes, file input and output functions, file status functions, file positioning functions, command line arguments.		

Text Books:

1. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
2. B. A. Forouzan, R. F. Gillberg, "C Programming and Data Structures", Cengage Learning, India, 3rd Edition, 2014.

Reference Books:

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

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. https://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

Course Home Page:

ENGINEERING PHYSICS AND CHEMISTRY LABORATORY

I Semester: CSE / ECE / EEE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS104	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Elevate practical knowledge to understand technological aspects of LED, energy gap and solar cell.
II. Enrich real-time application aspect of R-C, magnetic field intensity and numerical aperture of optical fiber.
III. Enlighten the phenomenon of instrumentation, physical properties and preparations.

LIST OF EXPERIMENTS

Expt. 1	**INTRODUCTION TO PHYSICS/CHEMISTRY LABORATORY**

Introduction to physics/chemistry laboratory. Do's and Don'ts in physics/chemistry laboratory.

Expt. 2	**PHY: LED AND LASER CHARACTERISTICS, CHE: VOLUMETRIC ANALYSIS**

Batch I: Characteristics of LED and LASER.
Batch II: Estimation of hardness of water by EDTA method.

Expt. 3	**CHE: VOLUMETRIC ANALYSIS, PHY: LED AND LASER CHARACTERISTICS**

Batch I: Estimation of hardness of water by EDTA method.
Batch II: Characteristics of LED and LASER.

Expt. 4	**PHY: STEWART GEE'S METHOD, CHE: INSTRUMENTATION**

Batch I: Magnetic field along the axis of current carrying coil-Stewart and Gee's method.
Batch II: Conduct to metric titration of strong acid vs strong base.

Expt. 5	**CHE: INSTRUMENTATION, PHY: STEWART GEE'S METHOD**

Batch I: Conduct to metric titration of strong acid vs strong base.
Batch II: Magnetic field along the axis of current carrying coil-Stewart and Gee's method.

Expt. 6	**PHY: SOLAR CELL, CHE: INSTRUMENTATION**

Batch I: Study of characteristics of solar cell.
Batch II: Potentiometric titration of strong acid vs strong base.

Expt. 7	**CHE: INSTRUMENTATION, PHY: SOLAR CELL**
Batch I: Potentiometric titration of strong acid vs strong base. Batch II: Study of characteristics of solar cell.	
Expt. 8	**PHY: R C CIRCUIT, CHE: INSTRUMENTATION**
Batch I: Time constant of an R C circuit. Batch II: Determination of P^H of a given solution by P^H meter.	
Week-9	**CHE: INSTRUMENTATION, PHY: R C CIRCUIT**
Batch I: Determination of P^H of a given solution by P^H meter. Batch II: Time constant of an R C circuit.	
Expt. 10	**PHY: OPTICAL FIBER, CHE: PHYSICAL PROPERTIES**
Batch I: Evaluation of numerical aperture of given fiber. Batch II: Determination of surface tension and viscosity of lubricants.	
Expt. 11	**CHE: PHYSICAL PROPERTIES, PHY: OPTICAL FIBER**
Batch I: Determination of surface tension and viscosity of lubricants. Batch II: Evaluation of numerical aperture of given fiber.	
Expt. 12	**PHY: ENERGY GAP, CHE: PREPARATION OF ORGANIC COMPOUNDS**
Batch I: Estimating energy gap of given semiconductor diode. Batch II: Preparation of Aspirin and Thiokol rubber.	
Expt. 13	**CHE: PREPARATION OF ORGANIC COMPOUNDS, PHY: ENERGY GAP**
Batch I: Preparation of Aspirin and Thiokol rubber. Batch II: Estimating energy gap of given semiconductor diode.	
Expt. 14	**REVISION**
Revision.	

Reference Books:

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.
3. Vogel's, "Quantitative Chemical Analysis", Prentice Hall, 6th Edition, 2000.
4. Gary D. Christian, "Analytical Chemistry", Wiley Publications, 6th Edition, 2007.

Web Reference:

1. http://www.iare.ac.in

Course Home Page:

LIST OF PHYSICS LABORATORY EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S.No	Name of the Component	Qty	Range
1	LED circuit	10	I/P 0-10V DC, Resistors 1k Ω-4kΩ
2	Digital ammeter	10	Digital Meter DC 0-20mA
3	Digital voltmeter	10	Digital Meter DC 0-20V
4	Probes	30	Dia - 4mm
5	Stewart and Gees's set	10	Coil 2, 50, 200 turns
6	DC Ammeter	10	Digital Meter DC 0-20V
7	Battery eliminator	10	DC 2Amps
8	Solar cell Kit with panel	10	XL-10
9	Bulb	20	0 – 100W, 230V
10	Numerical aperture kit	10	Optical power meter 660nm
11	RC Circuit	10	I/P 15V, Voltmeter 0-20V, Ammeter 0-2000mA, Resistors 4K7- 100K Ω, Capacitors 0.047-2200µF
12	Stop clock	20	+/- 1s
13	Energy gap	10	Heating element - 35W, E_g = 0.2-0.4eV I/P 0-10V, Ammeter 0-200µA
14	Laser diode circuit	10	I/P 0-10V DC, Resistors 1k Ω-4K Ω

LIST OF CHEMISTRY LABORATORY EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S.No	Name of the Apparatus	Quantity of the apparatus	Total numbers of apparatus required
1	Analytical balance	100 gm	04
2	Beaker	100 ml	30
3	Burette	50 ml	30
4	Burette Stand	Metal	30
5	Clamps with Boss heads	Metal	30
6	Conical Flask	250 ml	30
7	Conductivity cell	K=1	05
8	Calomel electrode	Glass	06
9	Digital Potentiometer	EI	05
10	Digital Conductivity meter	EI	05
11	Digital electronic balance	RI	01
12	Distilled water bottle	500 ml	30
13	Funnel	Small	30
14	Glass rods	20 cm length	30
15	Measuring Cylinders	10 ml	10
16	Oswald Viscometer	Glass	30
17	Pipette	20 ml	30
18	Platinum Electrode	PP	05
19	Porcelain Tiles	White	30
20	Reagent bottle	250 ml	30
21	Standard Flask	100 ml	30
22	Stalagmo meter	Glass	30
23	Digital P^H meter	P^H 0-14	05

COMPUTER PROGRAMMING LABORATORY

<table>
<tr><td colspan="9">I Semester: Common for CSE / ECE / EEE / IT | II Semester: Common for AE / CE / ME</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">ACS101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 36</td><td colspan="3">Total Classes: 36</td></tr>
</table>

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

Expt. 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)

Expt. 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 the sequence.
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 profit or loss incurred in percentage.

Expt. 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
```

Expt. 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.

Expt. 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 1 if S doesn't contain T.

Expt. 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.

Expt. 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.

Expt. 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.

Expt. 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 to 400.

Expt. 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 15 meters.
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.

Expt. 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.

Expt. 12	COMMAND LINE ARGUMENTS

a. Write a C program to read arguments at the command line and display it.
b. Write a C program to read two numbers at the command line and perform arithmetic operations on it.
c. Write a C program to read a file name at the command line and display its contents.

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 K N, “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. https://www.sanfoundry.com/c-programming-examples
2. https://www.geeksforgeeks.org/c
3. https://www.cprogramming.com/tutorial/c
4. https://www.cs.princeton.edu

Course Home Page:

COMPUTER AIDED ENGINEERING DRAWING

I Semester: CSE / ECE / EEE / IT								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME103	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of engineering drawing.
II. Understand the construction of scales.
III. Apply the knowledge of interpretation of dimensions of different quadrant projections.
IV. Convert the pictorial views into orthographic views and vice versa.
V. Create intricate details of components through sections and to develop its surfaces.

UNIT-I	**INTRODUCTION TO ENGINEERING DRAWING AND AUTOCAD**	**Classes : 06**

Introduction to engineering drawing: Introduction to engineering drawing**,** drawing instruments and accessories, types of lines, lettering practice and rules of dimensioning, geometrical constructions, basic geometrical shapes; Introduction to AutoCAD familiarization of graphical user interface, toggle functional keys and tool bars; Drawing of closed form entities like line, circle, ellipse, polygon; Lettering and standard drawing templates.

UNIT-II	**DRAFTING AND MODELING COMMANDS**	**Classes : 06**

Drafting and modeling commands: Geometric commands, layers, display control command, editing, dimensioning and solid modeling.

UNIT-III	**ORTHOGRAPHIC PROJECTION**	**Classes : 06**

Orthographic projection: Principles of orthographic projections, conventions, first and third angle projections.

Projection of points, straight lines, planes and regular solid, prisms, cylinders, pyramids and cones.

UNIT-IV	**ISOMETRIC PROJECTIONS**	**Classes : 06**

Isometric projections: Principle of isometric projection, isometric scale, isometric projections and isometric views, isometric projections of solids.

UNIT-V	**TRANSFORMATION OF PROJECTIONS**	**Classes : 06**

Transformation of projections: Conversion of isometric views to orthographic views and conversion of orthographic views to isometric views.

Text Books:

1. N D Bhatt, "Engineering Drawing", Charotar Publications, 49th Edition, 2012.
2. C. M. Agrawal, Basant Agrawal, "Engineering Drawing'', Tata McGraw-Hill, 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. https://www.nptel.ac.in/courses/112103019/ 2. https://www.autocadtutorials.net/ 3. https://www.grabcad.com/questions/tutorial-16-for-beginner-engineering-drawing-1
E-Text Book:
1. https://www.books.google.co.in/books?id=VRN7e09Rq0C&pg=PA9&source=gbs_toc_r&cad =4#v=onepage&q&f=false
Course Home Page:

COMPUTATIONAL MATHEMATICS LABORATORY

I Semester: CSE / ECE / EEE / IT								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS102	Foundation	L	T	P	C	CIE	SEE	Total
		-	-	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. Train the students how to approach for solving engineering problems.
II. Understand the concepts of algebra, calculus and numerical solutions using MATLAB software.
III. Enrich the knowledge in MATLAB and can apply for project works.

LIST OF EXPERIMENTS

Expt. l — BASIC FEATURES

a. Features and uses.
b. Local environment setup.

Expt. 2 — ALGEBRA

a. Solving basic algebraic equations.
b. Solving system of equations.
c. Two dimensional plots.

Expt. 3 — CALCULUS

a. Calculating limits.
b. Solving differential equations.
c. Finding definite integral.

Expt. 4 — MATRICES

a. Addition, subtraction and multiplication of matrices.
b. Transpose of a matrix.
c. Inverse of a matrix.

Expt. 5 — SYSTEM OF LINEAR EQUATIONS

a. Rank of a matrix.
b. Gauss Jordan method.
c. LU decomposition method.

Expt. 6 — LINEAR TRANSFORMATION

a. Characteristic equation.
b. Eigen values.
c. Eigen vectors.

Expt. 7	DIFFERENTIATION AND INTEGRATION

a. Higher order differential equations.
b. Double integrals.
c. Triple integrals.

Expt. 8	INTERPOLATION AND CURVE FITTING

a. Lagrange polynomial.
b. Straight line fit.
c. Polynomial curve fit.

Expt. 9	ROOT FINDING

a. Bisection method.
b. Regula false method.
c. Newton Raphson method.

Expt. 10	NUMERICAL DIFFERENTION AND INTEGRATION

a. Trapezoidal, Simpson's method.
b. Euler method.
c. Runge Kutta method.

Expt. 11	3D PLOTTING

a. Line plotting.
b. Surface plotting.
c. Volume plotting.

Expt. 12	VECTOR CALCULUS

a. Gradient.
b. Divergent.
c. Curl.

Reference Books:

1. Cleve Moler, "Numerical Computing with MATLAB", SIAM, Philadelphia, 2^{nd} Edition, 2008.
2. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Taylor & Francis Group, 6^{th} Edition, 2015.

Web Reference:

1. http://www.iare.ac.in

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Microsoft Windows 7 and MATLAB – V 8.5, which is also R2015a

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

ENGLISH FOR COMMUNICATION

<table>
<tr><td colspan="9">II Semester: CSE / ECE / EEE / IT</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td rowspan="2">AHS001</td><td rowspan="2">Foundation</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

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

UNIT-I	LISTENING SKILL	Classes: 08

Significance, essentials, barriers and effectiveness of listening; Listening to dialogues, conversation, discussions, monologues; Listening to sounds, silent letters, stressed syllables in English; Listening for the gist of the text, for identifying the topic, general meaning and specific information; Listening for multiple choice questions, positive and negative comments for interpretation

Note: Instructions in theory and practice in the lab

UNIT-II	SPEAKING SKILL	Classes: 10

Significance, essentials, barriers and effectiveness of speaking; Simple oral or casual interaction, dialogue, conversation; Debates: Differences between disagreeing and being disagreeable; Brief presentations; Role plays; Generating talks based on visual or written prompts; Addressing a small group or a large formal gathering; Speaking about present, past experiences and future plans; Arguing outs a topic without verbal fights; Paper presentation.

Note: Instructions in theory and practice in the lab

UNIT-III	READING SKILL	Classes: 09

Techniques of reading: Skimming, scanning, intensive and extensive reading; Reading comprehension: Exercises for multiple choice questions and contextual meaning – Values in Dr. Kalam.

Vocabulary enrichment and grammar exercises based on selective readings: Swami Vivekananda: Chicago Speech, 1893; Passages for intellectual and emotional comments; Reading for the gist of a text, for specific information, for information transfer and interpretation.

UNIT-IV	WRITING SKILL	Classes: 08

Significance, essentials and effectiveness of writing; Writing emails; Writing paragraphs: Comparing, contrasting, presentations with an introduction, body and conclusion; Writing formal and informal letters: Letter of invitation, accepting, declining, requesting, complaint, seeking information; Cover letter enclosing a CV.

UNIT-V	VOCABULARY AND GRAMMAR	Classes: 10

Punctuation, parts of speech, articles, prepositions, tenses, concords, phrasal verbs; Forms of verbs: Regular and irregular, direct and indirect speech, change of voice; prefixes, suffixes, Synonyms, antonyms, one word substitutes, idioms and phrases, technical vocabulary.

Text Books:

1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles Practices", Oxford University Press, New Delhi, 3rd Edition , 2015.

Reference Books:

1. Norman Whitby, "Business Benchmark: Pre-Intermediate to Intermediate – BEC Preliminary", Cambridge University Press, 2nd Edition, 2008.
2. Devaki Reddy, Shreesh Chaudhary, "Technical English", Macmillan, 1st Edition, 2009.
3. Rutherford, Andrea J, "Basic Communication Skills for Technology", Pearson Education, 2nd Edition, 2010.
4. Raymond Murphy, "Essential English Grammar with Answers" Cambridge University Press, 2nd Edition.

Web References:

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

E-Text Books:

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

Course Home Page:

MATHEMATICAL TRANSFORM TECHNIQUES

II Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS011	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Express non periodic function to periodic function using Fourier series and Fourier transforms.
II. Apply Laplace transforms and Z-transforms to solve differential equations.
III. Formulate and solve partial differential equations.

UNIT-I	**FOURIER SERIES**	**Classes: 09**

Definition of periodic function, determination of Fourier coefficients; Fourier expansion of periodic function in a given interval of length 2π; Fourier series of even and odd functions; Fourier series in an arbitrary interval; Half- range Fourier sine and cosine expansions.

UNIT-II	**FOURIER TRANSFORMS**	**Classes: 09**

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

UNIT-III	**LAPLACE TRANSFORMS**	**Classes: 09**

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.

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.

UNIT-IV	**Z –TRANSFORMS**	**Classes:09**

Z-transforms: Elementary properties, inverse Z-transform, convolution theorem, formation and solution of difference equations.

UNIT-V	**PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS**	**Classes: 09**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method; Charpit's method; method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.

Text Books:

1. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10th Edition, 2010.
2. B S Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013.

Reference Books:
1. S S Sastry, “Introduction methods of numerical analysis”, Prentice-Hall of India Private Limited, 5th Edition, 2005 2. G. Shanker Rao, “Mathematical Methods”, I. K. International Publications, 1st Edition, 2011.
Web References:
1. https://www.efunda.com/math/math_home/math.cfm 2. https://www.ocw.mit.edu/resources/#Mathematics 3. https://www.sosmath.com/ 4. https://www.mathworld.wolfram.com/
E-Text Books:
1. https://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook- download.html 2. https://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks
Course Home Page:

ENVIRONMENTAL STUDIES

II Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS009	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. 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.

UNIT-I	ENVIRONMENT AND ECOSYSTEMS	Classes: 08

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.

UNIT-II	NATURAL RESOURCES	Classes: 08

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.

UNIT-III	BIODIVERSITY AND BIOTIC RESOURCES	Classes: 10

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.

UNIT-IV	ENVIRONMENTAL POLLUTION, POLLUTION CONTROL TECHNOLOGIES AND GLOBAL ENVIRONMENTAL PROBLEMS	Classes: 10

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; International conventions / protocols: Earth summit, Kyoto protocol and Montreal protocol.

UNIT-V	ENVIRONMENTAL LEGISLATIONS AND SUSTAINABLE DEVELOPMENT	Classes: 09

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, 1st Edition, 200 6. 2. Erach Bharucha, “Textbook of Environmental Studies for Under Graduate Courses”, Orient Black Swan, 2nd Edition, 2013. 3. Dr. P. D Sharma, “Ecology and Environment”, Rastogi Publications, New Delhi, 12th Edition, 2015.
Reference Books:
1. Tyler Miller, Scott Spoolman, “Environmental Science”, Cengage Learning, 14th Edition, 2012. 2. Anubha Kaushik, “Perspectives in Environmental Science”, New Age International, New Delhi, 4th Edition, 2006. 3. Gilbert M. Masters, Wendell P. Ela, “Introduction to Environmental Engineering and Science, Pearson, 3rd Edition, 2007.
Web References:
1. https://www.elsevier.com 2. https://www. libguides.lib.msu.edu 3. https://www.fao.org 4. https://www nrc.gov 5. https://www istl.org 6. https://www.ser.org 7. https://www.epd.gov. 8. https://www.nptel.ac.in
E-Text Books:
1. http://www.ilocis.org 2. http://www.img.teebweb.org 3. http://www.ec.europa.eu 4. http://www.epa.ie 5. http://www.birdi.ctu.edu.vn
Course Home Page:

DATA STRUCTURES

II Semester: CSE / ECE / EEE / IT								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS002	Foundation	L	T	P	C	CIA	SEE	Total
		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 basic techniques of algorithm analysis.
II. Demonstrate several searching and sorting algorithms.
III. Implementation of linear data structure mechanisms.
IV. Demonstrate various tree and graph traversal algorithms.
V. Analyze and choose appropriate data structure to solve problems in real world.

UNIT-I	INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING	Classes: 10
Basic concepts: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms; Searching techniques: Linear search, binary search and Fibonacci search; Sorting techniques: Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.		
UNIT-II	**LINEAR DATA STRUCTURES**	**Classes: 10**
Stacks: Primitive operations, implementation of stacks using Arrays, applications of stacks arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Array, applications of linear queue, circular queue and double ended queue (deque).		
UNIT-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, linked list representation and operations of queue.		
UNIT-IV	**NON LINEAR DATA STRUCTURES**	**Classes: 08**
Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary search tree, tree variants, application of trees; Graphs: Basic concept, graph terminology, graph implementation, graph traversals, Application of graphs, Priority Queue.		
UNIT-V	**BINARY TREES AND HASHING**	**Classes: 08**
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. Mark A. Weiss, “Data Structures and Algorithm Analysis in C”, Pearson, 2nd Edition, 1996. 2. Ellis Horowitz, Satraj Sahni, Susan Anderson Freed, “Fundamentals of Data Structures in C”, Universities Press, 2nd Edition, 2008.
Reference Books:
1. Reema Thareja, “Data Structures using C”, Oxford University Press, 2nd Edition, 2014. 2. S. Lipschutz, “Data Structures”, Tata McGraw-Hill Education, 1st Edition, 2008. 3. D. Samanta, “Classic Data Structures”, PHI Learning, 2nd Edition, 2004. 4. Tanenbaum, Langsam, Augenstein, “Data Structures Using C”, Pearson, 1st Edition, 2003.
Web References:
1. https://www.tutorialspoint.com/data_structures_algorithms 2. https://www.geeksforgeeks.org/data-structures/ 3. https://www.studytonight.com/data-structures/ 4. https://www.coursera.org/specializations/data-structures-algorithms
E-Text Books:
1. https://www.scribd.com/doc/268924096/c-Data-Structures-Balaguruswamy-eBook 2. https://www.safaribooksonline.com/library/view/data-structures-using/9789332524248/ 3. https://www.amazon.com/Data-Structures-C-Noel-Kalicharan/dp/1438253273 4. https://www.scribd.com/doc/40147240/Data-Structures-Using-c-by-Aaron-m-Tenenbaum-946
Course Home Page:

ELECTRICAL CIRCUITS

<table>
<tr><td colspan="11">II Semester: EEE / ECE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE002</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

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. Apply network theorems to obtain the equivalent circuit of electrical networks.

UNIT - 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.

UNIT - 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.

UNIT - III	SINGLE PHASE AC CIRCUITS	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 of RL and RC circuits (in series, parallel and series parallel combinations) sinusoidal excitation.

Steady state analysis of RLC circuits (in series, parallel and series parallel combinations) with sinusoidal excitation, concept of power, real, reactive and complex power, power factor.

UNIT - IV	RESONANCE AND MAGNETIC CIRCUITS	Classes: 08

Resonance: Series and parallel resonance, concept of band width and Q factor; Magnetic circuits: Faraday's laws of electromagnetic induction, analysis of series and parallel magnetic circuits, composite magnetic circuits, coupled coils, concept of self and mutual inductance, dot convention, coefficient of coupling, multi winding analysis.

UNIT - V	NETWORK THEOREMS (AC AND DC)	Classes: 09

Zero current theorem, Tellegen's, superposition, reciprocity, voltage shift theorem, Thevinin's, Norton's, maximum power transfer, Milliman's and compensation theorems for DC and AC excitations.

Text Books:

1. A Chakrabarthy, "Electric Circuits", Dhanipat Rai & Sons, 6th Edition, 2010.
2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010.
3. 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.

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

Course Home Page:

COMMUNICATION SKILLS LABORATORY

II Semester: CSE / ECE / EEE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS101	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	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 EXPERIMENTS

Expt. 1 LISTENING SKILL

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

Expt. 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, British and American speakers to analyze intercultural differences.

Expt. 3 SPEAKING SKILL

a. Functions of English Language; Introduction to phonetics, exercises on pronunciation, symbols of phonetics.
b. Speaking exercises involving the use of stress and intonation, improving pronunciation through tongue twisters.
c. Tips on how to develop fluency, body language and communication; Introducing oneself: Talking about yourself others, leave taking.

Expt. 4 SPEAKING SKILL

a. Just a minute (JAM) sessions, public speaking, situational conversation/role-play.
b. Greetings for different occasions with feedback preferably through video recording; Speaking about present, past experiences and future plans; Acting as a compere and news reader.

Expt. 5 READING SKILL

a. Reading anecdotes to predict the content, reading for interpretation.
b. Suggested reading: Short stories and poem; Critical reading.

Expt. 6	**READING SKILL**
a. Reading for information transfer; Reading newspaper and magazine articles, memos, letters, notices and minutes for critical commentary. b. Reading selective autobiographies.	
Expt. 7	**READING SKILL**
a. Reading brochures, advertisements, pamphlets for improved presentation. b. Reading comprehension exercises with critical and analytical questions based on context.	
Expt. 8	**WRITING SKILL**
a. Writing messages, leaflets, notice; Writing tasks; Flashcard. b. Filling gaps while listening short stories.	
Expt. 9	**WRITING SKILL**
a. Write a slogan related to the image. b. Write a short story of 6-10 lines based on the hints given.	
Expt. 10	**WRITING SKILL**
a. Writing a short story on their own; Writing a review on: Video clippings on inspirational speeches. b. Writing a review on short films, advertisements, recipe and recently watched film.	
Expt. 11	**THINKING SKILL**
a. Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms, proverbs. b. Argumentative skills; Debates.	
Expt. 12	**THINKING SKILL**
a. Inculcating interest in English using thinking blocks. b. Making pictures and improvising diagrams to form English words, phrases and proverbs.	
Reference Books:	
1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles Practices", Oxford University Press, New Delhi, 3rd Edition, 2015. 2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009.	
Web References:	
1. https://www.learnenglish.britishcouncil.org 2. https://www.esl-lab.com/ 3. https://www.elllo.org/	
Course Home Page:	

DATA STRUCTURES LABORATORY

II Semester: CSE / ECE / EEE / IT								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS102	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	3	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. Implement linear and non linear data structures.
II. Analyze various algorithms based on their time complexity.
III. Choose appropriate data structure and algorithm design method for a specific application.
IV. Identify suitable data structure to solve various computing problems.

LIST OF EXPERIMENTS

Expt. 1 SEARCHING TECHNIQUES

Write C programs for implementing the following searching techniques.
a. Linear search.
b. Binary search.
c. Fibonacci search.

Expt. 2 SORTING TECHNIQUES

Write C 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.

Expt. 3 SORTING TECHNIQUES

Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order.
a. Quick sort.
b. Merge sort.

Expt. 4 IMPLEMENTATION OF STACK AND QUEUE

Write C programs to
a. Design and implement Stack and its operations using Arrays.
b. Design and implement Queue and its operations using Arrays

Expt. 5 APPLICATIONS OF STACK

Write C programs for the following:
a. Uses Stack operations to convert infix expression into postfix expression.
b. Uses Stack operations for evaluating the postfix expression.

Expt. 6	IMPLEMENTATION OF SINGLE LINKED LIST
Write C programs for the following: a. Uses functions to perform the following operations on single linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal b. To store a polynomial expression in memory using linked list.	
Expt. 7	**IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST**
Write C programs for the following: Uses functions to perform the following operations on Circular linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal	
Expt. 8	**IMPLEMENTATION OF DOUBLE LINKED LIST**
Write C programs for the following: Uses functions to perform the following operations on double linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.	
Expt. 9	**IMPLEMENTATION OF STACK USING LINKED LIST**
Write C programs to implement stack using linked list.	
Expt. 10	**IMPLEMENTATION OF QUEUE USING LINKED LIST**
Write C programs to implement queue using linked list.	
Expt. 11	**GRAPH TRAVERSAL TECHNIQUES**
Write C programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.	
Expt. 12	**IMPLEMENTATION OF BINARY SEARCH TREE**
Write a C program that uses functions 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.	

Reference Books:

1. Kernighan Brian W, Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India, Re-Print, 2008.
2. Balagurusamy E, "Programming in ANSI C", Tata McGraw-Hill, 6th Edition, 2008.
3. Gottfried Byron, "Schaum's Outline of Programming with C", Tata McGraw-Hill, 1st Edition, 2010.
4. Lipschutz Seymour, " Data Structures Schaum's Outlines Series", Tata McGraw-Hill, 3rd Edition, 2014.
5. Horowitz Ellis, Satraj Sahni, Susan Anderson, Freed, "Fundamentals of Data Structures in C", W. H. Freeman Company, 2nd Edition, 2011.

Web References:

1. https://www.tutorialspoint.com/data_structures_algorithms
2. https://www.geeksforgeeks.org/data-structures/
3. https://www.studytonight.com/data-structures/
4. https://www.coursera.org/specializations/data-structures-algorithms

Course Home Page:

ELECTRICAL CIRCUITS LABORATORY

<table>
<tr><td colspan="10">II Semester: ECE / EEE</td></tr>
<tr><th rowspan="1">Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEE102</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Implement different circuits and verify circuit concepts.
II. Study the concepts of mesh and nodal analysis in electrical circuits.
III. Design electric circuits to verify network theorems.
IV. Gain knowledge about resonance and magnetic circuits.

LIST OF EXPERIMENTS

Expt. 1	**KIRCHOFF'S LAWS**
Verification of Kirchhoff's current law and voltage law using hardware and digital simulation.	
Expt. 2	**MESH ANALYSIS**
Verification of mesh analysis using hardware and digital simulation.	
Expt. 3	**NODAL ANALYSIS**
Verification of nodal analysis using hardware and digital simulation.	
Expt. 4	**SINGLE PHASE AC CIRCUITS**
Determination of average value, RMS value, form factor, peak factor of sinusoidal wave, square wave using hardware and digital simulation.	
Expt. 5	**SUPERPOSITION THEOREM**
Verification of superposition theorem using hardware and digital simulation.	
Expt. 6	**RECIPROCITY THEOREM**
Verification of reciprocity theorem using hardware and digital simulation.	
Expt. 7	**MAXIMUM POWER TRANSFER THEOREM**
Verification of maximum power transfer theorem using hardware and digital simulation.	
Expt. 8	**THEVENINS THEOREM**
Verification of Thevenin's theorem using hardware and digital simulation.	

Expt. 9	**NORTON'S THEOREM**
Verification of Norton's theorem using hardware and digital simulation.	
Expt. 10	**COMPENSATION THEOREM**
Verification of compensation theorem using hardware and digital simulation.	
Expt. 11	**MILLIMAN'S THEOREM**
Verification of Milliman's theorem using hardware and digital simulation.	
Expt. 12	**SERIES RESONANCE**
Verification of series resonance using hardware and digital simulation.	
Expt. 13	**PARALLEL RESONANCE**
Verification of parallel resonance using hardware and digital simulation.	
Expt. 14	**SELF INDUCTANCE AND MUTUAL INDUCTANCE**
Determination of self inductance and mutual inductance by using hardware.	

Reference Books:

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

Web References:

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

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Microsoft Windows 7 and MATLAB – V 8.5, which is also R2015a

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

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V DC
2	CRO	0-20 MHz
3	Digital voltmeter	0-20 V
4	Digital ammeter	0-200 mA
5	Resistors	47Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3k Ω.5k Ω,10k Ω
6	Inductors	0.01mH, 0.1mH,10mH, 50mH
7	Capacitors	0.01μF, 0.1μF, 0.47μF, 470μF, 33μF
8	1-ϕ Transformer	3KVA, 115/230V
9	1-ϕ Auto Transformer	230/(0-270V), 10A
10	Ammeter	0-2.5/5A MI
11	Ammeter	0-10/20 A MI
12	Voltmeter	0-150/300V MI
13	Voltmeter	0-300/600V MI
14	Wattmeter	5/10A,75/150/300V LPF
15	Wattmeter	10/20A,150/300/600V UPF
16	Multimeter	10 Nos
17	Bread boards	30 Nos
18	Probes / Connecting wires	400 Nos

ENGINEERING PRACTICE LABORATORY

<table>
<tr><td colspan="10">II Semester: CSE / ECE / EEE / IT</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">ACS112</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>1</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental concepts of computer networking.
II. Design blogs and view the Skype installation.
III. Prepare productivity tools like word processors, spreadsheets, presentations.
IV. Develop models using fitting, carpentry and Tin-Smithy trades.
V. Demonstrate the process of house wiring for connecting and controlling home appliances.
VI. Illustrate metal joining arc welding process, plumbing, and power tools.

LIST OF EXPERIMENTS

WEEK-1 NETWORK DEVICES

1 Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2 Study of following Network Devices in Detail
- Repeater
- Hub
- Switch
- Bridge
- Router
- Gate Way

WEEK-2 IP ADDRESS

1 Study of network IP Classification of IP address, Sub netting ,Super netting
2 Connect the computers in Local Area Network
3 Study of basic network command and Network configuration commands

WEEK-3 PACKET TRACER

1 Configure a Network topology using packet tracer software
2 Configure a Network using Distance Vector Routing protocol(RIP)
3 Configure Network using Link State Vector Routing protocol(OSPF)

WEEK-4 BLOG CRAETION, SKYPE INSTALLATION AND CYBER HYGIENE

Creating blogs import the data into blogs, blog templates, blog design. Skype installation and usages of Skype. Install antivirus software; Configure their personal firewall and windows update on their computer.

WEEK-5 LATEX

To create project certificate, Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using

Date and Time option in LaTeX	
WEEK-6	**LATEX**
Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check and Track Changes using LaTeX.	
WEEK-7	**LATEX**
Mathematical expressions, Subscripts and superscripts, Brackets and Parentheses, Fractions and Binomials, Aligning Equations, Operators, Spacing in math mode, Integrals, sums and limits, Display style in math mode, List of Greek letters and math symbols, Mathematical fonts.	
WEEK-8	**LATEX**
Producing Simple Documents, a LaTeX Input File and Ordinary Text using LaTeX.	
WEEK-9	**LATEX**
Prepare class timetable and student marks list using LaTex.	
WEEK-10	**SHARE LATEX**
Create your first ShareLaTeX document, Uploading a project, Copying a project, Creating a project from a template, Including images in ShareLaTeX.	
WEEK-11	**SHARE LATEX**
Exporting your work from ShareLaTeX, Using bibliographies in ShareLaTeX, Sharing your work with others, Debugging Compilation timeout errors, Code Check.	
WEEK-12	**HOUSE WIRING**
Power point, light fitting and switches, television, home theater.	
WEEK-13	**CARPENTRY**
Study of tools and joints; Practice in planning, chiseling, marking and sawing; Joints: Cross joint, T joint, Dove tail joint.	
WEEK-14	**SOLDERING**
Electronic components (PCB'S), resistance soldering, desoldering, and soldering effects.	
WEEK-15	**FITTING**
Study of tools, practice in filing, cutting, drilling and tapping; Male and female joints, stepped joints.	
WEEK-16	**ELECTRICAL WINDING**
Lap winding, wave winding and design of transformer.	

Reference Books:

1. Peter Norton, "Introduction to Computers", Tata McGraw-Hill Publishers, 6^{th} Edition, 2010.
2. Scott Muller, Que, "Upgrading and Repairing", Pearson Education, PC's 18^{th} Edition, 2009.
3. H. S. Bawa, "Workshop Practice", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2^{nd}
4. Edition, 2007.

Web References:

1. http://www.cl.cam.ac.uk/teaching/1011/CompFunds
2. http://www.bibcol.com.
3. http://www.tutorialspoint.com/computer_fundamentals
4. http://www.craftsmanspace.com

POWER GENERATION SYSTEMS

<table>
<tr><td colspan="11">III Semester: EEE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE003</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Demonstrate thermal power generation systems including major subsystems.
II. Illustrate hydroelectric power generation systems along with pumped storage plants.
III. Understand basic working principles of nuclear power generation systems.
IV. Apply knowledge of solar and wind power generation systems in design and implementation to obtain clean energy.

UNIT - I	THERMAL POWER STATIONS	Classes: 09

Thermal power station: Line diagram of thermal power station, paths of coal, steam, water, air, ash and flue gasses, description of thermal power station components, economizers, boilers, super heaters, turbines, condensers, chimney and cooling towers.

UNIT - II	HYDROELECTRIC POWER STATIONS	Classes: 08

Hydroelectric power station: Elements, types, concept of pumped storage plants, storage requirements, mass curve and estimation of power developed from a given catchment area, heads and efficiencies, simple problems.

UNIT - III	SOLAR ENERGY	Classes: 14

Solar radiation: Environmental impact of solar power, physics of the sun, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation, solar radiation data, solar concentrators, collectors, thermal applications, design of standalone solar systems, simple problems.

Photovoltaic systems: Photovoltaic effect, semiconducting materials, band gap theory, photo emission of electrons, cell configuration, types of solar cells, cell properties, device physics, electrostatic field across the depletion layer, voltage developed, I-V characteristics, module structure and fabrication, output power and efficiency, fill factor, maximum power point tracking (MPPT), solar grid connected inverters, simple problems.

UNIT - IV	WIND ENERGY	Classes: 09

Wind energy: Sources and potential, power from wind, Betz criterion, components of wind energy conversion system, types of turbines, horizontal and vertical axis wind turbines, aerodynamics, momentum theory (actuator disk concept), operational characteristics, blade element theory, types of generating systems for wind energy, permanent magnet generators, DC generators, induction generators, doubly fed induction generators, applications of wind energy, safety and environmental aspects, simple problems.

UNIT - V	NUCLEAR POWER STATIONS	Classes: 05
Nuclear power stations: Nuclear fission and chain reaction, nuclear fuels, principle of operation of nuclear reactor and components, types of nuclear reactors, pressurized water reactor, boiling water reactor and fast breeder reactor, radiation hazards, shielding and safety precautions, applications.		
Text Books:		
1. C L Wadhawa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Limited, New Delhi, 3rd Edition, 2010. 2. G D Rai, "Non-Conventional Energy Sources", Khanna Publishers, 1st Edition, 2011. 3. G N Tiwari, M K Ghosal, "Fundamentals of Renewable Energy Sources", Narosa Publications, New Delhi, 1st Edition, 2007.		
Reference Books:		
1. J B Gupta, "A Course in Electrical Power", S K Kataria and Sons, New Delhi, 15th Edition, 2013. 2. M V Deshpande, "Elements of Power Station design", Prentice Hall India Learning Private Limited, New Delhi, 1st Edition, 1992. 3. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 1st Edition, 1999.		
Web References:		
1. https://www.solarpowernotes.com 2. https://www.electrical4u.com/power-plants-types-of-power-plant 3. https://www.iare.ac.in		
E-Text Books:		
1. https://www.amazon.in/Electrical-Power-Engineering-Reference-Applications 2. https://www.nitt.edu 3. https://www.textbooksonline.tn.nic.in		
Course Home Page:		

DC MACHINES AND TRANSFORMERS

III Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE004	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Illustrate the theory of electromechanical energy conversion and the concept of co energy.
II. Demonstrate the working principle of different types of dc machines and transformers.
III. Analyze the losses in dc machines to improve the efficiency by conducting various tests.
IV. Outline the principle of operation, construction and testing of single phase transformers.

UNIT - I	ELECTROMECHANICAL ENERGY CONVERSION	Classes: 05

Electromechanical energy conversion: Forces and torque in magnetic systems, energy balance, energy and force in a singly excited and multi excited magnetic field systems, determination of magnetic force, co energy.

UNIT - II	DC GENERATORS	Classes: 12

DC generators: Principle of operation, construction, armature windings, lap and wave windings, simplex and multiplex windings, use of laminated armature, commutator, emf equation, types of DC generators, voltage buildup, critical field resistance and critical speed, causes for failure to self excite and remedial measures; Armature reaction: Cross magnetization and demagnetization, ampere turns per pole, compensating winding, commutation, reactance voltage, methods of improving commutation; Characteristics: Principle of parallel operation load sharing, use of equalizer bars and cross connection of field windings problems.

UNIT - III	DC MOTORS AND TESTING	Classes: 10

DC motors: Principle of operation, back EMF, torque equation, condition for maximum power developed, types of DC motors, armature reaction and commutation, characteristics, methods of speed control, types of starters, numerical problems; Losses and efficiency: Types of losses, calculation of efficiency, condition for maximum efficiency.

Testing of DC machines: Swinburne’s test, brake test, regenerative testing, Hopkinson’s test, field’s test, retardation test and separation of stray losses, problems.

UNIT - IV	SINGLE PHASE TRANSFORMERS	Classes: 10

Single phase transformers: Principle of operation, construction, types of transformers, emf equation, concept of leakage flux and leakage reactance, operation of transformer under no load and on load, phasor diagrams, equivalent circuit, efficiency, regulation and all day efficiency; Testing of transformers: objective of testing, polarity test, measurement of resistance, OC and SC tests, back to back test, heat run test, parallel operation, problems.

UNIT - V	POLY PHASE TRANSFORMERS	Classes: 08
Three phase transformer: Principle of operation, star to star, delta to delta, star to delta, delta to star, three phase to six phase, open delta connection, scott connection; Auto transformers: Principles of operation, equivalent circuit, merits and demerits, no load and on load tap changers, harmonic reduction in phase voltages, problems.		
Text Books:		
1. I J Nagrath, D P Kothari, "Electrical Machines", Tata McGraw-Hill publication, 3rd Edition, 2010. 2. P S Bimbra, "Electrical Machines", Khanna Publishers, 2nd Edition, 2008. 3. J B Gupta, "Theory and Performance of Electrical Machines", S K Kataria & Sons Publication, 14th Edition, 2010. 4. A E Fitzgerald, Charles Kingsley, JR., Stephen D Umans, "Electric Machinery", McGraw- Hill, 6th Edition,1985.		
Reference Books:		
1. M G Say, E O Taylor, "Direct Current Machines", Longman Higher Education, 1st Edition, 1985. 2. M V Deshpande, "Electrical Machines", PHI Learning Private Limited, 3rd Edition, 2011. 3. Ian McKenzie Smith, Edward Hughes, "Electrical Technology", Prentice Hall, 10th Edition, 2015.		
Web References:		
1. https://www.electrical4u.com/working-or-operating-principle-of-dc-motor 2. https://www.freevideolectures.com 3. https://www.ustudy.in › Electrical Machines 4. https://www.freeengineeringbooks.com		
E-Text Books:		
1. https://www.textbooksonline.tn.nic.in 2. https://www.freeengineeringbooks.com 3. https://www.eleccompengineering.files.wordpress.com 4. https://www.books.google.co.in		
Course Home Page:		

NETWORK ANALYSIS

III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE005	Foundation	L	T	P	C	CIA	SEE	Total
		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. Analyze star and delta connected three phase circuits and calculate active and reactive powers.
II. Understand the response of RL, RC and RLC circuits for DC and AC excitations and plot locus diagrams.
III. Discuss the concept of network functions and calculate network parameters.
IV. Understand the simulation and design of various types of filters.

UNIT - I	THREE PHASE CIRCUITS	Classes: 08

Three phase circuits: Star and delta connections, phase sequence, relation between line and phase voltages and currents in balanced star and delta circuits, three phase three wire and three phase four wire systems, shifting of neutral point, analysis of balanced and unbalanced three phase circuits, measurement of active and reactive power.

UNIT - II	DC AND AC TRANSIENT ANALYSIS	Classes: 10

Transient response: Initial conditions, transient response of RL, RC and RLC series and parallel circuits with DC and AC excitations, differential equation and Laplace transform approach.

UNIT - III	LOCUS DIAGRAMS AND NETWORK FUNCTIONS	Classes: 10

Locus diagrams: Elementary treatment of locus diagrams of RL, RC and RLC circuits (series and parallel combinations).

Network functions: The concept of complex frequency, physical interpretation, transform impedance, series and parallel combination of elements, terminal ports, network functions for one port and two port networks, poles and zeros of network functions, significance of poles and zeros, properties of driving point functions and transfer functions, necessary conditions for driving point functions and transfer functions, time domain response from pole-zero plot.

UNIT - IV	TWO PORT NETWORK PARAMETERS	Classes: 08

Two port network parameters: Z, Y, ABCD, hybrid and inverse hybrid parameters, conditions for symmetry and reciprocity, inter relationships of different parameters, interconnection (series, parallel and cascade) of two port networks, image parameters.

UNIT - V	FILTERS AND DIGITAL SIMULATION OF CIRCUITS	Classes: 09

Filters: Low pass, high pass, band pass, band elimination filters, introduction to active filter, filter design. Digital simulation: MATLAB simulation and mathematical modeling of R, RL, RC and RLC circuits with DC and AC excitations: steady state and transient analysis, time and frequency domain analysis, frequency and phase spectra by Fourier analysis; basic test signals representation, filter design.

Text Books:
1. A Chakrabarthy, "Electric Circuits", Dhanpat Rai & Sons, 6th Edition, 2010. 2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010. 3. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014. 4. Rudrapratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, 1st Edition, 1999.
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.
Web References:
1. https://www.igniteengineers.com 2. https://www.ishuchita.com/PDF/Matlab%20rudrapratap.pdf 3. https://www.ocw.nthu.edu.tw 4. https://www.uotechnology.edu.iq 5. https://www.iare.ac.in
E-Text Books:
1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook 2. https://www.jntubook.com 3. https://www.allaboutcircuits.com 4. https://www.archive.org
Course Home Page:

ELECTROMAGNETIC FIELD THEORY

III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE006	Foundation	L	T	P	C	CIA	SEE	Total
		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. Demonstrate the concept of electrostatic field intensity and electric potential.
II. Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in electric field.
III. Understand the concept of magnetic field intensity and flux density.
IV. Discuss forces in magnetic fields and law of electromagnetic induction.

UNIT - I	ELECTROSTATICS	Classes: 10

Electrostatic fields: Coulomb's law, electric field intensity due to line and surface charges, work done in moving a point charge in an electrostatic field, electric potential, properties of potential function, potential gradient, Gauss's law, application of Gauss's law, Maxwell's first law, Laplace's and Poisson's equations, solution of Laplace's equation in one variable.

UNIT - II	CONDUCTORS AND DIELECTRICS	Classes: 09

Electric dipole: Dipole moment, potential and electric field intensity due to an electric dipole, torque on an electric dipole in an electric field, behavior of conductors in an electric field, electric field inside a dielectric material, polarization, conductor and dielectric, dielectric boundary conditions, capacitance of parallel plate and spherical and coaxial capacitors with composite dielectrics, energy stored and energy density in a static electric field, current density, conduction and convection current densities, Ohm's law in point form, equation of continuity.

UNIT - III	MAGNETOSTATICS	Classes: 08

Static magnetic fields: Biot-Savart's law, magnetic field intensity, magnetic field intensity due to a straight current carrying filament, magnetic field intensity due to circular, square and solenoid current carrying wire, relation between magnetic flux, magnetic flux density and magnetic field intensity, Maxwell's second equation, div(B)=0.

Ampere's circuital law and it's applications: Magnetic field intensity due to an infinite sheet of current and a long current carrying filament, point form of Ampere's circuital law, Maxwell's third equation, Curl (H)=Jc, field due to a circular loop, rectangular and square loops.

UNIT - IV	FORCE IN MAGNETIC FIELD AND MAGNETIC POTENTIAL	Classes: 09

Magnetic force: Moving charges in a magnetic field, Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, magnetic dipole and dipole moment, a differential current loop as a magnetic dipole, torque on a current loop placed in a magnetic field; Scalar magnetic potential and its limitations: Vector magnetic potential and its properties, vector magnetic potential due to simple configurations, Poisson's equations, self and mutual inductance, Neumann's formula, determination of self-inductance of a solenoid, toroid and determination of mutual inductance between a straight long wire and a square loop of wire in the same plane, energy stored and density in a magnetic field, characteristics and applications of permanent magnets.

UNIT - V	TIME VARYING FIELDS AND FINITE ELEMENT METHOD	Classes: 09

Time varying fields: Faraday's laws of electromagnetic induction, integral and point forms, Maxwell's fourth equation, curl (E)=∂B/∂t, statically and dynamically induced EMFs, modification of Maxwell's equations for time varying fields, displacement current; Numerical methods: Finite difference method (FDM), finite element method (FEM), charge simulation method (CSM), boundary element method, application of finite element method to calculate electrostatic and magneto static fields.

Text Books:

1. William H Hayt, John A Buck, "Engineering Electromagnetics", McGraw-Hill Publications, 8th Edition, 2012.
2. David J Griffiths, "Introduction to Electrodynamics", Pearson Education Ltd., 4th Edition, 2014.
3. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics", Oxford University Press, 1st Edition, 2012.
4. E Kuffel, W S Zaengl, J Kuffel, "High Voltage Engineering Fundamentals", Newnes, 2nd Edition, 2000.

Reference Books:

1. Matthew N O Sadiku, S V Kulkarni, "Principles of Electromagnetics", Oxford University Press, 6th Edition, 2015.
2. J D Krauss, Fleish, "Electromagnetics with Applications", McGraw-Hill Publications, 5th Edition, 1999.
3. Matthew N O Sadiku, "Numerical Techniques in Electromagnetics", CRC Press, 2nd Edition, 2001.
4. William H Hayt, John A Buck, "Problems and Solutions in Electromagnetics", McGraw-Hill Publications, 1st Edition, 2010.

Web References:

1. https://www.calvin.edu/~pribeiro/courses/engr315/EMFT_Book.pdf
2. https://www.web.mit.edu/viz/EM/visualizations/coursenotes/modules/guide02.pdf
3. https://www.nptel.ac.in/courses/108106073/
4. https://www.iare.ac.in

E-Text Books:

1. https://www.bookboon.com/en/electromagnetism-for-electronic-engineers
2. https://www.books.google.co.in/books/.../Fundamentals of Electromagnetic Fields
3. https://www.aliexpress.com/item/EBOOK...Electromagnetic-Fields-2

Course Home Page:

ELECTRONIC DEVICES AND CIRCUITS

III Semester: **EEE / ECE**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC001	Foundation	L	T	P	C	CIA	SEE	Total
		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. Be acquainted with electrical characteristics of ideal and practical diodes under forward and reverse bias to analyze and design diode application circuits such as rectifiers and voltage regulators.
II. Utilize operational principles of bipolar junction transistors and field effect transistors to derive appropriate small-signal models and use them for the analysis of basic amplifier circuits.
III. Perform DC analysis (algebraically and graphically using current voltage curves with super imposed load line) and design of CB,CE and CC transistor circuits.
IV. Compare and contrast different biasing and compensation techniques.

UNIT - I	SEMICONDUCTOR DIODES	Classes: 08

PN Junction Diode: Open circuit of PN diode, energy band diagram of PN diode, PN junction as a diode, operation and V-I characteristics, static and dynamic resistances, diode equivalent circuits, diffusion and transition capacitance, diode current equation, temperature dependence of V-I characteristics, Zener diode characteristics, break down mechanisms in semiconductor diodes, Zener diode as a voltage regulator.

UNIT - II	SPECIAL PURPOSE ELECTRONIC DEVICES AND RECTIFIERS	Classes: 08

Special purpose electronic devices: SCR, tunnel diode, varactor diode, photodiode; Half wave rectifier, full wave rectifier, general filter consideration, harmonic components in a rectifier circuit, inductor filter, capacitor filter, L-Section filter, multiple L-C section, RC filter, comparison of filters.

UNIT - III	TRANSISTORS	Classes: 11

Bipolar Junction Transistors: Construction of BJT, operation of BJT, minority carrier distributions and current components, configurations, characteristics, BJT specifications; Applications: Amplifier, switch.

Field Effect Transistors: Types of FET, FET construction, symbol, principle of operation, volt-Ampere characteristics, FET parameters, FET as voltage variable resistor, comparison of BJT and FET; MOSFET, IGBT construction, operation and characteristics; Uni-Junction Transistor: Symbol, principle of operation, characteristics, Applications (UJT as relaxation oscillator).

UNIT - IV	BIASING AND COMPENSATION TECHNIQUES	Classes: 10

Need for biasing, BJT operating point, the DC and AC load lines, types of biasing circuits, bias stability, stabilization factors, stabilization against variations in V_{BE} and β; Bias compensation techniques, thermal runaway, thermal stability, biasing the FET and MOSFET.

UNIT - V	BJT AND FET AMPLIFIERS	Classes: 08
BJT small signal analysis, BJT hybrid model, determination of h-parameters from transistor characteristics, transistor amplifiers analysis using h- parameters; FET small signal model, FET as common source amplifier, FET as common drain amplifier, FET as common gate amplifier, generalized FET amplifier .		

Text 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 McGrawHill, 2nd Edition, 1998.
3. Mohammad Rashid, "Electronic Devices and Circuits", Cengage learning, 2013.
4. David A Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.

Reference Books:

1. Sedha R S, "A Text Book of Applied Electronics", S Chand Publishers, 2008.
2. R L Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", PEI/PHI, 9th Edition, 2006.
3. Gupta J B, "Electron Devices and Circuits", S K Kataria and Sons, 2012.
4. S Salivahanan, N Suresh Kumar and A Vallavaraj, "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd Edition, 2011.
5. Anil K Maini and Varsha Agarwal, "Electronic Devices and Circuits", Wiley India Pvt. Ltd, 1st Edition, 2009,
6. Floyd, "Electron Devices" Pearson Asia, 5th Edition, 2001.

Web References:

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

E-Text Books:

1. https://www.services.eng.uts.edu.au/pmcl/ec/Downloads/LectureNotes.pdf
2. https://www.nptel.ac.in/courses/122106025/
3. https://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. https://www.faadooengineers.com/threads/32735-Electronic-Devices-And-Circuits-(EDC)-by-J-B-Gupta-full-book-pdf

Course Home Page:

DC MACHINES LABORATORY

III Semester: EEE									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE104	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Conduct various tests on DC series and shunt machines.
II. Develop procedure for speed control of DC machines and test with PLC and LabVIEW.
III. Utilise labVIEW, programmable logic controllers to control various machines.
IV. Simulate DC machine to study the characteristics by using digital simulation.

LIST OF EXPERIMENTS

Expt. 1 OPEN CIRCUIT CHARACTERISTICS OF DC SHUNT GENERATOR

Magnetization characteristics of DC shunt generator.

Expt. 2 LOAD TEST ON DC SHUNT GENERATOR

Determination of efficiency by load test in DC shunt generator.

Expt. 3 LOAD TEST ON DC SERIES GENERATOR

Determination of efficiency by load test on DC series generator.

Expt. 4 LOAD TEST ON DC COMPOUND GENERATOR

Determination of efficiency by load test on DC compound generator.

Expt. 5 HOPKINSON'S TEST

Study the performance characteristics of two identical DC shunts machines.

Expt. 6 FIELD'S TEST

Study the performance characteristics of two identical DC series machines.

Expt. 7 SWINBURNE'S TEST AND SPEED CONTROL OF DC SHUNT MOTOR

Predetermine the efficiency and study the characteristics of DC shunt machine with different speed control techniques.

Expt. 8 BRAKE TEST ON DC COMPOUND MOTOR

Study the performance characteristics of DC compound motor.

Expt. 9	**BRAKE TEST ON DC SHUNT MOTOR**
Study the performance characteristics of DC shunt motor by brake test.	
Expt. 10	**RETARDATION TEST**
Study the performance characteristics by using retardation test on DC shunt motor.	
Expt. 11	**SEPARATION OF LOSSES IN DC SHUNT MOTOR**
Study the method used for separation of losses in DC shunt motor.	
Expt. 12	**MAGNETIZATION CHARACTERISTICS OF DC SHUNT GENERATOR**
Study the magnetization characteristics of DC shunt generator using digital simulation.	
Expt. 13	**LOAD TEST ON DC SHUNT GENERATOR USING DIGITAL SIMULATION**
Perform the load test on DC shunt generator using digital simulation.	
Expt. 14	**SPEED CONTROL OF DC SHUNT MOTOR USING LabVIEW**
Verify the speed control techniques of DC motor using LabVIEW.	

Reference Books:

1. P S Bimbhra, "Electrical Machines", Khanna Publishers, 2nd Edition, 2008.
2. M G Say, E O Taylor, "Direct Current Machines", Longman Higher Education, 1st Edition, 1985.
3. Hughes, "Electrical Technology", Prentice Hall, 10th Edition, 2015.
4. Nesimi Ertugrul, "LabVIEW for Electric Circuits, Machines, Drives, and Laboratories", Prentice Hall, 1st Edition, 2002.
5. Gupta, Gupta & John, "Virtual Instrumentation Using LabVIEW", Tata McGraw-Hill, 1st Edition, 2005.

Web References:

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

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB R2015a and LabVIEW

HARDWARE: Desktop Computers (04 nos)

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	DC Shunt Motor-Generator Set	3 KW
2	DC Shunt motor-DC Series generator	3 KW
3	DC Series motor-DC Series generator	3 KW
4	Resistive load	4 A
5	DC shunt Motor-DC Compound Generator	3 KW
6	DC Shunt Motor Set	5 HP
7	DC Compound Motor	5 HP
8	Ammeter	0-2A MC
9	Ammeter	0-10 / 20A MC
10	Voltmeter	0-150 / 300V MC
11	Rheostats	300 ohms / 2A
12	Rheostats	370 ohms / 1.7A
13	Rheostats	50ohms / 5A
14	Tachometers	0-9999 RPM

ELECTRICAL ENGINEERING SIMULATION LABORATORY

III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE105	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Apply different techniques used in electric circuit analysis to calculate circuit parameters and two port network parameters.

II. Demonstrate the applications of Fourier transforms in electric circuits.

III. Design filters and analyze through digital simulation in electrical circuits.

LIST OF EXPERIMENTS

Expt. 1	**MEASUREMENT OF THREE PHASE ACTIVE POWER AND REACTIVE POWER**
Measurement of three phase active and reactive power for balanced and unbalanced loads.	
Expt. 2	**LOCUS DIAGRAMS**
Plot the locus diagram of series RL and RC circuits.	
Expt. 3	**IMPEDANCE(Z) AND ADMITTANCE(Y) PARAMETERS**
To calculate and verify 'Z' parameters and ‘Y’ parameters of two-port network.	
Expt. 4	**TRANSMISSION (ABCD) AND HYBRID(H) PARAMETERS**
To calculate and verify 'ABCD' parameters and ‘H’ parameters of two-port network.	
Expt. 5	**FOURIER ANALYSIS**
Fourier analysis of square wave, half wave rectified and full wave rectified sine wave using MATLAB.	
Expt. 6	**ELECTRICAL SYMBOLS USING VISSIO SOFTWARE**
Draw the electrical symbols using VISSIO software.	
Expt. 7	**TRANSIENT RESPONSE OF ELECTRICAL CIRCUITS USING DIGITAL SIMULATION**
To study and plot the transient response of series and parallel RL and RC circuits using MATLAB.	
Expt. 8	**TRANSIENT RESPONSE OF ELECTRICAL CIRCUITS USING DIGITAL SIMULATION**
To study and plot the transient response of series and parallel RLC circuit using MATLAB.	

Expt. 9	DESIGN OF LOW PASS AND HIGH PASS FILTERS USING DIGITAL SIMULATION
Simulation of low pass and high pass filters using digital simulation.	
Expt. 10	**VIRTUAL INSTRUMENTS (VI) USING LabVIEW**
Editing and building a VI, creating a sub VI.	
Expt. 11	**STRUCTURES USING LabVIEW**
Using FOR loop, WHILE loop, charts and arrays, graph and analysis VIs.	
Expt. 12	**GENERATION OF COMMON WAVE FORMS USING LabVIEW**
Signal generation of sine wave, triangular wave; saw tooth, square wave and display of wave form, minimum and maximum values of wave form and modulation.	
Expt. 13	**SINE WAVE GENERATION USING LabVIEW**
Three phase sine wave generation and display.	
Expt. 14	**FREQUENCY MEASUREMENT USING LabVIEW**
Frequency measurement using Lissajous figures in LabVIEW.	

Reference Books:

1. B R Gupta, Vandana Singhal, "Fundamentals of Electrical Machines", New Age International Publishers, 1st Edition, 2010.
2. A Sudhakar, Shyammohan S Palli, "Circuits & Networks", Tata McGraw- Hill, 4th Edition, 2010.
3. P S Bimbhra, "Electrical Machines", Khanna Publishers, 2nd Edition, 2008.
4. Nesimi Ertugrul, "LabVIEW for Electric Circuits, Machines, Drives, and Laboratories", Prentice Hall, 1st Edition, 2002.
5. Gupta, Gupta & John, "Virtual Instrumentation Using LabVIEW", Tata McGraw-Hill, 1st Edition, 2005.

Web References:

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

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB R2015a and LabVIEW

HARDWARE: Desktop Computers (04 nos)

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	0-20 V
4	Digital ammeter	0-200 mA
5	Resistors	100 No.s (47 Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3k Ω, 5k Ω,10k Ω)
6	Inductors	0.01 mH, 0.1 mH,10 mH, 50 mH
7	Capacitors	0.01 μF, 0.1 μF, 0.47 μF, 470 μF, 33 μF
8	1-ϕ Transformer	3 KVA, 115 / 230V
9	1-ϕ Auto Transformer	230 / 0-270V, 10A
10	Ammeter	0-2.5 / 5A, MI
11	Ammeter	0-10 / 20 A, MI
12	Voltmeter	0-150 / 300V, MI
13	Voltmeter	0-300 / 600V, MI
14	Wattmeter	5 / 10A,75 / 150 / 300V, LPF
15	Wattmeter	10 / 20A,150 / 300 / 600V, UPF
16	Multimeter	10 No.s
17	Bread boards	30 No.s
18	Probes / Connecting wires	400 No.s

ELECTRONIC CIRCUITS LABORATORY

III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC113	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

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

Expt. 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.

Expt. 2 ELECTRONIC WORKSHOP PRACTICE

Study the operation of

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

Expt. 3 PN DIODE CHARACTERISTICS

Verification of V-I characteristics of PN diode using hardware and digital simulation.

Expt. 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.

Expt. 5 HALF WAVE RECTIFIER

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

Expt. 6 FULL WAVE RECTIFIER

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

Expt. 7	**TRANSISTOR CB CHARACTERISTICS**
Verification of input and output characteristics of CB configuration using hardware and digital simulation.	
Expt. 8	**TRANSISTOR CE CHARACTERISTICS**
Verification of input and output characteristics of CE configuration using hardware and digital simulation.	
Expt. 9	**FREQUENCY RESPONSE OF CE AMPLIFIER**
Determine the gain and bandwidth of CE amplifier using hardware and digital simulation.	
Expt. 10	**FREQUENCY RESPONSE OF CC AMPLIFIER**
Determine the gain and bandwidth of CC amplifier using hardware and digital simulation.	
Expt. 11	**UJT CHARACTERISTICS**
Verification of V-I characteristics of UJT using hardware and digital simulation	
Expt. 12	**SCR CHARACTERISTICS**
Verification of V-I characteristics of SCR using hardware and digital simulation.	
Expt. 13	**FET CHARACTERISTICS**
Verification of V-I characteristics of FET using digital simulation.	
Expt. 14	**FREQUENCY RESPONSE OF CS AND CD AMPLIFIER (FET/MOSFET)**
Determine the gain and Bandwidth of CS and CD 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://www.archive.org/details/ElectronicDevicesCircuits
2. https://www.tedpavlic.com/teaching/osu/ece327/

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V DC , 0-15V 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	100 No.s (1K Ω, 100K Ω, 470 Ω, 150 Ω,10K Ω, 47K Ω,1M Ω, 2.2k Ω, 220K Ω)
6	Capacitors	0.01 μF, 0.01 μF, 100 μF Electrolytic, 10 μF Electrolytic
7	Diodes	1N4007, 4v7, 6v2.
8	Transistors	BC 107, 2N 2646, C106 MG / XL084
9	Semiconductor Trainer Kit with Bread Board	30 No.s
10	Connecting Wires and Patchcords	400 No.s

AC MACHINES

IV Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE007	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Discuss the construction, working and characteristics of three phase induction motor and synchronous motor.
II. Illustrate the equivalent circuit and speed control methods of three phase induction motors.
III. Outline the working and parallel operation of alternators.
IV. Evaluate synchronous impedance and voltage regulation of synchronous machine.

UNIT - I	THREE PHASE INDUCTION MOTORS	Classes: 10

Three phase induction motors: Introduction, construction, types of induction motors, slip and frequency of rotor currents, rotor MMF and production of torque, equivalent circuit, power across air gap, torque and power output, torque slip characteristics, generating and braking modes, maximum (breakdown) torque, starting torque, maximum power output, problems.

UNIT - II	TESTING AND SPEED CONTROL OF INDUCTION MACHINES	Classes: 08

Equivalent circuit model: No load test and blocked rotor test, circuit model, starting methods, speed control of induction motors, induction generator, principle of operation, isolated induction generator, circle diagram, determination of induction motor parameters from circle diagram, problems.

UNIT - III	ALTERNATORS	Classes: 14

Synchronous generators: Introduction, principle of operation, constructional features, armature windings, integral slot and fractional slot windings, distributed and concentrated windings, winding factors, basic synchronous machine model, circuit model of a synchronous machine, phasor diagrams, determination of synchronous impedance, short circuit ratio, armature reaction, ampere turns and leakage reactance.

Voltage regulation: Calculation of regulation by synchronous impedance method, MMF, ZPF and ASA methods, slip test, parallel operation of alternators, synchronization of alternators, problems.

UNIT - IV	SYNCHRONOUS MOTORS	Classes: 08

Synchronous motors: Principle of operation, power developed, synchronous motor with different excitations, effect of increased load with constant excitation, effect of change in excitation with constant load, effect of excitation on armature current and power factor, construction of "V" and inverted "V" curves, power and excitation circles, starting methods, salient pole synchronous motor, phasor diagrams and analysis, synchronous condenser.

UNIT - V	SINGLE PHASE INDUCTION MOTOR	Classes: 05
Single phase induction motor: Principle of operation, two reaction theory, equivalent circuit analysis, split phase motor, construction, principle of operation, capacitor start, capacitor run, capacitor start - capacitor run motor, shaded pole motor, torque speed characteristics.		
Text Books:		
1. P S Bimbra, "Electrical Machines", Khanna Publishers, 2^{nd} Edition, 2008. 2. I J Nagrath, D P Kothari, "Electrical Machines", TMH publication, 3^{rd} Edition, 2010. 3. J B Gupta, "Theory and Performance of Electrical Machines", S K Kataria & Sons Publication, 14^{th} Edition, 2010.		
Reference Books:		
1. A. E Fitzgerald, Charles Kingsley JR., Stephen D Umans, "Electric Machinery", McGraw-Hill, 6^{th} Edition, 1985. 2. M G Say, "Alternating Current Machines", Pitman Publishing Ltd, 4^{th} Edition, 1976. 3. S K Bhattacharya, "Electrical Machines", TMH publication, 2^{nd} Edition, 2006.		
Web References:		
1. https://www.researchgate.net 2. https://www.aar.faculty.asu.edu/classes/ 3. https://www.control.eng.cam.ac.uk/ 4. https://www.facstaff.bucknell.edu/ 5. https://www.electrical4u.com 6. https://www.iare.ac.in		
E-Text Books:		
1. https://www.jntubook.com 2. https://www.freeengineeringbooks.com 3. https://www.bookboon.com/en/mechanics		
Course Home Page:		

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

IV Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE008	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. Demonstrate the construction, working and characteristics of electrical measurement instruments.
II. Illustrate the principles of energy measurement in electrical loads.
III. Outline the use of cathode ray oscilloscope.
IV. Evaluate various transducers for electrical measurements.

UNIT - I	INTRODUCTION TO MEASURING INSTRUMENTS	Classes: 10

Introduction: Classification of measuring instruments, deflecting, damping and control torques, types of errors, ammeter and voltmeter: PMMC, MI instruments, expression for deflection and control torque, errors and compensation, extension of range using shunts and series resistances; Electro static voltmeter, electro dynamic type, attracted type, disc type, extension of range of ES voltmeters.

UNIT - II	POTENTIOMETERS AND INSTRUMENT TRANSFORMERS	Classes: 08

DC Potentiometers: Principle and operation of Crompton potentiometer, standardization, measurement of unknown resistance, current, voltage; AC potentiometers: polar and coordinate type, standardization, applications; Instrument transformers: CT and PT, ratio and phase angle error.

UNIT - III	MEASUREMENT OF POWER AND ENERGY	Classes: 10

Measurement of Power: Single phase dynamometer type wattmeter, LPF and UPF, double elements and three elements dynamometer wattmeter; Expression for deflection and control torque, extension of range of wattmeter by using instrument transformers, measurement of active and reactive power for balanced and unbalanced Systems.

Measurement of Energy: Single phase induction type energy meter, driving and braking torques, errors and compensations, testing by phantom loading using RSS meter, three phase energy meter, introduction to net energy metering (web ref: 4.5), maximum demand meters.

UNIT - IV	DC AND AC BRIDGES	Classes: 08

Measurement of Resistance: Methods of measuring low, medium, high resistance, Wheatstone bridge, carry foster, Kelvin's double bridge, loss of charge method; Measurement of Inductance: Maxwell's bridge, hay's bridge , Anderson's bridge, Owen's bridge; Measurement of Capacitance: Desauty's bridge, Wein's bridge, Schering bridge.

UNIT - V	TRANSDUCERS AND OSCILLOSCOPES	Classes: 09

Transducers: Definition of transducers, classification of transducers, advantages of electrical transducers, characteristics and choice of transducers, principle of operation of LVDT and capacitor transducers,

LVDT applications, strain gauge and its principle of operation, gauge factor, thermistors, thermocouples, synchros, piezo-electric transducers, photovoltaic, photo conductive cells, photo diodes; Cathode ray oscilloscope: Cathode ray tube, time base generator, horizontal and vertical amplifiers, CRO probes, applications of CRO, measurement of phase and frequency, Lissajous patterns, sampling oscilloscope, analog oscilloscope, tubeless oscilloscopes, digital storage oscilloscope (web ref: 6).
Text Books:
1. A K Sawhney, "Electrical and Electronic measurement and instruments", Dhanpat Rai and Sons Publications, 2002. 2. E W Golding and F C Widdis, "Electrical measurements and measuring instruments", Wheeler publishing, 5th Edition, 2006.
Reference Books:
1. Buckingham and Price, "Electrical measurements", Prentice Hall. 2. D V S Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2nd Edition, 2009. 3. A S Morris, "Principles of measurement of instrumentation", Pearson/Prentice Hall of India, 2nd Edition, 1994. 4. H S Kalsi, "Electronic Instrumentation", Tata McGraw-Hill Publications, 1st Edition 1995.
Web References:
1. https://www.researchgate.net 2. https://www.aar.faculty.asu.edu/classes/ 3. https://www.electrical4u.com 4. https://www.efficientcarbon.com/wp-content/uploads/2013/07/Net-Metering-and-Solar-Rooftop_Whitepaper_EfficientCarbon.pdf 5. https://www.conserve-energy-future.com/what-is-net-metering-and-how-net-metering-works.php 6. https://www.electrical4u.com/digital-storage-oscilloscope/ 7. https://www.iare.ac.in
E-Text Books:
1. https://www.jntubook.com 2. https://www.freeengineeringbooks.com 3. https://www.bookboon.com/en/mechanics
Course Home Page:

DIGITAL AND PULSE CIRCUITS

IV Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC019	Foundation	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

This course should enable the student to:

I. Understand basics, different binary codes in digital electronic circuits and be able to convert between different codes.
II. Implement minimization techniques and state machines using flip-flops.
III. Implement and design logical operations using large scale integration and medium scale integration devices.
IV. Discuss the concept of sequential circuits and analyze sequential systems.
V. Design finite state machine and algorithmic state machines charts and memories.

UNIT - I	BOOLEAN ALGEBRA AND SWITCHING FUNCTIONS	Classes: 08

Introduction of binary numbers: Complements of numbers, codes, binary codes, binary code decimal code and its properties, unit distance codes, alpha numeric codes, error detecting and correcting codes; Boolean algebra: Basic theorems and properties, switching functions, canonical and standard form.

UNIT - II	MINIMIZATION TECHNIQUES AND DESIGN OF MSI	Classes: 10

Minimization with theorem: Karnaugh map method, five variable map, prime and essential implications, don’t care map entries, tabular method, partially specified expressions; combination all design: Arithmetic circuits, comparator, multiplexers, code converters, hazards and hazard free relations.

UNIT - III	SEQUENTIAL CIRCUITS DESIGN	Classes: 09

Basic differences between combinational and sequential logic circuits, binary cell, fundamentals of sequential machine operation, D Flip Flop, T Flip Flop, J K Flip Flop, design procedure for conversion of Flip Flops, conversion from one type of Flip-Flop to another, timing and triggering consideration, clock skew.

Counters: Design of single mode counter, ripple counter, ring counter, shift register, shift register sequences, ring counter using shift register.

UNIT - IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	Classes: 10

Feedback Amplifiers: 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; Current shunt feedback configurations, illustrative examples; Oscillators: Classification of oscillators, condition for oscillations, RC phase shift oscillators; Generalized analysis of LC oscillators: Hartley and Colpitts oscillators, Wien Bridge and crystal oscillators, stability of oscillators.

UNIT - V	SINGLE STAGE AMPLIFIERS AND MULTISTAGE AMPLIFIERS	Classes: 08

Single Stage Amplifiers: Classification of amplifiers, distortion in amplifiers, analysis of CE, CC and CB configurations with simplified hybrid model, analysis of CE amplifier with emitter resistance and emitter follower, Miller's theorem and its dual design of single stage RC coupled amplifier using BJT; Multistage amplifiers: Analysis of cascaded RC coupled BJT amplifiers, cascade amplifier, darlington pair, different coupling schemes used in amplifiers RC coupled amplifiers, transformer coupled amplifier, direct coupled amplifier.

Text Books:

1. M Morris Mano, Michael D Ciletti, "Digital Design", Pearson Education / PHI, 3rd Edition, 2008.
2. Fletcher W I, "An Engineering Approach to Digital Design", Prentice Hall India Learning Private Limited, 1990.
3. Zvi Kohavi, "Switching and Finite Automata Theory", Tata McGraw-Hill, 3rd Edition, 2004.
4. John M Yarbrough, "Digital logic applications and design", Thomson publications, 1st Edition, 2006.
5. J Millman, C C Halkias, "Integrated Electronics", Tata McGraw -Hill, 2008.

Reference Books:

1. Fredriac J Hill, Gerald R Peterson, "Introduction to Switching Theory and Logic Design", 3rd Edition, 2008.
2. Thomas L Floyd, "Digital Fundamentals", Pearson Publications, 10th Edition, 2013.
3. Roth, "Fundamentals of Logic Design", Thomson Publications,7th Edition, 2004
4. Comer, "Digital Logic and State machine Design", Oxford Publications, 3rd Edition, 2013.
5. Rashid, "Electronic Circuit Analysis", Cengage Publishers, 12th Edition,2013
6. Robert L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", PHI, 9th Edition, 2008.

Web References:

1. https://www.mcsbzu.blogspot.com
2. https://www.books.askvenkat.com
3. https://www.web02.gonzaga.edu
4. https://www.daenotes.com
5. https://www.worldclassprogramme.com
6. https://www.cse.psu.edu

E-Text Books:

1. https://www.springer.com/us/book/9780387285931
2. https://www.books.askvenkat.com/2016/01/switching-theory-and-logic-design-textbook-by-anand-kumar.html
3. https://www.freebookcentre.net/Electronics/Electronic-Circuits-Books.html

Course Home Page:

CONTROL SYSTEMS

IV Semester: EEE									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE009	Core	L	T	P	C	CIA	SEE	Total
		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.

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

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

UNIT - 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, DC servomotors, signal flow graph, Mason's gain formula; Time response analysis: Standard test signals, shifted unit step, ramp and impulse signals, 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.

UNIT - 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.

UNIT - IV	FREQUENCY DOMAIN ANALYSIS	Classes: 10

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

UNIT - 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

Course Home Page:

COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTIONS

IV Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS004	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Understand the 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.

UNIT - I	**COMPLEX FUNCTIONS AND DIFFERENTIATION**	**Classes: 09**

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-Thompson method.

UNIT - II	**COMPLEX INTEGRATION**	**Classes: 09**

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.

UNIT - III	**POWER SERIES EXPANSION OF COMPLEX FUNCTION**	**Classes: 09**

Expansion in Taylor's series, Maclaurin's series and Laurent series, singular point, isolated singular point; pole of order m, essential singularity.

Residue: Evaluation of residue by formula and by Laurent series, residue theorem, evaluation of integrals of the type

1. $\int_{0}^{2\Pi} f(\cos\theta, \sin\theta)d\theta$ 2. $\int_{-\infty}^{\infty} f(x)dx$

UNIT - IV	**SINGLE AND MULTIPLE RANDOM VARIABLES**	**Classes: 09**

Random variables: Discrete and continuous, probability distributions, mass function density function of a probability distribution, mathematical expectation, moment about origin, central moments, moment generating function of probability distribution, joint probability distributions, joint probability mass, density, function, marginal probability, mass, density functions.

UNIT - V	**PROBABILITY DISTRIBUTIONS**	**Classes: 09**

Binomial, Poisson and normal distributions and their properties.

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

E-Text Books:

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

Course Home Page:

AC MACHINES LABORATORY

IV Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE106	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Evaluate losses and determine the efficiency of single phase and three phase electrical machines.
II. Determine the voltage regulation, efficiency and temperature rise in various transformers.
III. Apply PLC and digital simulation software to gain practical knowledge.

LIST OF EXPERIMENTS

Expt. 1	**OC AND SC TEST ON SINGLE PHASE TRANSFORMER**
Determine the equivalent circuit parameters; predetermine the efficiency and regulation by open circuit and short circuit test on a single phase transformer.	
Expt. 2	**SUMPNER'S TEST**
Predetermine the efficiency and regulation of two identical single phase transformers.	
Expt. 3	**SCOTT CONNECTION OF TRANSFORMERS**
Conversion of three phase to two phase using single phase transformers.	
Expt. 4	**SEPARATION OF CORE LOSSES IN SINGLE PHASE TRANSFORMER**
Find out the eddy current and hysteresis losses in single phase transformer.	
Expt. 5	**HEAT RUN TEST ON SINGLE PHASE TRANSFORMERS**
Determine the temperature rise in three single phase transformers set.	
Expt. 6	**BRAKE TEST ON THREE PHASE SQUIRREL CAGE INDUCTION MOTOR**
Plot the performance characteristics of three phase induction motor**.**	
Expt. 7	**CIRCLE DIAGRAM OF THREE PHASE SQUIRREL CAGE INDUCTION MOTOR**
Plot the circle diagram and predetermine the efficiency and losses of three phase squirrel cage induction motor.	
Expt. 8	**REGULATION OF ALTERNATOR**
Determine the regulation of alternator using synchronous impedance method.	

Expt. 9	**SLIP TEST ON THREE PHASE SALIENT POLE SYNCHRONOUS MOTOR**
Determination of Xd and Xq in a three phase salient pole synchronous motor.	
Expt. 10	**‘V’ AND INVERTED ‘V’ CURVES OF SYNCHRONOUS MOTOR**
Plot ‘V’ and inverted ‘V’ curves to study the effect of power factor in synchronous motor.	
Expt. 11	**EQUIVALENT CIRCUIT PARAMETERS OF SINGLE PHASE INDUCTION MOTOR**
Determine the equivalent circuit parameters of a single phase induction motor.	
Expt. 12	**OC AND SC TESTS ON SINGLE PHASE TRANSFORMER USING DIGITAL SIMULATION**
Determine the efficiency and regulation by open circuit and short circuit test in a single phase transformer using digital simulation.	
Expt. 13	**SCOTT CONNECTION OF TRANSFORMERS USING DIGITAL SIMULATION**
Scott connection of single phase transformers using digital simulation.	
Expt. 14	**STARTING AND SPEED CONTROL OF INDUCTION MOTOR USING PLC**
Implementation of star-delta starter using PLC; Speed control of three phase slip ring induction motor with rotor resistance cutting using PLC.	

Reference Books:

1. P S Bimbhra, “Electrical Machines”, Khanna Publishers, 2nd Edition, 2008.
2. M V Deshpande, “Electrical Machines”, PHI Learning Private Limited, 3rd Edition, 2011.
3. R K Srivastava, “Electrical Machines”, Cengage Learning, 2nd Edition, 2013.

Web References:

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

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB R2015a and Wpl Soft software

HARDWARE: Desktop Computers (03 nos)

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S. No	Name of the Equipment	Range
1	Single phase Transformer	3 KVA
2	Ammeter	0-2.5 / 5A MI
3	Ammeter	0-10 / 20A MI
4	Voltmeter	0-150 / 300V MI
5	Voltmeter	0-300 / 600V MI
6	Wattmeter	5 / 10A, 75 / 150 / 300V LPF
7	Wattmeter	10 / 20A, 150 / 300 / 600V UPF
8	Single phase variac	0-230 / 270V, 8A
9	Three phase variac	0-440 / 470V, 15A
10	Ammeter	0-2A MC
11	Tachometer	0-9999 RPM
12	Rheostats	0-400Ω / 1.7A
13	Three phase Induction Motor	415V, 7.8A, 5HP
14	Single phase Induction Motor	230V, 4.5
15	Three phase Alternator set	415V, 3A, 3 KW
16	Three phase Synchronous motor	415V, 7.8A, 5 HP
17	Resistive Load	5 KW
18	Three phase Transformers	3 KVA

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY

IV Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
AEE107	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 42**				**Total Classes: 42**		

OBJECTIVES:

The course should enable the students to:

I. Understand various measurement techniques used in electrical engineering.
II. Analyse waveforms using LabVIEW to measure various parameters.
III. Demonstrate the use of sensors and transducers in electrical and nonelectrical measurements.
IV. Apply knowledge of virtual instruments in measurement of analysis of electrical parameters.

LIST OF EXPERIMENTS

Expt. 1	**SENSING OF TEMPERATURE AND SPEED**
Measurement of temperature using transducers like thermocouple, thermistors and resistance temperature detector with signal conditioning; speed measurement using proximity sensor.	
Expt. 2	**CALCULATION OF DISTANCE AND LEVEL**
Distance measurement using ultrasonic transducer; measurement of level using capacitive transducer.	
Expt. 3	**MEASUREMENT OF STRAIN AND PRESSURE**
Strain measurement using strain gauge; measurement of pressure using differential pressure transducer.	
Expt. 4	**MEASUREMENT OF POSITION AND LINEAR DISPLACEMENT**
Measurement of position using encoders; measurement of linear displacement using Linear Voltage Differential Transformer (LVDT).	
Expt. 5	**PHANTOM LOADING ON LPF WATTMETER**
Calibration of electrodynamometer type LPF wattmeter using phantom loading	
Expt. 6	**CALIBRATION OF SINGLE PHASE ENERGY METER AND POWER FACTOR METER**
Calibration of single phase energy meter using resistive load and dynamometer power factor meter.	
Expt. 7	**MEASUREMENT OF TURNS RATIO AND APPLICATIONS OF CTs**
Measurement of turns ratio using AC bridge; the extension of range of wattmeter to measure three phase power using two CTs and one single phase wattmeter.	

Expt. 8	**MEASUREMENT OF REACTIVE POWER**
Measurement of reactive power using one single phase wattmeter.	
Expt. 9	**NET METERING**
Study of bidirectional energy measurement using net metering	
Expt. 10	**MEASUREMENT OF FREQUENCY AND THD USING DIGITAL SIMULATION**
Determination of frequency and Total Harmonic Distortion (THD) using LabVIEW	
Expt. 11	**ANALYSIS OF WAVE FORMS USING DIGITAL SIMULATION**
Measurement and display of voltage, current wave forms and analysis using LabVIEW.	
Expt. 12	**TWO WATTMETER METHOD USING DIGITAL SIMULATION**
Measurement of real and reactive powers using two wattmeter method and verification with LabVIEW.	
Expt. 13	**WORKING OF STATIC ENERGY METER USING DIGITAL SIMULATION**
Measurement of energy using static energy meter and verification with LabVIEW.	
Expt. 14	**MEASUREMENT OF PASSIVE PARAMETERS USING DIGITAL SIMULATION**
Resistance measurement using Kelvin's double bridge, inductance measurement using Anderson bridge and capacitance measurement using Schering bridge and verification with LabVIEW.	

Reference Books:

1. https://www.bookpump.com/bwp/pdf-b/2335004b.pdf.
2. https://www.books.google.co.in › Technology & Engineering › Sensors
3. https://www.bambang.lecturer.pens.ac.id/rekayasa%20sensor%20aktuator/Sensors%20&%20Trans...
4. https://www.sae.org/images/books/toc_pdfs/BELS036.pdf
5. https://www.Gupta, Gupta & John, "Virtual Instrumentation Using Labview", Tata McGraw-Hill, 1st Edition, 2005.

Web References:

1. https://www.gnindia.dronacharya.info/EEEDept/Downloads/Labmanuals/EMI_Lab.pdf
2. https://www.scribd.com/doc/25086994/electrical-measurements-lab

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB R2015a and LabVIEW

HARDWARE: Desktop Computers (04 nos)

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S. No	Name of the Equipment	Range
1	Watt meters	300 / 600V, 10 / 20A UPF
2	Watt meters	150 / 300V, 5 / 10A LPF
3	Power factor meter	150 / 300V, 5 / 10A
4	Analog energy meter	1-Phase , 10A
5	Current Transformer	20A / 5A
6	Resistive load,	5KW / 20A
7	Three Phase Inductive load	5A
8	Voltmeters MI	0-150 / 300 V
9	Voltmeters MI	0-300 / 600 V
10	Ammeters MI	10 / 20A
11	Turns Ratio kit	01 No.
12	Strain gauge Kit	01 No.
13	LVDT Kit	01 No.
14	Transducers	06 No.
15	Encoder	01 No.

CONTROL SYSTEMS AND SIMULATION LABORATORY

IV Semester: EEE

Course Code	Category	Hours / Week			Credit	Maximum Marks		
AEE115	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Understand mathematical models of electrical and mechanical systems.
II. Analysis of control system stability using digital simulation.
III. Demonstrate the time domain and frequency domain analysis for linear time invariant systems.
IV. Apply programmable logic controllers to demonstrate industrial controls in the laboratory.

LIST OF EXPERIMENTS

Expt. 1	**TIME RESPONSE OF SECOND ORDER SYSTEM**
To obtain the time response of a given second order system with time domain specifications.	
Expt. 2	**TRANSFER FUNCTION OF DC MOTOR**
Determine the transfer function, time response of DC motor and verification with digital simulation.	
Expt. 3	**DC AND AC SERVO MOTOR**
Study DC and AC servomotor and plot its torque speed characteristics	
Expt. 4	**EFFECT OF VARIOUS CONTROLLERS ON SECOND ORDER SYSTEM**
Study the effect of P, PD, PI and PID controller on closed loop second order systems**.**	
Expt. 5	**COMPENSATOR**
Study lead-lag compensator and obtain its magnitude, phase plots.	
Expt. 6	**TEMPERATURE CONTROLLER**
Study the performance of PID controller used to control the temperature of an oven.	
Expt. 7	**DESIGN AND VERIFICATION OF OP-AMP BASED PID CONTROLLER**
Implementation of PID controller using Op-Amps and verification using MATLAB.	
Expt. 8	**STABILITY ANALYSIS USING DIGITAL SIMULATION**
Stability analysis using root locus, Bode plot, Polar, Nyquist criterions of linear time invariant system by digital simulation.	

Expt. 9	**STATE SPACE MODEL USING DIGITAL SIMULATION**
Verification of state space model from transfer function and transfer function from state space model using digital simulation	
Expt. 10	**LADDER DIAGRAMS USING PLC**
Input output connection, simple programming, ladder diagrams, uploading, running the program and debugging in programmable logic controller.	
Expt. 11	**TRUTH TABLES USING PLC**
Study and verification of truth tables of logic gates, simple boolean expressions and application to speed control of DC motor using programmable logic controller.	
Expt. 12	**IMPLEMENTATION OF COUNTER**
Implementation of counting number of objects and taking action using PLC.	
Expt. 13	**BLINKING LIGHTS USING PLC**
Implementation of blinking lights with programmable logic controller.	
Expt. 14	**WATER LEVEL CONTROL**
Control of maximum and minimum level of water in a tank using PLC.	

Reference Books:

1. J Nagrath, M Gopal, "Control Systems Engineering", New Age International, 3rd Edition, 2007.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th Edition, 2003.
3. Benjamin Kuo, "Automatic Control Systems", PHI, 7th Edition, 1987.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.ggnindia.dronacharya.info/ece2dept/Downloads/Labmanuals/VI Sem/Control_ System _ Lab. pdf
3. https://www.iare.ac.in
4. https://www.deltaww.com

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB, WPL soft Software

HARDWARE: Desktop Computers (04 nos)

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S. No	Name of the Equipment	Range
1	Linear System Simulator kit	01 No.
2	Cathode Ray Oscilloscope	0-20 MHz
3	PLC Trainer unit	05 No.
4	DC Motor study kit	220V DC, 2.1A
5	PID controller trainer kit	01 No.
6	Function Generator	0-1000 KHz
7	Transfer function of DC Generator Kit	220V DC, 2.1 A.
8	Temperature control system study Kit	01 No.
9	AC Servo motor	01 No.
10	Probes / Connecting wires	100 No.s

INTEGRATED CIRCUITS APPLICATIONS

V Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC008	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Discuss the principles and characteristics of op-amps and their applications.
II. Analyze and design the filters, timers, analog to digital and digital to analog converters.
III. Understand the functionality and characteristics of commercially available digital integrated circuits.

UNIT - I	INTEGRATED CIRCUITS	Classes: 08

Integrated Circuits: Classification of integrated circuits, package types and temperature ranges; Differential Amplifier: DC and AC analysis of dual input Balanced output configuration; Properties of differential amplifier configuration: Dual input unbalanced output, single ended input, balanced / unbalanced output; DC Coupling and Cascade differential amplifier stages, level translator characteristics of OP-Amps: Op-amp block diagram, ideal and practical Op-amp specifications, DC and AC characteristics, 741 op-amp and its features; Op-Amp parameters and Measurement: Input and out put off set voltages and currents, slew rate, CMRR, PSRR, drift.

UNIT - II	APPLICATIONS OF OP- AMPS	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, multivibrators, triangular and square wave generators, non - linear function generators, log and anti log amplifiers.

UNIT - III	ACTIVE FILTERS AND TIMERS	Classes: 09

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

Timers: Introduction to 555 timer, functional diagram, monostable, astable operations and applications, Schmitt Trigger; PLL: Introduction, block schematic, principles and description of individual blocks, 565 PLL.

UNIT - 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, DAC characteristics; ADC techniques: Integrating, successive approximation, flash converters, A/D characteristics.

UNIT - V	DIGITAL IC APPLICATIONS	Classes: 09

Combinational Design Using TTL / CMOS ICs: Logic delays, TTL / CMOS Interfacing, Adders, multiplexer, de-multiplexer, decoder, Encoder; Sequential Design Using TTL / CMOS ICs: SR, JK, T, and D flip-flops; Counters: Synchronous and a synchronous counters, decade counter; Registers: Shift registers, universal shift register, ring counters and Johnson counters.

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, 3rd Edition, 2003. 3. John F Wakerly, "Digital Design: Principles and Practices", Prentice Hall, 3rd Edition, 2005.
Reference Books:
1. Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1st Edition, 2008. 2. R P Jain, "Modern Electronics", Tata McGraw-Hill, 4th Edition, 2010. 3. James M. Fiore, Cengage, "Op-Amps and Linear Integrated Circuits: concepts and applications", Jaicc, 2nd Edition, 2009.
Web References:
1. hptts//www.nptel.ac.in 2. hptts//www.svecw.edu.in 3. hptts//www.smartzworld.com 4. hptts//www.crectirupati.com
E-Text Books:
1. https://www.books.google.co.in/books?isbn=8122414702 2. https://www.books.google.co.in/books?isbn=013186389
Course Home Page:

POWER ELECTRONICS

V Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE010	Core	L	T	P	C	CIA	SEE	Total
		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. Integrate the revolutionary development in power transmission, distribution and utilization with the advent of semiconductor devices.

II. Demonstrate rectifiers, choppers and various schemes of pulse width modulated inverters.

III. Explain AC voltage converters and cycloconverters.

IV. Outline complete range of power supplies, including switched mode and uninterruptible power supplies.

UNIT - I	POWER SEMICONDUCTOR DEVICES AND COMMUTATION CIRCUITS	Classes: 09

Power semiconductor devices and commutation circuits: Thyristors, principle of operation of silicon controlled rectifiers (SCR), bipolar junction transistor (BJT), power metal oxide semiconductor field effect transistor (MOSFET), power insulated gate bipolar transistor (IGBT), gate turn off thyristor (GTO) and characteristics, turn on and turnoff methods, dynamic characteristics of SCR, two transistor analogy, unijunction transistor firing circuit, series and parallel operation of SCRs, design of snubber circuit; Specifications and ratings: Ratings of SCR, BJT and IGBT, line commutation and forced commutation circuits, numerical problems.

UNIT - II	SINGLE PHASE AND THREE PHASE CONTROLLED RECTIFIERS	Classes: 10

AC - DC converters: Phase control technique, single phase line commutated converters, midpoint and bridge connections, half controlled converters and semi converters with R, RL and RLE loads, derivation of average load voltage and current, active and reactive power inputs to the converters without and with freewheeling diode, numerical problems; Fully controlled converters: Midpoint and bridge connections with R, RL loads and RLE load, derivation of average load voltage and current, line commutated inverters, active and reactive power inputs to the converters without and with freewheeling diode, derivation of load voltage and current, numerical problems; Three phase converters: Three pulse and six pulse converters, midpoint and bridge connections, average load voltage with R and RL loads, effect of source inductance, operation of single phase and three phase dual converters, numerical problems.

UNIT – III	AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS	Classes: 08

AC - AC controllers: Introduction, single phase two SCRs in anti – parallel with R and RL loads, modes of operation of triac, triac with R and RL loads, derivation of RMS load voltage, current and power factor, wave forms, numerical problems.

Cycloconverters: Principle of operation of single phase midpoint and bridge type cycloconverters with resistive and inductive loads, continuous and discontinuous mode of operation.

UNIT - IV	DC – DC CONVERTERS	Classes: 09
DC - DC converters: Principle of operation of choppers, time ratio control and current limit control strategies, types of choppers, derivation of load voltage and currents with R, RL and RLE loads, AC chopper, problems; Switched mode regulators: Study of buck, boost and buck - boost regulators, Cuk regulators.		
UNIT - V	**INVERTERS**	**Classes: 09**
DC - AC converters: Single phase inverter, basic series inverter, parallel inverter, operation and waveforms, voltage source inverter (VSI), three phase inverters 180^0, 120^0 conduction modes of operation, voltage control techniques for inverters, pulse width modulation techniques, reduction of harmonics, current source inverter (CSI) with ideal switches, capacitor commutated type CSI, numerical problems.		

Text Books:

1. M D Singh, K B Kanchandhani, "Power Electronics", Tata McGraw-Hill Publishing Company, 2^{nd} Edition, 1998.
2. Dr. P S Bimbhra, "Power Electronics", Khanna Publishers, 5^{th} Edition, 2012.
3. Ned Mohan, Tore M Undeland, William P Robbins, "Power Electronics: Converters, Applications, and Design", 3^{rd} Edition, John Wiley and sons, 2002.
4. M H Rashid, "Power Electronics, Circuits, Devices and Applications", Pearson, 3^{rd} Edition, 2001.

Reference Books:

1. Vedam Subramanyam, "Power Electronics", New Age International Limited, 2^{nd} Edition, 2006.
2. P C Sen, "Power Electronics", Tata McGraw-Hill Publishing, 1^{st} Edition, 1987.
3. G K Dubey, S R Doradra, A Joshi, R M K Sinha, "Thyristorised Power Controllers", New Age International Limited, 2^{nd} Edition, 2008.
4. V R Moorthi, "Power Electronics Devices", Oxford University Press, 4^{th} Edition, 2005.

Web References:

1. https://www.nptel.iitm.ac.in
2. https://www.iare.ac.in
3. https://www.bookboon.com/en/introduction-to-power-electronics-ebook

E-Text Books:

1. https://www.freebookcentre.net
2. https://www.amazon.in/POWER-ELECTRONICS-HANDBOOK
3. https://www.circuitstoday.com

Course Home Page:

OPTIMIZATION TECHNIQUES

<table>
<tr><td colspan="9">V Semester: CSE / IT / EEE</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>AHS012</td><td>Foundation</td><td>2</td><td>1</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 30</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Learn fundamentals of linear programming through optimization.
II. Understand and apply optimization techniques to industrial applications.
III. Apply the dynamic programming and quadratic approximation to electrical and electronic problems and applications.

UNIT - I	LINEAR PROGRAMMING	Classes: 09

Definition, characteristics and phases, types of models, operations research models, applications, linear programming problem formulation, graphical solution, simplex method; Artificial variables techniques: Two-phase method, Big-M method.

UNIT - II	TRANSPORTATION AND ASSIGNMENT PROBLEMS	Classes: 09

Transportation problem, formulation, optimal solution, unbalanced transportation problem, degeneracy, assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

UNIT - III	SEQUENCING AND THEORY OF GAMES	Classes: 09

Sequencing: Introduction, flow-shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, two jobs through m machines.

Theory of games: Introduction, terminology, solution of games with saddle points and without saddle points, 2 x 2 games, dominance principle, m x 2 and 2 x n games, graphical method.

UNIT - IV	DYNAMIC PROGRAMMING	Classes: 09

Introduction: Terminology, Bellman's principle of optimality, applications of dynamic programming shortest path problem, linear programming problem.

UNIT - V	QUADRATIC APPROXIMATION	Classes: 09

Quadratic approximation methods for constrained problems: Direct quadratic approximation, quadratic approximation of the Legrangian function, variable metric methods for constrained optimization.

Text Books:

1. A Ravindran, "Engineering Optimization", John Wiley & Sons Publications, 4th Edition, 2009.
2. Hillier, Liberman, "Introduction to Operation Research", Tata McGraw-Hill, 2nd Edition, 2000.

Reference Books:

1. Dr. J K Sharma, “Operation Research”, Mac Milan Publications, 5th Edition, 2013.
2. Ronald L Rardin, “Optimization in Operation Research”, Pearson Education Pvt. Limited, 2005.
3. N V S Raju, “Operation Research”, S M S Education, 3rd Revised Edition, .

Web References:

1. https://www.informs.org/Resources/
2. https://www.mit.edu/~orc/
3. https://www.ieor.columbia.edu/
4. https://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
5. https://www.wolfram.com/solutions/OperationsResearch/

E-Text Books:

1. https://www.engineeringstudymaterial.net/ebook/new-optimization-techniques-in-engineering-godfrey/
2. https://www.freetechbooks.com/urban-operations-research-logistical-and-transportation-planning-methods-t486.html

Course Home Page:

TRANSMISSION AND DISTRIBUTION SYSTEM

V Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE011	Core	L	T	P	C	CIA	SEE	Total
		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. Evaluate the voltage regulation and efficiency of different transmissions lines.
II. Demonstrate the mechanical design of overhead lines, cables and insulators.
III. Illustrate the performance of different types of distribution systems.
IV. Discuss the operation of different distribution schemes and design of feeders.

UNIT - I	TRANSMISSION LINE PARAMETERS	Classes: 09
Transmission line parameters: Types of conductors, simple diagrams of typical towers and conductors for 400, 220 and 132 kV operations, calculation of resistance for solid conductors, calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR and GMD, symmetrical and asymmetrical conductor configuration with and without transposition, numerical problems, capacitance calculations for symmetrical and asymmetrical single and three phase lines, single and double circuit lines, effect of ground on capacitance, numerical problems; Corona: Types, critical disruptive voltages, factors affecting corona, methods for reducing corona power loss, charge voltage diagram, audible noise, radio interference.		
UNIT - II	MODELLING AND PERFORMANCE OF TRANSMISSION LINES	Classes: 08
Classification of transmission lines: Short, medium and long line and their model representations, nominal T, nominal π and A, B, C, D constants for symmetrical and asymmetrical networks, numerical problems, mathematical solutions to estimate regulation and efficiency of all types of lines, numerical problems; Long transmission line: Rigorous solution, evaluation of A, B, C, D constants, interpretation of the long line equations, methods of voltage control, Ferranti effect, incident, reflected and refracted waves, surge impedance and surge impedance loading of long lines, wave length and velocity of propagation of waves, representation of long lines, equivalent T and equivalent π network model, numerical problems.		
UNIT - III	OVER HEAD INSULATORS AND UNDER GROUND CABLES	Classes: 09
Overhead insulators: Types of insulators, voltage distribution, string efficiency and methods for improvement, capacitance grading and static shielding, numerical problems. Underground cables: Types of cables, construction, types of insulating materials, calculations of insulation resistance and stress in insulation, capacitance of single and three core belted cables, grading of cables, capacitance grading, description of inter sheath grading, numerical problems.		
UNIT - IV	MECHANICAL DESIGN OF TRANSMISSION LINES	Classes: 04
Sag and tension calculations: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductor, stringing chart and sag template and its applications, numerical problems.		

UNIT - V	DISTRIBUTION SYSTEMS	Classes: 15
Distribution systems: Classification, comparison of DC vs AC and underground vs overhead, radial and ring main system, requirements and design features, Substation: Substation design, equipments, types of substations, bus bar arrangement layout, bus schemes, location, Kelvin's law for the design of feeders and its limitations; voltage drop calculations in DC distributors: Radial DC distributor fed at one end and at both the ends (equal / unequal voltages) and ring main distributor, voltage drop calculations in AC distributors, power factors referred to receiving end voltage and with respect to respective load voltages, numerical problems; Basic concept of interconnected systems: Indian electricity rules, various voltage levels of transmission and distribution systems, Indian grid scenario.		

Text Books:

1. C L Wadhwa, "Electric Power Systems", New age publications, New Delhi, 9th Edition, 2007.
2. Singh S N, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.
3. Turan Gonen, "Electrical Power Distribution System Engineering", CRC Press, 3rd Edition, 2014.
4. V Kamaraju, "Electrical Power Distribution Systems", TMH, Publication, Edition 2009

Reference Books:

1. J B Gupta, "A Course in Power Systems", S K Kataria and Sons, 2013 Edition, 2013
2. D Kothari and I J Nagrath, "Power System Engineering", McGraw-Hill Education, 2nd Edition, 2007.
3. V K Mehta and Rohit Mehta, "Principles of Power System", S Chand, 3rd revised Edition, 2015.
4. M L Soni, P V Gupta, U S Bhatnagar and A Chakrabarthy, "A Text Book on Power System Engineering", Dhanpat Rai and Co Pvt. Ltd., revised Edition, 2009.

Web References:

1. https://www.en.wikipedia.org/wiki/Electric_power_transmission
2. https://www.iec.ch/about/brochures/pdf/technology/transmission.pdf
3. https://www.teriin.org/upfiles/pub/papers/ft33.pdf
4. https://www.energy.gov/sites/prod/files/2015/09/f26/QTR2015-3F-Transmission-and-Distribution_1.pdf

E-Text Books:

1. https://www.jfgieras.com/Grigsby_Chapter_34_LEM.pdf
2. https://www.personal.psu.edu/sab51/vls/vonmeier.pdf
3. https://www.edsonjosen.dominiotemporario.com/doc/Livro_Electric_Power_Distribution_System_Engineering_-_Turan_Gonen.pdf

Course Home Page:

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

V Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS015	**Skill**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Describe the market dynamics namely demand, elasticity of demand and pricing in different market structures.
II. Discuss how the production function is carried out to achieve least cost combination of inputs and cost analysis.
III. Analyze how capital budgeting decisions are carried out.
IV. Develop the frame work for both manual and computerized accounting process.
V. Analyze and interpret the financial statements through ratio analysis.

UNIT - I	**INTRODUCTION AND DEMAND ANALYSIS**	**Classes : 07**

Introduction to managerial economics: 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.

UNIT - II	**PRODUCTION AND COST ANALYSIS**	**Classes : 10**

Production function and cost analysis: 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 breakeven point (simple problems), managerial significance of breakeven analysis.

UNIT - III	**MARKETS AND NEW ECONOMIC ENVIRONMENT**	**Classes: 08**

Introduction of markets and forms of business units: 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 organization, sole proprietorship, partnership, joint stock company, public enterprises and their types.

UNIT - IV	**CAPITAL BUDGETING**	**Classes: 10**

Capital budgeting techniques: Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital, 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).

UNIT - V	INTRODUCTION TO FINANCIAL ACCOUNTING AND FINANCIAL ANALYSIS	Classes : 10

Financial analysis: 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), 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, 4th Edition, 2012.
2. M Kasi Reddy, Saraswathi, "Managerial Economics and Financial Analysis", PHI, New Delhi, 2nd Edition, 2012.
3. Varshney, Maheswari, Sultan Chand, "Managerial Economics", 11th Edition, 2009.

Reference Books:

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

Web References:

1. https://www.scribd.com/doc/37684926
2. https://www.slideshare.net/glory1988/managerial-economics-and- financial analysis
3. https://www.cs.utah.edu/~devnani/2-2.pdf
4. https://www.thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis
5. https://www.bookshallcold.link/pdfread/managerial-economics-and-financial analysis
6. https://www.gvpce.ac.in/syllabi/Managerial Economics and financial analysis

E-Text Book:

1. https://www.books.google.co.in/books/about/Managerial economics and financial analysis
2. https://www.ebooktake.in/pdf/title/managerial-economics-and-financial analysis
3. https://www.ll4ryou.blogspot.in/2012/06/mefa-managerial-economics and financial analysis
4. https://www.books.google.com/books/about/Managerial economics and financial analysis
5. https://www.scribd.com/doc/37684926

Course Home Page:

RESEARCH AND CONTENT DEVELOPMENT

V Semester: AE / CSE / IT / ECE / EEE / MECH								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS106	**Skill**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	30	70	100

OBJECTIVES:

The course should enable the students to:

I. Gain a practical understanding of the various methodological tools used for social scientific research.
II. Learn the ethical, political, and pragmatic issues involved in the research process.
III. Improve their ability to develop technical writing.
IV. Identify the overall process of designing a research study from its inception to its report.

Week - l, 2, 3	**LATEX FOR DOCUMENTATION**

Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check and Track Changes using LaTeX; Mathematical expressions, Subscripts and superscripts, brackets and parentheses, fractions and binomials, aligning equations, operators, spacing in math mode, integrals, sums and limits, display style in math mode, list of Greek letters and math symbols, mathematical fonts; Prepare class timetable and student marks list using LaTex;

Week - 4	**RESEARCH FORMULATION AND DESIGN**

1. Topic/Title Selection for Research and Problem Statement
2. Title Selection and / or Methodology Formulation
3. Finalization of tentative Methodology

Week - 5	**DATA COLLECTION**

Data Preparation: Data Generation (simulated data) or Collection of Real Data – Part: I

Week - 6	**DATA COLLECTION AND SAMPLING DESIGN**

Data Preparation: Data Generation (simulated data) or Collection of Real Data – Part: II

Week – 7	**IMPLEMENTATION**

Implementation of Methodology on the Data and discussion of results - Part: I

Week – 8	**IMPLEMENTATION**

Implementation of Methodology on the Data and discussion of results - Part: II

Week – 9	**IMPLEMENTATION OF METHODOLOGY**

1. Block diagram / flowchart of Methodology or Algorithm
2. Testing of Methodology / algorithm, discussion of Results

Week – 10	**RESULTS**

Evaluation of Methodology / Algorithm, Discussion or Results and conclusion

Week – 11	**PLAGIARISM ANALYSIS**

Documentation / Paper formatting of Review / Research Article – Part: I (Plagiarism analysis)

Week – 12	**DOCUMENTATION**
Documentation / Paper formatting of Review / Research Article – Part: II (Paper ready for submission)	

Text Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, "An Introduction to Research Methodology", RBSA Publishers. U.K., 2002.
2. Kothari, C.R, "Research Methodology: Methods and Techniques". New Age International. 418p, 1990.
3. Stefan Kottwitz , " LATEX Beginner's Guide", Packt Publishing Limited, 2011.

Reference Book:

1. Meenakshi Raman, Sangeeta Sharma, "Technical Communication", Oxford Publishers, 1st Edition, 2004.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

Web References:

1. https://www.techwhirl.com/what-is-technical-writing/
2. https://www.mit.edu/me-ugoffice/communication/technical-writing
3. https://www.vocabulary.com/dictionary/technical

E-Text Books:

1. www.ebooksgo.org/
2. www.e-booksdirectory.com

POWER ELECTRONICS AND SIMULATION LABORATORY

<table>
<tr><td colspan="10">V Semester: EEE</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEE108</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Examine the characteristics of various devices and application of firing circuits used in power electronics.
II. Outline the performance characteristics of AC voltage regulators, choppers, inverters, rectifiers and cycloconverters.
III. Demonstrate the working principle of various power electronic devices and circuits using simulation.
IV. Design the circuit of switched mode power supplies through simulation.

LIST OF EXPERIMENTS

Expt. 1	**SCR, MOSFET AND IGBT**
Study the characteristics of SCR, MOSFET and IGBT.	
Expt. 2	**GATE FIRING CIRCUITS**
Study the operation of gate firing circuits of SCR.	
Expt. 3	**HALF CONTROLLED CONVERTER**
Study the performance characteristics of single phase half controlled converter with R and RL loads.	
Expt. 4	**FORCED COMMUTATION CIRCUITS**
Plot the characteristics of forced commutation circuits (Class A, Class B, Class C, Class D and Class E).	
Expt. 5	**FULLY CONTROLLED BRIDGE CONVERTER**
Study the characteristics of single phase fully controlled bridge converter with R and RL loads.	
Expt. 6	**SERIES INVERTER**
Study the characteristics of single phase series inverter with different loads.	
Expt. 7	**PARALLEL INVERTER**
Study the characteristics of single phase parallel inverter with different loads.	
Expt. 8	**VOLTAGE CONTROLLER**
Plot the characteristics of single phase AC voltage controller with R and RL loads.	

Expt. 9	**DUAL CONVERTER**
Study the characteristics of single phase dual converter with R and RL loads.	
Expt. 10	**CYCLOCONVERTER**
Study the characteristics of single phase cycloconverter with R and RL loads.	
Expt. 11	**THREE PHASE SEMI CONVERTER**
Plot the characteristics of three phase half converter with R and RL loads.	
Expt. 12	**MOSFET BASED CHOPPERS**
Study the principle of operation of step down chopper using MOSFET.	
Expt. 13	**SIMULATION OF THREE PHASE FULL CONVERTER AND PWM INVERTER**
Simulation of three phase full converter and PWM inverter with R and RL loads by using MATLAB.	
Expt. 14	**SIMULATION OF BUCK – BOOST CHOPPER**
Simulation of boost, buck, buck boost converter with R and RL loads by using MATLAB.	

Reference Books:

1. M H Rashid, "Power Electronics, Circuits, Devices and Applications", Pearson, 3rd Edition, 2001.
2. M D Singh, K B Kanchandhani, "Power Electronics", Tata McGraw-Hill Publishing Company, 7th Edition, 2007.
3. Dr. P S Bimbhra, "Power Electronics", Khanna Publishers, 5th Edition, 2012.

Web References:

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

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB R2015a

HARDWARE: Desktop Computers (04 nos)

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	SCR,TRAIC, DIAC, MOSFET AND IGBT Characteristics study unit-CSU	-
2	Differentiator and Integrator using OP-AMP	-
3	Operational Amplifier Trainer	-
4	Meter unit (CSU)	-
5	DC Chopper power unit (Johns Chopper)	-
6	UJT firing circuit	-
7	Forced Commutation study power circuit	-
8	1-Ø fully controlled converter power circuit	-
9	1-Ø cyclo converter power circuit	-
10	Parallel Inverter	-
11	1-Ø Half controller converter power circuit	-
12	Series Inverter	-
13	1-Ø A.C. Voltage controller	-
14	D.C. Chopper firing circuit unit	-
15	1-Ø converter firing circuit	-
16	V-I Characteristics of SCR, MOSFET, IGBT	-
17	1-Ø to 1-Ø cyclo converter	-
18	Rheostat	150 Ω / 5A
19	Rheostat	50 Ω / 2A
20	Loading Inductors	5A, 0-150 mH
21	Loading Inductors	2A, 0 - 150 mH
22	1-Ø Isolation Transformer	5A, 230V
23	1-Ø Centered tapped Transformer	5A, 230V
24	R,RC,UJT Triggering circuit	-
25	Parallel Inverter using SCR	-
26	1-Ø Cycloconverter firing circuit	-
27	1- Ø Semi-Converter	-
28	Gate Firing circuit for SCR Trainer kit	-
29	1-Ø Series inverter	-
30	Cathode Ray Oscilloscopes	-

INTEGRATED CIRCUITS APPLICATIONS LABORATORY

<table>
<tr><td colspan="10">V Semester: EEE</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEC106</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

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. Understand and verify the operations of the 555 timers and PLLs and their applications.
IV. Verify the operation of combinational and sequential circuits.

LIST OF EXPERIMENTS

Expt. 1	**INVERTING, NON-INVERTING AND DIFFERENTIAL AMPLIFIER**
To construct and test the performance of an Inverting, Non-inverting amplifier and Differential amplifier using IC741	
Expt. 2	**INTEGRATOR AND DIFFERENTIATOR**
To construct and test the performance of an Integrator and Differentiator using IC741	
Expt. 3	**SECOND ORDER ACTIVE LOWPASS, HIGHPASS AND BANDPASS FILTERS STUDY OF BASIC GATES**
To design and verify the operation of the Active low pass, High pass and Band pass filters using IC741	
Expt. 4	**ASTABLE MULTIVIBRATORS AND SCHMITT TRIGGER USING 555**
To design and construct an astable multi vibrators and Schmitt trigger using IC555	
Expt. 5	**MONOSTABLE MULTIVIBRATORS 555**
To design and construct Mono stable multi vibrators using IC555	
Expt. 6	**SCHMITT TRIGGER USING 555 TIMER**
To design and construct schimitt trigger using NE555 Timer.	
Expt. 7	**PLL USING IC 565**
Verifying characteristics of PLL.	
Expt. 8	**INSTRUMENTATION AMPLIFIER.**
To design and verify the operation of instrumentation amplifier using IC741.	

Expt. 9	**MULTIPLEXER AND DEMULTIPLEXER**
Verify Functionality of multiplexer and de multiplexer.	
Expt. 10	**ENCODER AND DECODER**
Verify Functionality of encoder and decoder.	
Expt. 11	**REALISATION OF DIFFERENT FLIP-FLOPS USING LOGIC GATES**
Verify Functionality of flip-flop	
Expt. 12	**4 BIT COUNTERS**
Verify Functionality of counters	
Expt. 13	**REALISATION OF SHIFT REGISTERS**
Verify Functionality of shit register	
Expt. 14	**DECADE COUNTER**
Verify Functionality of decade counter	

Reference 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, 3rd Edition, 2003.
3. John F Wakerly, "Digital Design Principles and Practices", Prentice Hall, 3rd Edition, 2005.

Web References:

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

Course Home Page:

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	CRO	0-20 MHz
3	Function generator	20 MHZ
4	Digital IC Trainer Kit	
5	Resistors	47 Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3k Ω.5k Ω,10k Ω
6	Inductors	0.01 mH, 0.1 mH,10mH, 50 mH
7	Capacitors	0.01 µF, 0.1 µF, 0.47 µF, 470 µF,33µF
8	Decade counter	IC 7490
9	Op-amp	741 IC
10	Timer IC	555 IC
11	IC'S	IC 7432, IC 7404, IC 7411, IC 7408, IC 7402, IC 7400 IC 7410, IC 7474, NE 565
12	Probes / Connecting wires	400 Nos

POWER SYSTEM ANALYSIS

<table>
<tr><td colspan="11">VI Semester: EEE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE012</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Illustrate the formation of [Z] bus of a power system network.
II. Compute power flow studies by various numerical methods.
III. Discuss the symmetrical component theory, sequence networks and short circuit calculations.
IV. Analyse power system for steady state and transient stability and suggest methods to improve.

UNIT - I	POWER SYSTEM NETWORK MATRICES	Classes: 09

Graph Theory: Definitions, bus incidence matrix, Y bus formation by direct and singular transformation methods, numerical problems; Formation of Z Bus: Partial network, algorithm for the modification of Z bus matrix for addition of element from a new bus to reference bus, addition of element from a new bus to an old bus, addition of element between an old bus to reference bus and addition of element between two old busses (Derivations and Numerical Problems), modification of Z bus for the changes in network (Numerical Problems).

UNIT - II	POWER FLOW STUDIES AND LOAD FLOWS	Classes: 09

Load flows studies: Necessity of power flow studies, data for power flow studies, derivation of static load flow equations; Load flow solutions using Gauss Seidel method: Acceleration factor, load flow solution with and without PV buses, algorithm and flowchart; Numerical load flow solution for simple power systems (Max. 3 buses): Determination of bus voltages, injected active and reactive powers (Sample one iteration only) and finding line flows / losses for the given bus voltages; Newton Raphson method in rectangular and polar coordinates form: Load flow solution with or without PV busses derivation of Jacobian elements, algorithm and flowchart, decoupled and fast decoupled methods, comparison of different methods, DC load flow study.

UNIT - III	SHORT CIRCUIT ANALYSIS PER UNIT SYSTEM OF REPRESENTATION	Classes: 09

Per unit system: Equivalent reactance network of a three phase power system, numerical problems; Symmetrical fault analysis: Short circuit current and MVA calculations, fault levels, application of series reactors, numerical problems; Symmetrical component theory: Symmetrical component transformation, positive, negative and zero sequence components, voltages, currents and impedances.

Sequence networks: Positive, negative and zero sequence networks, numerical problems; Unsymmetrical fault analysis: LG, LL, LLG faults with and without fault impedance, numerical problems.

UNIT - IV	STEADY STATE STABILITY ANALYSIS	Classes: 09

Steady state stability: Elementary concepts of steady state, dynamic and transient stabilities, description of steady state stability power limit, transfer reactance, synchronizing power coefficient, power angle curve and determination of steady state stability and methods to improve steady state stability.

UNIT - V	TRANSIENT STATE STABILITY ANALYSIS	Classes: 09

Swing equation: Derivation of swing equation, determination of transient stability by equal area criterion, application of equal area criterion, critical clearing angle calculation, solution of swing equation, point by point method, methods to improve stability, application of auto reclosing and fast operating circuit breakers.

Text Books:

1. I J Nagrath & D P Kothari, "Modern Power system Analysis", Tata McGraw-Hill Publishing Company, 2nd Edition.
2. C L Wadhwa, "Electrical Power Systems", New age International, 3rd Edition.
3. M A Pai, "Computer Techniques in Power System Analysis", TMH Publications.

Reference Books:

1. K Umarao, "Computer techniques and models in power systems", I K International Pvt. Ltd.
2. HadiSaadat, "Power System Analysis", 2nd Edition, TMH. Edition, 2003.
3. Grainger and Stevenson, "Power System Analysis", Tata McGraw-Hill, 3rd Edition, 2011.
4. J Duncan Glover and M S Sarma., THOMPSON, "Power System Analysis and Design", 3rd Edition 2006.
5. Abhijit Chakrabarthi and Sunita Haldar, "Power system Analysis Operation and control", 3rd Edition, PHI, 2010.

Web References:

1. https://www.worldcat.org/title/computer-methods-in-power-system-analysis/.../600788826
2. https://www.sjbit.edu.in/.../COMPUTER%20%20TECHNIQUES%20IN%20POWER%20%20SYS..
3. https://www.books.google.com › Technology & Engineering › Electrical
4. https://www.nptel.ac.in/courses/108105067/
5. https://www.jntusyllabus.blogspot.com/2012/01/computer-methods-power-systems-syllabus.html

E-Text Books:

1. https://www.scribd.com/.../Computer-Methods-in-Power-System-Analysis-by-G-W-St...
2. https://www.academia.edu/8352160/Computer_Methods_and_Power_System_Analysis_Stagg
3. https://www.uploady.com/#!/download/ddC9obmVTiv/NwO1AnQrlmogeJjS
4. https://www.materialdownload.in/article/Computer-Methods-in-Power-System-Analysis_159/
5. https://www.ee.iitm.ac.in/2015/07/ee5253/

Course Home Page:

SOLID STATE ELECTRIC MOTOR DRIVES

<table>
<tr><td colspan="10">VI Semester: EEE</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEE013</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
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<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Demonstrate DC drives through phase controlled rectifiers and choppers.
II. Analyze operating principle of four quadrant DC drives.
III. Illustrate the speed control of induction motors through various parameters.
IV. Outline the separate and self control of synchronous motors.

UNIT - I	CONTROL OF DC MOTORS THROUGH PHASE CONTROLLED RECTIFIERS	Classes: 09

Introduction to thyristor controlled drives: Single phase semi and fully controlled converters connected to DC separately excited and dc series motors, continuous current operation, output voltage and current waveforms, speed and torque expressions, speed torque characteristics, problems on converter fed DC motors; Three phase semi and fully controlled converters connected to DC separately excited and DC series motors, output voltage and current waveforms, speed and torque expressions, speed torque characteristics and problems.

UNIT - II	SPEED CONTROL OF DC MOTORS	Classes: 08

Introduction to four quadrant operation: Motoring operations, electric braking, plugging, dynamic and regenerative braking operations; Four quadrant operation of DC motors by dual converters, closed loop operation of DC motor; Chopper fed DC drives: Single quadrant, two quadrant and four quadrant chopper fed DC separately excited and series excited motors, continuous current operation output voltage and current wave forms, speed torque expressions, speed torque characteristics, problems on chopper fed DC motors and closed loop operation.

UNIT - III	SPEED CONTROL OF INDUCTION MOTORS THROUGH VARIABLE VOLTAGE AND VARIABLE FREQUENCY	Classes: 08

Variable voltage characteristics: Control of induction motor by AC voltage controllers, waveforms, speed torque characteristics.

Variable frequency characteristics: Variable frequency characteristics, variable frequency control of induction motor by voltage source and current source inverter and cycloconverters, pulse with modulation control, comparison of voltage source inverter and current source inverter operations, speed torque characteristics, numerical problems on induction motor drives, closed loop operation of induction motor drives.

UNIT - IV	SPEED CONTROL OF INDUCTION MOTORS THROUGH ROTOR RESISTANCE AND VECTOR CONTROL	Classes: 12

Static rotor Resistance control: Slip power recovery schemes, static Scherbius drive, static Kramer drive, their performance and speed torque characteristics, advantages and applications, vector control of induction motor drives: Principles of vector control, vector control methods, direct methods of vector control, indirect methods of vector control and problems.

UNIT - V	SPEED CONTROL OF SYNCHRONOUS MOTORS	Classes: 08
Separate control and self control of synchronous motors, operation of self controlled synchronous motors by voltage source inverter and current source inverter cycloconverters. Load commutated CSI fed synchronous motor, operation, waveforms, speed torque characteristics, applications, advantages and numerical problems, closed loop control operation of synchronous motor drives (block diagram only), variable frequency control, cycloconverter, PWM, variable frequency inverter and current source inverte.		

Text Books:

1. PV Rao, "Power Semiconductor Drives", BS Publications, 1st Edition, 2014.
2. G K Dubey, "Fundamentals of Electric Drives", Narosa Publications, 2nd Edition, 2001.
3. SB Devan, GR Slemon, A Straughen, "Power semiconductor drives", Wiley Pvt. Ltd,. 4th Edition, 2001.
4. B K Bose, "Modern Power Electronics and AC Drives", Prentice Hall India Learning Private Limited, 2005

Reference Books:

1. Vedam Subramanyam, "Thyristor Control of Electric Drives", Tata McGraw-Hill Publication, 5th Edition, 2008.
2. John Hindmarsh, Alasdair Renfew, "Electrical Machines and Drive Systems", Oxford Butterworth Heinemann, 3rd Edition.
3. Austin Hughes, "Electrical motors and drives Fundamentals Types and Applications", Elsevier, 3rd Edition, 2006.
4. M D Singh, K B Kanchandhani, "Power Electronics", Tata McGraw-Hill Publishing Company, 2nd Edition, 1998.
5. M H Rashid, "Power Electronics, Circuits, Devices and Applications", Pearson, 3rd Edition, 2001

Web References:

1. https://www.researchgate.net.
2. https://www.aar.faculty.asu.edu/classes.
3. https://www.books.askvenkat.com/engineering-textbooks/
4. https://www.electrical4u.com.
5. https://www.iare.ac.in.

E-Text Books:

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

Course Home Page:

MICROCONTROLLERS AND DIGITAL SIGNAL PROCESSING

VI Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC022	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the architecture of 8086 and 8051.
II. Design and develop programs for different applications using assembly language of 8051.
III. Develop skills for analyzing discrete signals and systems and apply discrete Fourier transform for frequency domain analysis along with the implementation of FFT.
IV. Design IIR and FIR filters, with given specifications, using different techniques.

UNIT - I	MICROPROCESSORS AND MICROCONTROLLERS	Classes: 08
Evaluation of processors, 8086 architecture, functional diagram, register organization, memory segmentation, microcontrollers, comparison of microprocessors and microcontrollers, microcontroller survey, 8051 architecture, pin diagram of 8051, I/O ports, memory organization, counters and timers, serial data input / output, interrupts.		
UNIT - II	**INSTRUCTION SET AND PROGRAMMING OF 8051**	**Classes: 09**
Addressing modes, Instruction set of 8051, programming of 8051, timers and counters, serial communication.		
UNIT - III	**8051 MICRO CONTROLLER DESIGN**	**Classes: 09**
Microcontroller design: External memory and memory space decoding, clock circuits, memory mapped I/O. Keyboard Interface, Seven segment numeric display interface, D/A and A/D converter interface to 8051.		
UNIT - IV	**INTRODUCTION TO DIGITAL SIGNAL PROCESSING AND FAST FOURIER TRANSFORMS**	**Classes: 10**
Discrete time signals and sequences, linear shift invariant systems, stability and causality, frequency domain representation of discrete time signals and systems, review of discrete Fourier transforms, fast Fourier transforms, radix2 decimation in time and decimation in frequency, FFT algorithms, inverse FFT and FFT with general radix- N.		
UNIT - V	**IIR AND FIR DIGITAL FILTERS**	**Classes: 09**
Analog filter approximations, Butterworth and Chebyshev, design of IIR digital filters from analog filters, step and impulse invariant techniques, characteristics of FIR digital filters, frequency response; Design of FIR digital filters: Fourier method, digital filters using window techniques.		

Text Books:

1. A K ray and K M Bhurchandani, "Advanced microprocessors and peripherals", Tata McGraw-Hill, 2nd Edition 2006.
2. Kenneth J Ayala, " The 8051 microcontroller",. Cengage learning, 3rd Edition 2010.
3. John G Proakis, Dimitris G Manolakis, "Digital signal processing, principles, Algorithms and applications", Pearson Education / PHI, 4th Edition. 2007.
4. V Oppenheim, R W Schaffer, "Discrete Time Signal Processing", Prentice Hall of India, New Delhi.

Reference Books:

1. D V Hall, "Microprocessors and Interfacing TMGH", 2nd Edition 2006
2. Liu and GA Gibson, "Micro computer system 8086 / 8088 family architecture, programming and design", PHI, 2nd Edition,
3. Ajay V Deshmukh, "Microcontrollers and application",. TMGH, 1st Edition, 2005
4. Loney Ludeman, John wiley, "Fundamentals of Digital signal processing", 1st Edition, 2009.
5. Li tan Elsevier, " Digital signal processing: fundamentals and applications", 1st Edition, 2008.

Web References:

1. http://www.nptel.ac.in/downloads/106108100/
2. http://www.the8051microcontroller.com/web-references
3. http://www.eceweb1.rutgers.edu/~orfanidi/ece348/
4. http://www.eecs.umich.edu/courses/eecs452/refs.html
5. http://www.dsp.sun.ac.za/lab-reference-guide/

E-Text Books:

1. https://www.books.google.co.in/books3
2. https://www.jntubook.com
3. https://www.ebooklibrary.org/articles/mpmc
4. https://www.dspguide.com/pdfbook.htm
5. https://www.dspguru.com/dsp/books/favorites
6. https://www.onlinevideolecture.com/ebooks
7. https://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Books

Course Home Page:

IDEATION AND PRODUCT DEVELOPMENT

VI Semester: Common for all branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE201	Skill	L	T	P	C	CIA	SEE	Total
		0	0	2	1	30	70	100
Contact Classes:	Tutorial Classes:	Practical Classes: 28				Total Classes: 28		

OBJECTIVES:

The course should enable the students:

- **I.** To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.
- **II.** To understand about the future needs of industries.
- **III.** To transform innovative ideas into successful businesses.
- **IV.** To use a range of creative thinking tools to develop Out of the Box Ideas.
- **V.** To develop Breakthrough Innovators and Dynamic Thinkers.

Syllabus

- Successful team formation and management
- Introduction to user-centred design
- Ideation and use of personas and POVs
- Need finding
- Embedded Microcontrollers for consumer products
- Human factors in engineering design
- Critical Experience and Critical Function Prototyping
- Dark Horse and 'Funky' prototyping
- Rapid prototyping and manufacturing
- Design for manufacture
- User testing
- Use of video/electronic media for communication
- Start-ups and entrepreneurship
- Intellectual Property

Text Books:

1. Product Design: Techniques in Reverse engineering & New Product development. K Otto & K Wood. Prentice Hall, 2001. ISBN 0-13-0212271-7 TCD Shelf Mark. HL-236-568.
2. Invention by design: how engineers get from thought to thing, Petroski H. Cambridge, Mass., London, Harvard University Press, 1996. ISBN 0674463676. TCD Shelf Mark. HL-201-280.
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, Harper Business, 2009, ISBN 978-0061766084.
4. Creative Confidence: Unleashing the Creative Potential Within Us All, Tom & David Kelley, Crown Business, 2013, ISBN 978-0385349369.

SOLID STATE ELECTRIC MOTOR DRIVES LABORATORY

<table>
<tr><td colspan="9">VI Semester: EEE</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEE109</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Apply principles of power electronics in speed control of various drives.
II. Demonstrate the concept of four quadrant operations of drives.
III. Discuss various drives used in industries to control torque and speed.

LIST OF EXPERIMENTS

Expt. 1 SINGLE PHASE RECTIFIER FED DC SHUNT MOTOR

Speed control of DC shunt motor using single phase rectifier.

Expt. 2 THREE PHASE RECTIFIER FED DC SEPARATELY EXCITED MOTOR

Speed control of DC separately excited shunt motor using three phase rectifier.

Expt. 3 SPEED MEASUREMENT AND CLOSED LOOP CONTROL OF PMDC MOTOR

Speed measurement and closed loop control of PMDC motor using thyristorized and MOSFET based chopper drive.

Expt. 4 FOUR QUADRANT CHOPPER DRIVE

Four quadrant operation of PMDC motor using chopper.

Expt. 5 AC VOLTAGE CONTROLLER FED INDUCTION MOTOR

Speed control of induction motor using AC voltage controller.

Expt. 6 FOUR QUADRANT CHOPPER DRIVE

Study of closed loop speed control of DC motor using three phase fed four quadrant chopper drive.

Expt. 7 SPEED CONTROL OF INDUCTION MOTOR

Speed control of induction motor using VVVF drive in three phase AC to three phase variable AC with 400V line voltage.

Expt. 8	**SPEED CONTROL OF INDUCTION MOTOR**
Speed control of induction motor using VVVF drive with external contacts, potentiometer arrangement.	
Expt. 9	**STATIC ROTOR RESISTANCE CONTROL**
Speed control of three phase wound rotor induction motor using static rotor resistance control.	
Expt. 10	**SYNCHRONOUS MOTOR SPEED CONTROL**
Speed control of synchronous motor using VFD.	
Expt. 11	**SVPWM CONTROL OF INDUCTION MOTOR USING DIGITAL SIMULATION**
SVPWM VSI fed induction motor drive simulation using MATLAB.	
Expt. 12	**DIRECT TORQUE CONTROL OF INDUCTION MOTOR DRIVE USING DIGITAL SIMULATION**
Direct torque control of induction motor drive simulation using MATLAB.	
Expt. 13	**FOUR QUADRANT OPERATION OF DC MOTOR USING DIGITAL SIMULATION**
Four quadrant operation of DC drives with three phase converter simulation using MATLAB.	
Expt. 14	**BLDC MOTOR DRIVE USING DIGITAL SIMULATION**
Simulation of BLDC motor drive using MATLAB	

Reference Books:

1. G K Dubey, "Power semiconductor drives", Khanna Publishers, 5th Edition, 2012.
2. P S Bimbhra, "Power Electronics", Khanna Publishers, 5th Edition, 2012.
3. M D Singh, K B Kanchandhani, "Power Electronics", Tata McGraw-Hill Publishing Company, 7th Edition, 2007.

Web References:

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

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	Speed control of DC shunt motor using single phase rectifier trainer kit	--
2	Speed control of DC shunt motor using three phase rectifier trainer kit	--
3	Four quadrant operation of DC motor using dual converter trainer kit	--
4	Four quadrant operation of PMDC motor using chopper trainer kit	--
5	Speed control of induction motor using AC voltage controller trainer kit	--
6	Single phase AC voltage controller with built in 48V / 2A Isolation Transformer	--
7	VVVF drive with different inputs and outputs	--
8	Speed control of V / F drive using external contexts and potentiometer trainer kit	--
9	Speed control of VFD using PLC power circuit	--
10	Speed control of synchronous motor using VFD power unit	--
11	Hardware: Desktop Computers (04 nos) Software: MATLAB	

PROGRAMMABLE LOGIC CONTROLLERS AND AUTOMATION LABORATORY

VI Semester: EEE								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
AEE110	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Illustrate the functioning of programmable logic controllers and implementation in automation of industry.

II. Analyze working of hardware related to programmable logic controllers.

III. Demonstrate control system applications in industry using programmable logic controllers.

IV. Apply sequential logic to industrial applications and control systems.

LIST OF EXPERIMENTS

Expt. 1	STAR DELTA STARTER
Star delta starter for three phase squirrel cage induction motor using programmable logic controller.	
Expt. 2	AUTOMATIC FORWARD AND REVERSE CONTROL
Automatic forward and reverse control of three phase squirrel cage induction motor for milling operation using programmable logic controller.	
Expt. 3	FAULT ANNUNCIATION SYSTEM
Fault annunciation system using programmable logic controller.	
Expt. 4	TEMPERATURE CONTROL SYSTEM
Temperature control system using programmable logic controllers and PT100 using programmable logic controller.	
Expt. 5	PLUGGING
Starting, stopping, reversing and braking by plugging of a squirrel cage induction motor using programmable logic controller.	
Expt. 6	CONTROL OF LIFT
Control of lift using programmable logic controller.	
Expt. 7	TRAFFIC SIGNAL CONTROL
Traffic signal control using programmable logic controller.	

Expt. 8	**IMPLEMENTATION OF TIMERS**
Implementation of ON-delay and OFF – delay timers using PLC	
Expt. 9	**SOLAR TRACKING**
Solar tracking using programmable logic controller.	
Expt. 10	**DIRECT ONLINE STARTER**
Direct online starter for AC motor implementation using programmable logic controller.	
Expt. 11	**UP DOWN COUNTER**
Implementation of up down counter to count the objects in a store using programmable logic controller.	
Expt. 12	**DIGITAL CLOCK**
Implementation of 24 hour digital clock using programmable logic controller.	
Expt. 13	**TIMERS**
Implementation of on delay, off delay and retentive timer using programmable logic controller.	
Expt. 14	**SEQUENTIAL CONTROL**
Sequential control of three motors to start one after the other with a time delay using programmable logic controller.	

Reference Books:

1. L A Bryan, E A Bryan, "Programmable Controllers: Theory & Implementation", Industrial Text Company Publications, 2nd Edition, 1997.
2. John R Hackworth & Frederick D. Hackworth Jr., "Programmable Logic Controllers: Programming methods and applications", Pearson education, 2008.

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

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

SOFTWARE: WPL soft programmable logic controller software

HARDWARE: Desktop Computers (04 nos)

MICROCONTROLLERS AND DIGITAL SIGNAL PROCESSING LABORATORY

VI Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEC114	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 42**				**Total Classes: 42**		

OBJECTIVES:

The course should enable the students to:

I. Develop assembly language program for arithmetic and logical operations using 8051.
II. Implement convolution using MATLAB.
III. Implement digital signal processing algorithms using MATLAB.

LIST OF EXPERIMENTS

Expt. 1	**DESIGN A PROGRAM USING WIN862 AND 8086 MICROPROCESSOR**
Design and develop an assembly language program using 8086 microprocessor and to show the following aspects, programming execution debugging to demonstrate the tool chain for WIN862 and hardware for 8086 microprocessor.	
Expt. 2	**8 AND 16 BIT ARITHMETIC OPERATIONS**
a) Write an ALP program to perform 8 Bit arithmetic operations using 8051 b) Write an ALP program to perform 16 Bit arithmetic operations using 8051	
Expt. 3	**NUMBER OF ZEROS AND ONES IN ANY NUMBER**
a) write an ALP program to count the number of ones in any number b) Write an ALP program to count the number of zeros in any number	
Expt. 4	**TIMER / COUNTER IN 8051**
Write an ALP program and verify timer/counter in 8051	
Expt. 5	**UART OPERATION IN 8051**
Write an ALP program to operate UARE in 8051.	
Expt. 6	**INTERFACE SEVEN SEGMENT DISPLAY**
Write an ALP program to interface 8051 and keyboard	
Expt. 7	**ADC, DAC WITH 8051**
a) write an ALP program to convert analog signal to digital signal using 8051 b) write an ALP program to convert digital signal to analog signal using 8051	

Expt. 8	CONVOLUTION
a) Generation of linear convolution without using built in function in MATLAB b) Generation of circular convolution without using built in function in MATLAB	
Expt. 9	**DISCRETE FOURIER TRANSFORM**
Compute the Discrete Fourier Transform and IDFT with and without fft and ifft in MATLAB	
Expt. 10	**POWER SPECTRUM**
Determination of power spectrum of a given sequence.	
Expt. 11	**DIT - FAST FOURIER TRANSFROM**
Implementation of Decimation-in-time radix-2 FFT algorithm	
Expt. 12	**DIF - FAST FOURIER TRANSFROM**
Implementation of Decimation-in-frequency radix-2 FFT algorithm	
Expt. 13	**IIR FILTER**
Implementation of LP/HP IIR digital filter	
Expt. 14	**FIR FILTER**
Implementation of LP/HP FIR digital filter	
Reference Books:	
1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd Edition, Cengage learning, 2010. 2. D V Hall, "Microprocessors and Interfacing", Tata McGraw-Hill Education, 3rd Edition 2013. 3. A K ray and K M Bhurchandani, "Advanced microprocessors and peripherals", Tata McGraw-Hill Education, 2nd Edition 2006. 4. Fundamentals of Digital signal processing - LoneyLudeman, John wiley, 2009. 5. Digital signal processing: fundamentals and applications - Li Tan Elsevier, 2008.	
Web References:	
1. https://www.nptel.ac.in/downloads/106108100/ 2. https://www.the8051microcontroller.com/web-references 3. https://www.eceweb1.rutgers.edu/~orfanidi/ece348/ 4. https://www.eecs.umich.edu/courses/eecs452/refs.html 5. https://www.dsp.sun.ac.za/lab-reference-guide/	
Course Home Page:	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-5V & 12V DC
2	Digital Storage Oscilloscope	0-20 MHz
3	8086 Trainer Kits with keyboard	43 No.s
4	8051 Trainer kits with keyboard	40 No.s
5	Serial Interface cable	45 No.s
6	Stepper Motors	45 No.s
7	A/D Device	14 No.s
8	A/D and Dual D/A Devices	27 No.s
9	Dual D/A Devices	14 No.s
10	PPI 8255	12 No.s
11	USART 8251	7 No.s
12	Keyboard/ Seven segment controller	7 No.s
13	Traffic Light Controller	3 No.s
14	RTC/ Tone generator	3 No.s
15	Elevator	2 No.s
16	SRAM and DRAM	2 No.s
17	DMA Controller	1 No.s
18	LCD Display	40 No.s
19	Timer/Counter, UART and Interrupt	44 No.s
20	Keyboard	40 No.s
21	Hardware: Desktop Computers (04 nos), ESA 86 / 88 trainer kit. Software: win 862, Keil µVision Tools	

POWER SYSTEM PROTECTION

<table>
<tr><td colspan="10">VII Semester: EEE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE014</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand types of various circuit breakers
II. Classify relays into various types such as of electromagnetic, static and numerical relays
III. Evaluate the performance of protection schemes of generator and transformer
IV. Analyze the performance of feeder and bus-bar protection
V. Discuss the protection schemes against over voltages

UNIT - I	CIRCUIT BREAKERS	Classes: 08

Circuit Breakers: Elementary principles of arc interruption, restriking and recovery voltages, restriking phenomenon, average, maximum and rate of rise of restriking voltage, current chopping and resistance switching, circuit breaker ratings and specifications, auto reclosures, description and operation of various types of circuit breakers, minimum oil circuit breakers, air blast circuit breakers, vacuum and SF6 circuit breakers, numerical problems.

UNIT - II	ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS	Classes: 14

Electromagnetic relays: Principle of operation and construction of attracted armature, balanced beam, induction disc and induction cup relays; Relays classification: instantaneous, definite minimum time and inverse definite minimum time relays over current / under voltage relays, direction relays, differential relays and percentage differential relays, universal torque equation; Distance relays: Impedance, reactance, mho and offset mho relays, characteristics of distance relays; Static relays: Overview of static relay, block diagram, operating principle and comparison, static relays versus electromagnetic relays; Numerical relays: Introduction, block diagram of numerical relay, sampling theorem, anti aliasing filter, block diagram of phasor measurement unit and intelligent electronic device, data acquisition systems and numerical relaying algorithms, applications and numerical problems.

UNIT - III	SUBSTATIONS AND PROTECTION OF FEEDER / BUS BAR	Classes: 07

Indoor and outdoor substations: Substations layout, bus bar arrangements like single, sectionalized, main and transfer bus bar system with relevant diagrams; Gas insulated substation (GIS): Types, single line diagram, constructional aspects of GIS, Installation, maintenance, advantages, comparison of GIS with air insulated substations.

Protection of lines: Over current, carrier current and three zone distance relay protection using impedance relays, translay relay; Protection of bus bars: Differential protection, grounded and ungrounded neutral systems, effect of ungrounded neutral on system performance, methods of neutral grounding, solid, resistance, reactance arcing grounds and grounding practices, application of numerical relays.

UNIT - IV	GENERATOR AND TRANSFORMER PROTECTION	Classes: 08
Generator protection: Protection of generators against stator faults, rotor faults, and abnormal conditions, restricted earth fault and inter turn fault protection, numerical problems on percentage winding unprotected; Transformer protection: Percentage differential protections, numerical problem on design of current transformers ratio, buchholz protection.		
UNIT - V	**PROTECTION AGAINST OVER VOLTAGES**	**Classes: 08**
Over voltages in power systems: Generation of over voltages in power systems, protection against lightning over voltages, valve type and zinc oxide lighting arresters, insulation coordination, basic insulation level, impulse ratio, standard impulse test wave, volt time characteristics.		

Text Books:

1. Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 1st Edition, 2013.
2. Badari Ram, D N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 1st Edition, 2001.
3. A R van C Warrington, "Protective Relays: Their Theory and Practice", Springer Science & Business Media, Volume 2, 2nd Edition, 1977.
4. B L Soni, Gupta, Bhatnagar, Chakrabarthy, "Power System Engineering", Dhanpat Rai & Co, 3rd Edition, 2007.
5. T S Madhava Rao, "Power system protection: static relays", McGraw-Hill Companies, 2nd Edition, 1989.

Reference Books:

1. Paithankar, S R Bhide, "Fundamentals of Power System Protection", PHI, 1st Edition, 2003.
2. C LWadhwa, "Electrical Power Systems", New Age international (P) Limited, 6th Edition, 2010.
3. VK Mehta, "Principles of power systems", S Chand Publications, 4th Edition, 2009.

Web References:

1. https://www.eiseverywhere.com/file_uploads/aaf42a76a5588f69c7a1348d6f77fe0f_Introduction_to_System_Protection-_Protection_Basics.pdf
2. https://www.scribd.com/doc/94677925/Protection-and-Switch-Gear-by-U-a-bakshi-and-M-v-bakshi
3. https://www.scadec.ac.in/upload/file/psg%20notes_opt.pdf
4. https://www.vssut.ac.in/lecture_notes/lecture1425873259.pdf
5. https://www.en.wikipedia.org/wiki/Power-system_protection

E-Text Books:

1. https://www.igs.nigc.ir/STANDS/BOOK/Electrical-Eng-HB.pdf
2. https://www.file:///C:/Users/iare20071/Downloads/Electrical_Power_Systems_Quality_Second_Edition_007138622X.pdf
3. https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=49&cad=rja&uact=8&ved=0ahUKEwiB89WRo5vQAhWMuY8KHYNDCPA4KBAWCEcwCA&url=http%3A%2F%2Fbank.engzenon.com%2Fdownload%2F565727ab-789c-4920-a807-4447c0feb99b%2Fpower_ system_ relaying_by_stanley_h_horowitz_4th.pdf&usg=AFQjCNFH1CozChcgjUBC3AUV_XJPG1Raog&bvm=bv.138169073,d.c2I

Course Home Page:

HIGH VOLTAGE ENGINEERING

VII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE015	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the various types of over voltages in power system and protection methods.
II. Demonstrate generation of higher voltages and currents in laboratories for testing purposes.
III. Measure over voltages using various advanced techniques.
IV. Analyze nature of breakdown mechanism in solid, liquid and gaseous dielectrics.
V. Design and test the power apparatus and insulation coordination.

UNIT - I	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	Classes: 09

Origin of over voltages: Causes of over voltages and their effects on power system, lightning, switching surges and temporary over voltages, corona and its effects, reflection and refraction of travelling waves, protection against over voltages.

UNIT - II	DIELECTRIC BREAKDOWN	Classes: 09

Breakdown of dielectrics: Gaseous breakdown in uniform and non uniform fields, corona discharges, breakdown of vacuum, conduction and breakdown in pure and commercial liquids, maintenance of oil quality, breakdown mechanisms in solid and composite dielectrics.

UNIT - III	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	Classes: 09

High AC, DC voltages and currents: Generation of high DC, AC and impulse voltages and currents.
Triggering: Triggering and control of impulse generators.

UNIT - IV	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	Classes: 09

High voltage and current measurement: High resistance with series ammeter, dividers, resistance, capacitance and mixed dividers, peak voltmeter, generating voltmeters, capacitance voltage transformers, electrostatic voltmeters, sphere gaps, high current shunts, digital techniques in high voltage measurement.

UNIT - V	HIGH VOLTAGE TESTING AND INSULATION COORDINATION	Classes: 09

Testing: High voltage testing of electrical power apparatus as per international and Indian standards, power frequency, impulse voltage and dc testing of insulators, circuit breakers, bushings, isolators and transformers, insulation coordination.

Text Books:

1. S Naidu, V Kamaraju, "High Voltage Engineering", Tata McGraw-Hill, 5th Edition, 2013.
2. E Kuffel, W S Zaengl, J Kuffel, "High voltage Engineering fundamentals", Newnes, 2nd Edition Elsevier, New Delhi, 2005.
3. Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi, 2nd Edition, 2013.

Reference Books:
1. L L Alston, "High Voltage Technology", Oxford University Press, 1st Indian Edition, 2011. 2. C L Wadhwa, "High Voltage Engineering", New Age International Publishers, 3rd Edition, 2010.
Web References:
1. https://www.nptel.ac.in/courses/108104048/ 2. https://www.hve.iisc.ernet.in/ 3. https://www.ee.iisc.ac.in/research-hve.php 4. https://www.wikipedia.org/wiki/High_voltage 5. https://www.annauniv.edu/HighVoltage/
E-Text Books:
1. https://www.docs.google.com/file/d/0B5vXY4-Kg5GeQi1LcEU2UnJNbE0/edit 2. https://www.7see.blogspot.in/2015/04/high-voltage-engineering-by-wadhwa-free.html 3. https://www.itebooks.zone/1849192634.html 4. https://www.studynama.com/community/threads/329-High-voltage-engineering-ebook-pdf-lecture-notes-download-for-electrical
Course Home Page:

POWER SYSTEM OPERATION AND CONTROL

VII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE016	Core	L	T	P	C	CIA	SEE	Total
		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. Demonstrate economic operation of power systems, hydrothermal scheduling.
II. Illustrate modeling of turbines, generators and automatic controllers.
III. Discuss single area and two area load frequency control.
IV. Analyze reactive power control and load modeling.

UNIT - I	ECONOMIC OPERATION OF POWER SYSTEMS	Classes: 12

Optimal scheduling of thermal power system: Optimal operation of generators in thermal power stations, heat rate curve, cost curve, incremental fuel and production costs, input output characteristics, optimum generation allocation without and with transmission line losses coefficients, general transmission line loss formula, unit commitment; Optimal scheduling of hydrothermal system: Hydro electric power plant models, scheduling problems, short term hydro thermal scheduling problem.

UNIT - II	MODELING OF GOVERNOR, TURBINE AND EXCITATION SYSTEMS	Classes: 09

Modeling of governor: Mathematical modeling of speed governing system, derivation of small signal transfer function; Modeling of turbine: First order turbine model, block diagram representation of steam turbines and approximate linear models; Modeling of excitation system: Fundamental characteristics of an excitation system, transfer function, block diagram representation of IEEE type-1 model.

UNIT - III	SINGLE AREA AND TWO AREA LOAD FREQUENCY CONTROL	Classes: 09

Load frequency control of single area system: Necessity of keeping frequency constant, definitions of control area, single area control, block diagram representation of an isolated power system, steady state analysis, dynamic response, uncontrolled case.

Load frequency control of two area system: Uncontrolled case and controlled case, tie line bias control; Load frequency controllers: Proportional plus integral control of single area and its block diagram representation, steady state response, load frequency control and economic dispatch.

UNIT - IV	COMPENSATION FOR POWER FACTOR IMPROVEMENT AND REACTIVE POWER CONTROL	Classes: 09

Voltage control: Equipment for voltage control, effect of series capacitors, line drop compensation, effect of AVR, power factor control using different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (fixed and switched), power factor correction, capacitor allocation, economic justification, procedure to determine the best capacitor location; Reactive power control: Reactive power compensation in transmission systems, advantages and disadvantages of different types of compensating equipment for transmission systems; Uncompensated and compensated transmission lines: Shunt and series compensation.

UNIT - V	LOAD COMPENSATION	Classes: 06

Load Compensation: characteristics of loads, factors associated with loads, relation between the load factor and loss factor; specifications of load compensator; Classification of loads: Residential, commercial, agricultural and industrial and their characteristics.

Text Books:

1. C L Wadhwa, “Electrical power systems”, Newage International, 3rd Edition, 2005.
2. I J Nagarath, D P Kothari, “Modern power system analysis”, Tata McGraw-Hill, 2nd Edition, 2006.
3. T J E Miller, “Reactive power control in Electrical system”, Wiley Interscience Publication, 1982.
4. V K Mehta and Rohit Mehta, “Principles of Power System”, S Chand, 3rd revised Edition, 2015.

Reference Books:

1. Singh S N, “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.
2. Turan Gonen, “Electrical Power Distribution System Engineering”, CRC Press, 3rd Edition, 2014.
3. V Kamaraju, “Electrical Power Distribution Systems”, TMH, Publication, Edition, 2009
4. O I Elgerd, “Electrical Energy Systems Theory”, Tata McGraw-Hill, 2nd Edition, 2007.

Web References:

1. https://www.electrical4u.com/working-or-operating-principle-of-dc-motor
2. https://www.freevideolectures.com
3. https://www.ustudy.in › Electrical Machines
4. https://www.freeengineeringbooks.com

E-Text Books:

1. https://www.textbooksonline.tn.nic.in
2. https://www.freeengineeringbooks.com
3. https://www.eleccompengineering.files.wordpress.com
4. https://www.books.google.co.in

Course Home Page:

HIGH VOLTAGE ENGINEERING AND SOLAR LABORATORY

VII Semester: EEE

Course Code	Category	Hours / Week			Credit	Maximum Marks		
AEE111	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42				Total Classes: 42		

OBJECTIVES:

The course should enable the students to:

I. Understand the principles of high voltage generation and measurements.
II. Determine the break down voltage of atmospheric air using rod gap and sphere gap apparatus.
III. Understand breakdown phenomena in solid, liquid and gas mediums.
IV. Familiarize the students with solar power generation and measurement technology.

LIST OF EXPERIMENTS

Expt. 1 GENERATION OF AC HIGH VOLTAGES

Study of generation of high AC voltages using cascaded transformers.

Expt. 2 VERIFICATION OF BREAKDOWN POTENTIAL OF AIR AT SPECIFIED GAP

Verification of breakdown potential with reference to empirical formula.

Expt. 3 DETERMINATION OF BREAKDOWN VOLTAGE OF AIR BY ROD GAP APPARATUS

Determination of breakdown voltage of atmospheric air using rod gap apparatus.

Expt. 4 DETERMINATION OF BREAKDOWN VOLTAGE OF AIR USING SPHERE GAP APPARATUS

Determination of breakdown voltage of atmospheric air using sphere gap apparatus.

Expt. 5 DETERMINATION OF BREAKDOWN VOLTAGE OF SOLID INSULATOR

Determination of breakdown of solid insulators such as paper, thermocol and glass.

Expt. 6 DETERMINATION OF BREAKDOWN VOLTAGE OF LIQUID INSULATOR

Determination of breakdown of liquid insulator using oil insulation tester.

Expt. 7 CHARACTERSTICS OF SOLAR PANEL

Determination of IV characteristics of solar panel and calculation of equivalent circuit parameters of a PV array in PACAD.

Expt. 8 SOLAR INVERTER

Study of off-grid solar inverter with battery charging controller.

Expt. 9	**EFFECT OF SHADING ON SOLAR PANNEL PERFORMANCE**
Study of a) Series parallel connections of solar panels and effect of shading. b) Improvement in power efficiency of photovoltaic array under shading conditions using bypass diode with PSCAD.	
Expt. 10	**EFFECT OF TEMPERATURE AND TILT ANGLE ON SOLAR PANNEL**
Study of effect of surrounding temperature and tilt angle on the performance solar PV panel.	
Expt. 11	**DESIGN OF SOLAR PANEL**
Study of solar panel manufacturing using solar cells by interconnecting them to get desired voltage and power rating.	
Expt. 12	**DATA ACQUISITION USING DIGITAL SIMULATION**
Data acquisition using temperature, voltage and irradiation with sensors of solar panel using digital simulation.	
Expt. 13	**MAXIMUM POWER POINT TRACKER USING DIGITAL SIMULATION / PSCAD**
a) Implementation of maximum power point tracker using Perturb and observe algorithm using digital simulation. b) Determine the mathematical model of PV cell, ensure MPPT algorithm using PSCAD.	
Expt. 14	**DETERMINATION OF PARAMETERS OF SOLAR CELL USING DIGITAL SIMULATION**
Study of characteristics and determination of parameters of solar cell using digital simulation.	

Reference Books:

1. M S Naidu and V Kamaraju, "High Voltage Engineering", TMH Publications, 3rd Edition
2. E Kuffel, W S Zaengl, J Kuffel, "High Voltage Engineering Fundamentals", Elsevier, 2nd Edition
3. S P Sukhatme, J K Nayak., "Solar Energy", Tata McGraw-Hill Education Private Limited, New Delhi 1st Edition, 2010.
4. Mukund R. Patel, "Wind and Solar Power Systems: Design, Analysis, and Operation", 2nd Edition, CRC, 2005.

Web References:

1. https://www.cl.cam.ac.uk/teaching/1011/CompFunds
2. https://www.bibcol.com
3. https://www.tutorialspoint.com/computer_fundamentals
4. https://www.craftsmanspace.com

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S No	Name of the Equipment	Range
1	Cascaded transformer	0-100 kV
2	Rod gap apparatus	0-100 kV
3	Sphere gap apparatus	0-100 kV
4	Oil test setup	0-140 kV
5	Charge controller with inverter	0-220V, 50 Hz
6	Solar Panels	0-100W peak

POWER SYSTEM PROTECTION LABORATORY

<table>
<tr><td colspan="10">VII Semester: EEE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE112</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Determine the parameters, surge impedance loading and reactive power compensation of transmission lines.
II. Understand the concept of various transmission line protection schemes.
III. Simulate and study feeder protection circuits.

LIST OF EXPERIMENTS

Expt. 1	**CHARACTERISTICS OF AN MCB**
Plotting the Characteristics of Miniature Circuit Breaker (MCB).	
Expt. 2	**CHARACTERISTICS OF FUSE AND THERMAL OVERLOAD PROTECTION**
Study of characteristics of High Rupturing Capacity (HRC) fuse and tripping of bimetallic thermal overload protection and its characteristics.	
Expt. 3	**ABCD PARAMETERS OF TRANSMISSION LINE**
Measurement of ABCD parameters of a transmission line	
Expt. 4	**FERRANTI EFFECT IN A TRANSMISSION LINE**
Study of Ferranti effect in a the transmission line	
Expt. 5	**SURGE IMPEDANCE LOADING**
Study of Surge Impedance Loading (SIL) of a transmission line.	
Expt. 6	**EFFECT OF SHUNT COMPENSATION**
Determine shunt compensation to counteract the voltage rise on no load and zero regulation at different loads in a transmission line.	
Expt. 7	**VOLTAGE PROFILE IMPROVEMENT USING TAP CHANGING TRANSFORMER**
Study of voltage improvement by reactive power control using tap changing transformer.	
Expt. 8	**EFFICINCY AND REGULATION OF A TRANSMISSION LINE**
Determine the performance of a transmission line by calculating its efficiency and regulation.	

Expt. 9	**PERFORMANCE OF IMPEDANCE RELAY**
Study the working principle of impedance relay and its effect during faults in a transmission line.	
Expt. 10	**PERFORMANCE OF OVER CURRENT RELAY**
Study the working principle of over current relay and its effect during faults in a transmission line.	
Expt. 11	**EARTH FAULT PROTECTION**
Study of earth fault detection methods and various earth fault protection schemes	
Expt. 12	**FEEDER PROTECTION**
Study the various protection schemes in radial feeder under various fault conditions.	
Expt. 13	**MEASURMENT OF SEQUENCE IMPEDANCES OF SYNCHRONOUS MACHINE**
Measurement of positive, negative and zero sequence impedances of synchronous machine by using direct method and fault analysis method	
Expt. 14	**STRING EFFICIENCY OF INSULATORS**
Determination of string efficiency in a string of insulators.	

Reference Books:

1. Paithankar, S R Bhide, "Fundamentals of Power System Protection", PHI, 1st Edition, 2003.
2. C L Wadhwa, "Electrical Power Systems", New Age international (P) Limited, 6rd Edition, 2010.
3. VK Mehta, "Principles of power systems", S Chand Publications, 4th Edition, 2009.
4. T S Madhava Rao, "Power system Protection static relay", Tata McGraw-Hill Publishing Company limited, 2nd Edition, 1989.
5. Badri Ram and D N Vishwakarma, "Power system Protection and Switchgear ", Tata McGraw-Hill Publication company limited First Edition,1995.

Web References:

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

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S No	Name of the Equipment	No.s / Range
1	Miniature Circuit Breaker (MCB)	01
2	HRC Fuse	01
3	Impedance Relay	01
4	Over Current Relay	01
5	Earth Fault Relay	01
6	Radial Feeder Protection Unit	01
7	Transmission Line Simulating Unit	01
8	Three Phase Alternator	01
9	Capacitors / String Insulators	05

POWER SYSTEM COMPUTER AIDED DESIGN LABORATORY

VII Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE113	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 42**				**Total Classes: 42**		

OBJECTIVES:

The course should enable the students to:

I. Simulate transmission lines using PSCAD software to analyze faults in transmission system.
II. Demonstrate load flow studies using static load flow methods using MATLAB.
III. Analyze transient state stability in power systems.

LIST OF EXPERIMENTS

Expt. 1 FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRICES

Formation of bus admittance matrices by adding one element at a time and also write a program for Zbus building algorithm using MATLAB.

Expt. 2 LOAD FLOW SOLUTION USING GAUSS SEIDEL METHOD

Write a MATLAB program for load flow studies without and with generator buses using Gauss Seidel Method.

Expt. 3 LOAD FLOW SOLUTION USING NEWTON RAPHSON AND FDLF METHOD

Write a MATLAB program for load flow studies using Newton Raphson and Fast Decoupled Load Flow (FDLF) method.

Expt. 4 POWER SYSTEM FAULT ANALYSIS

Analysis of symmetrical and unsymmetrical faults using symmetrical components using MATLAB.

Expt. 5 POINT BY POINT METHOD

Development of MATLAB program for Transient stability analysis of single machine - infinite bus and multi machine system by point by point method.

Expt. 6 TRANSIENT RESPONSE OF RLC CIRCUIT

Obtain transient response of RLC circuit using PSCAD.

Expt. 7 THREE PHASE SHORT CIRCUIT ANALYSIS IN A SYNCHRONOUS MACHINE

Analyze symmetrical faults and short circuit studies in a given synchronous machine using PSCAD.

Expt. 8	**STUDY OF TRANSMISSION SYSTEM AND SHORT CIRCUIT ANALYSIS OF 9 BUS SYSTEM**
Study of simple transmission system and also Perform short circuit analysis on IEEE 9 bus system using PSCAD.	
Expt. 9	**TRANSFORMER INRUSH CURRENT**
Determination of transformer inrush current under unbalanced three phase parameters using PSCAD.	
Expt. 10	**SMALL SIGNAL STABILITY ANALYSIS**
Development of PSCAD model for stability analysis of single machine - infinite bus with STATCOM.	
Expt. 11	**TRANSMISSION LINE PARAMETERS**
Obtaining parameters of a typical transmission line and modelling it in PSCAD.	
Expt. 12	**LOAD FREQUENCY CONTROL**
Obtain the frequency response of single and two area power system using PSCAD.	
Expt. 13	**POWER QUALITY**
Familiarization with PSCAD and Understanding of a) Reactive power and power factor correction in AC circuits. b) Current harmonics drawn by power electronics interface	
Expt. 14	**DISTANCE PROTECTION**
Development of PSCAD model to study the distance protection scheme in long transmission line.	

Reference Books:

1. M A Pai, "Computer Techniques in Power System Analysis", TMH Publications, 1st Edition, 2010
2. Grainger, Stevenson, "Power System Analysis", Tata McGraw-Hill, 1st Edition, 2010.
3. Badri Ram and D N Vishwakarma, "Power system Protection and Switchgear", Tata McGraw-Hill Publication company limited, First Edition -1995.
4. Paithankar, S R Bhide, "Fundamentals of Power System Protection", PHI, 1st Edition, 2003.
5. C L Wadhwa, "Electrical Power Systems", New Age international (P) Limited, 6rd Edition, 2010.

Web References:

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

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

SOFTWARE: Power System Computer Aided Design (PSCAD) software and MATLAB

HARDWARE: 36 No. of Desktop Computers

EMBEDDED SYSTEMS DESIGN AND PROGRAMMING

VIII SEMESTER: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC024	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Imbibe knowledge about the basic functions, structure, concepts and applications of Embedded Systems.
II. Understand Real time operating system concepts.
III. Design interfacing of switches, displays and stepper motor.
IV. Analyze different tools for development of embedded software.
V. Be acquainted the architecture of advanced processors.

UNIT-I	EMBEDDED COMPUTING	Classes: 09

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, , formalisms for system design, design examples

UNIT-II	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 09

Embedded systems programming in C, binding and running embedded C program in Keil IDE, building the hardware; The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' example.

UNIT-III	EMBEDDED C APPLICATIONS	Classes: 09

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).

Basic techniques for reading and writing from I/O port pins, LED interfacing, interfacing with keyboards, displays, Stepper motor interfacing.

UNIT-IV	INTRODUCTION TO REAL – TIME OPERATING SYSTEMS	Classes: 09

Tasks and Task States, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Interrupt Routines in an RTOS Environment.

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine.

UNIT-V	INTRODUCTION TO ADVANCED ARCHITECTURES	Classes: 09

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus.

Text Books:

1. Wayne Wolf, “Computers and Components”, Elseveir.
2. Kenneth J.Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson.
3. K. V. K. K. Prasad,“Embedded / Real-Time Systems: Concepts, Design & Programming”
4. Michael J. Pont,“Embedded C”, 2nd Edition, Pearson Education, 2008

Reference Books:

1. Labrosse,“Embedding system building blocks”, CMP publishers.
2. Raj Kamal,“Embedded Systems”, TMH.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley
5. Raj kamal, “Microcontrollers”, Pearson Education.
6. David E. Simon,“An Embedded Software Primer”, Pearson Education.
7. Muhammad Ali Mazadi,JaniceMazidi,JaniceGillispieMazdi,“8051 Microcontroller and Embedded Systems”.

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

HYBRID ELECTRIC VEHICLES

VIII Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE019	Core	L	T	P	C	CIA	SEE	Total
		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. Compare the performance of hybrid electric vehicles and conventional vehicles.
II. Discuss the concept of hybrid traction and application of power electronics in hybrid electric vehicles.
III. Design hybrid electric vehicle utilizing suitable electric motor and drive.
IV. Demonstrate the need for energy storage and energy management in hybrid electric vehicles.

UNIT - I	INTRODUCTION	Classes: 08

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies; Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT - II	HYBRID ELECTRIC DRIVE TRAINS	Classes: 10

Hybrid Electric Drive trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive train topologies, fuel efficiency analysis; Electric Drive trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive train topologies, fuel efficiency analysis.

UNIT - III	ELECTRIC MOTORS FOR HYBRID ELECTRIC VEHICLES	Classes: 10

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, configuration and control of DC motor drives, configuration and control of Induction Motor drives.

Configuration and control of permanent magnet motor drives, configuration and control of switch reluctance motor drives, drive system efficiency.

UNIT - IV	ENERGY STORAGE	Classes: 08

Energy Storage: Introduction to energy storage requirements in hybrid and electric vehicles, Battery based energy storage and its analysis, fuel cell based energy storage and its analysis, super capacitor based energy storage and its analysis, flywheel based energy storage and its analysis, hybridization of different energy storage devices; sizing the drive system: matching the electric machine and the internal combustion engine (ICE), sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, communications, supporting subsystems.

UNIT - V	ENERGY MANAGEMENT STRATEGIES	Classes: 09

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2nd Edition, 2003.
2. James Larminie, John Lowry, “Electric Vehicle Technology”, Wiley publications, 1st Edition, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals Theory and Design”, CRC Press, 2nd Edition, 2004.

Reference Books:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 1st Edition 2004.
2. B D McNicol, D A J Rand, “Power Sources for Electric Vehicles”, Elsevier publications, 1st Edition, 1998.
3. Seth Leitman, “Build Your Own Electric Vehicle” McGraw-Hill, 1st Edition, 2013.

Web References:

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.unep.org/transport/pcfv/PDF/HEV_Report.pdf
3. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf
4. https://www.afdc.energy.gov/pdfs/52723.pdf
5. https://www.leb.eei.uni-langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf

E-Text Books:

1. https://www.onlinelibrary.wiley.com/book/10.1002/9781119998914
2. https://www.go2hev.com/hybrid-electric-vehicles-student-textbook.html
3. https://www.sciencedirect.com/science/book/9780444535658
4. https://www.accessengineeringlibrary.com/browse/hybrid-electric-vehicle-design-and-control-intelligent-omnidirectional-hybrids

Course Home Page:

REAL TIME CONTROL OF POWER SYSTEMS

Group - I									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE501	Elective	L	T	P	C	CIA	SEE	Total
		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 state estimation into different types.
II. Analyse and monitor security and contingency evaluation.
III. Justify the need of automation in power systems.
IV. Recognize the importance of voltage stability and voltage stability indices.
V. Apply artificial intelligence and artificial neural networks to power system analysis.

UNIT - I	STATE ESTIMATION	Classes: 09

Introduction: Different types of state estimation, theory of WLS state estimation, sequential and non sequential methods to process measurements, bad data observability, bad data detection, identification and elimination.

UNIT - II	SECURITY AND CONTINGENCY EVALUATION	Classes: 09

Evaluations: Security concept, security Analysis and monitoring, contingency analysis for generator and line outages by iterative linear power flow method, fast decoupled model, and network sensitivity methods.

UNIT - III	COMPUTER CONTROL OF POWER SYSTEMS AND SCADA	Classes: 09

Computer control: Need for real time and computer control of power systems, operating states of a power system.

SCADA: Supervisory control and data acquisition systems implementation considerations, energy control centres, software requirements for implementing the above functions.

UNIT - IV	VOLTAGE STABILITY	Classes: 09

Analysis of voltage stability: What is voltage stability, voltage collapse, and voltage security, relation of voltage stability to rotor angle stability, voltage stability analysis, introduction to voltage stability analysis, `P-V' curves and `Q-V' curves, voltage stability in mature power systems, long term voltage stability, power flow analysis for voltage stability, voltage stability static indices and research areas

UNIT - V	APPLICATION OF AI AND ANN IN POWER SYSTEM	Classes: 09

Use of AI and ANN in power system: Basic concepts and definitions, algorithms for load flow, short term load forecasting, fault diagnosis and state estimation.

Text Books:

1. R N Dhar, "Computer Aided Power Systems Operation and Analysis", Tata McGraw-Hill, 2nd Edition, 1982.
2. LP Singh, "Advanced Power System Analysis and Dynamics", Wiley Eastern Ltd., 1st Edition, 1986.
3. Prabha Kundur, "Power System Stability and Control", McGraw Hill, 1st Edition, 1994.
4. P D Wasserman, "Neural Computing Theory and Practice", Van Nostrand - Reinhold, New York, 1st Edition, 1989.

Reference Books:

1. John J Grainger and William D Stevenson, Jr., "Power System Analysis", McGraw-Hill, 1st Edition, 1994,
2. Allen J Wood and Bruce F Wollen berg, "Power Generation operation and control", John Wiley & Sons, 1st Edition ,1984.

Web References:

1. https://www.certs.lbl.gov/sites/all/files/rt-security-monitoring_0
2. https://www.researchgate.net/.../2993799
3. https://www.ieeexplore.ieee.org/iel5/5/31182/01451471

E-Text Books:

1. https://www.calvin.edu/.../Power%20Systems%20Interim 2. 2.
2. https://www.onlinelibrary.wiley.com/doi/10.1002/9780470423912.fmatter
3. https://www.selixc.com/api/download/248
4. https://www.cdn.intechopen.com/pdfs/37991.pdf

Course Home Page:

POWER SYSTEM TRANSIENTS

Group - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE502	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. Summarize the generation of switching transients and their control using circuit, theoretical concepts and analyze security and contingency evaluation.
II. Discuss the mechanism of lighting strokes and the production of lighting surges.
III. Outline the propagation, reflection and refraction of travelling waves.
IV. Appraise the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT - I	INTRODUCTION AND SURVEY	Classes: 09

Study of transients: Review and importance of the study of transients, causes for transients, RL circuit transient with sine wave excitation, double frequency transients, basic transforms of the RLC circuit transients, different types of power system transients, effect of transients on power systems, role of the study of transients in system planning.

UNIT - II	SWITCHING TRANSIENTS	Classes: 09

Switching transients: Over voltages due to switching transients, resistance switching and the equivalent circuit for interrupting the resistor current, load switching and equivalent circuit, waveforms for transient voltage across the load and the switch, normal and abnormal switching transients; Effects of switching transients: Current suppression, current chopping, effective equivalent circuit, capacitance switching, effect of source regulation, capacitance switching with a restrike, with multiple re strikes, illustration for multiple restriking transients, ferro resonance.

UNIT - III	LIGHTNING TRANSIENTS	Classes: 09

Cloud formation: Review of the theories regarding the formation of clouds and charge formation, rate of charging of thunder clouds.

Characteristics of lightning transients: Mechanism of lightning discharges and characteristics of lightning strokes, model for lightning stroke, factors contributing to good line design, protection using ground wires, tower footing resistance , interaction between lightning and power system.

UNIT - IV	TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS	Classes: 09

Computation: Computation of transients, transient response of systems with series and shunt lumped parameters and distributed lines; Travelling wave: Traveling wave concept, step response, Bewely's lattice diagram, standing waves and natural frequencies, reflection and refraction of travelling waves.

UNIT - V	TRANSIENTS IN INTEGRATED POWER SYSTEM	Classes: 09
Integrated power systems transients: The short line and kilometric fault, distribution of voltages in a power system, line dropping and load rejection, voltage transients on closing and reclosing lines, over voltage induced by faults, switching surges on integrated system qualitative application of EMTP for transient computation.		

Text Books:

1. Allan Greenwood, "Electrical Transients in Power Systems", Wiley Inter Science, NewYork, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., 2nd Edition, 2009.
3. C S Indulkar, D P Kothari, K Ramalingam, "Power System Transients: A statistical approach", Prentice Hall of India, 2nd Edition, 1996.

Reference Books:

1. M S Naidu, V Kamaraju, "High Voltage Engineering", Tata McGraw-Hill, 5th Edition, 2013.
2. R D Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Limited, 2nd Edition, 1986.
3. Y Hase, "Handbook of Power System Engineering", Wiley India, 1st Edition 2012.
4. J L Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use", Wiley, 1st Edition, 2012.

Web References:

1. https://www.researchgate.net/.../3275167_Categorization_and_Analysis_of_Power_Sy..
2. https://www.ece.mtu.edu/faculty/bamork/ee5220/
3. https://www.books.google.co.in/books?isbn=1466577843
4. https://www.studyname.com/community/archive/index.php/t-351.html

E-Text Books:

1. https://www.crcpress.com/Power-System-Transients
2. https://www.chegg.com › ... › electronics › power system transients

Course Home Page:

ENERGY AUDIT AND MANAGEMENT

<table>
<tr><td colspan="9">Group - I</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE503</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
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OBJECTIVES:

The course should enable the students to:

I. Outline the principles and objectives of energy management.
II. Illustrate the techniques, procedures, evaluation and energy audit reporting.
III. Devise energy policy planning and implementation.
IV. Analyse energy balance sheet and management information System.

UNIT - I	GENERAL ASPECTS	Classes: 09

General philosophy: Need of energy audit and management, definition and objective of energy management, general principles of energy management, energy management skills, energy management strategy; Energy audit: need, types, methodology and approach, energy management approach, understanding energy costs, bench marking, energy performance, matching energy usage to requirements, maximizing system efficiency, optimizing the input energy requirements, fuel and energy substitution.

UNIT - II	PROCEDURES AND TECHNIQUES , EVALUATION OF SAVING OPPORTUNITIES AND ENERGY AUDIT REPORTING	Classes: 12

Data gathering: Level of responsibilities, energy sources, control of energy and uses of energy, facts, figures and impression about energy / fuel and system operations, past and present operating data, special tests, questionnaire for data gathering; Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of energy inputs and rejections; Evaluations: Heat transfer calculations, evaluation of electric load characteristics, process and energy system simulation, determining the savings in Rs, noneconomic factors, conservation opportunities, estimating cost of implementation; Audit report: The plant energy study report, importance, contents, effective organization, report writing and presentation.

UNIT - III	ENERGY POLICY PLANNING AND IMPLEMENTATION	Classes: 08

Policy planning: Force field analysis, energy policy purpose, perspective, contents and formulation, location of energy manager, top management support, managerial functions, role and responsibilities of energy manager, accountability.

Motivating: Motivation of employees, requirements for energy action planning; Implementation: Designing, barriers, strategies, marketing and communicating training and planning

UNIT - IV	ENERGY BALANCE AND MIS	Classes: 08

Energy balance: First law of efficiency and second law of efficiency, facility as an energy system, methods for preparing process flow, materials and energy balance diagram, identification of losses, improvements; MIS: Energy balance sheet and management information system (MIS) energy modeling and optimization.

UNIT - V	ENERGY AUDIT INSTRUMENTS	Classes: 08
Instruments: Instruments for audit and monitoring energy and energy savings, types and accuracy.		
Text Books:		
1. W R Murphy, G Mckay, "Energy Management", Butterworths, 2nd Edition, 2009. 2. C B Smith, "Energy Management Principles", Pergamon Press, 2nd Edition, 1981. 3. I G C Dryden, "Efficient Use of Energy", Butterworths, 1st Edition, 1982. 4. AV Desai, "Energy Economics" , Wiley Eastern, 1st Edition, 1991.		
Reference Books:		
1. D A Reay, "Industrial Energy Conservation", Pergammon Press, 1st Edition, 1977. 2. W C Turner, " Energy Management Handbook, John Wiley and Sons, 6th Edition , 2006. 3. L C Witte, P S Schmidt, D R Brown, "Industrial Energy Management and Utilization",.Hemisphere Publication, Washington, 1st Edition, 1988.		
Web References:		
1. https://www.beeindia.gov.in/content/energy-auditors 2. https://www.cpri.in ›energy efficiency and renewable energy division (ered) 3. https://www.michigan.gov/documents/cis_eo_inside_churchmanual_45636_7.pdf		
E-Text Books:		
1. https://www.bookstore.teri.res.in/books/9788179930922 2. https://www.sjbit.edu.in/.../eee/.../energy%20auditing%20&%20demand%20side%20		
Course Home Page:		

EXTRA HIGH VOLTAGE AC TRANSMISSION

Group - I								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE504	Elective	L	T	P	C	CIA	SEE	Total
		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. Illustrate basic concepts of extra high voltage AC transmission and understand the need for it.
II. Outline the line and ground reactive parameters and voltage gradients of conductors.
III. Describe effects of corona and methods of associated measurement.
IV. Associate the knowledge of electro static field theory and traveling wave theory.
V. Select voltage control methods for extra high voltage AC transmission system.

UNIT - I	PRELIMINARIES	Classes: 09

Necessity of EHV AC transmission: Advantages and problems, power handling capacity and line losses mechanical considerations, resistance of conductors, properties of bundled conductors, bundle spacing and bundle radius, examples.

UNIT - II	LINE AND GROUND REACTIVE PARAMETERS AND VOLTAGE GRADIENTS OF CONDUCTORS	Classes: 09

Reactive parameters: Line inductance and capacitances, sequence inductances and capacitances, modes of propagation, ground return, examples, electrostatics, field of sphere gap, field of line changes and properties, charge, potential relations for multi conductors; Voltage gradient: Surface voltage gradient on conductors, distribution of voltage gradient on sub conductors of bundle, examples.

UNIT - III	CORONA EFFECTS	Classes: 09

Corona effect I: Power loss and audible noise (AN), corona loss formulae, charge voltage diagram, generation, characteristics, limits and measurements of AN, relation between 1-phase and 3-phase AN levels, examples.

Corona effect II: Radio interference (RI), corona pulses generation, properties, limits, frequency spectrum, modes of propagation, excitation function, measurement of RI, RIV and excitation functions, examples.

UNIT - IV	ELECTRO STATIC FIELD AND TRAVELING WAVE THEORY	Classes: 09

Electrostatic field: Calculation of electrostatic field of EHV / AC lines, effect on humans, animals and plants electrostatic induction in un-energised circuit of double, circuit line, electromagnetic interference, examples; Travelling wave theory: Traveling wave expression and solution, source of excitation, terminal conditions, open circuited and short circuited end reflection and refraction coefficients, lumped parameters of distributed.

UNIT - V	VOLTAGE CONTROL	Classes: 09
Voltage control: Power circle diagram and its use, voltage control using synchronous condensers; Compensation: Cascade connection of shunt and series compensation, sub synchronous resonance in series capacitor, compensated lines, static VAR compensating system.		
Text Books:		
1. R D Begamudre, " EHVAC Transmission Engineering", New Age International (p) Ltd, 1st Edition, 2010. 2. S Rao, "HVAC and DC Transmission", Khanna Publishers, 3rd Edition, 2010.		
Reference Books:		
1. Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Limited, 1st Edition, 2010. 2. Sanjay Kumar Sarma, "EHV-AC, HVDC Transmission and Distribution Engineering", Kataria & Sons, 1st Edition, 2014.		
Web References:		
1. https://www.rceroorkee.in/pdf/pdfo/tee033.pdf 2. https://www.books.google.com/books?id=e24fndv2aroc 3. https://www.nptel.ac.in/syllabus/108108033/		
E-Text Books:		
1. https://www.rceroorkee.in/pdf/pdfo/tee033.pdf 2. https://www.archive.org/stream/extrahighvoltage00meht/extrahighvoltage00meht_djvu.txt		
Course Home Page:		

ADVANCED POWER SYSTEM PROTECTION

Group - I								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE505	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Illustrate concepts of transformer protection.
II. Describe about the various schemes of over current protection.
III. Analyze three stepped distance and carrier protection of transmission lines.
IV. Outline the concepts of bus bar protection and numerical over current and distance protection.

UNIT - I	OVER CURRENT PROTECTION	Classes: 08

Zones of protection: Primary and Backup protection, operating principles and relay construction, time current characteristics, current setting, time setting, over current protective schemes, reverse power or directional relay, protection of parallel feeders, protection of ring feeders, earth fault and phase fault protection, combined earth fault and phase fault protection scheme, phase fault protective scheme directional earth fault relay ,static over current relays; numerical example for a radial feeder.

UNIT - II	EQUIPMENT PROTECTION	Classes: 10

Types of transformers, phasor diagram for a three Phase transformer, equivalent circuit of transformer, types of faults in transformers, over current protection percentage differential Protection of transformers, Inrush phenomenon, high resistance ground faults in transformers, inter turn faults in transformers, incipient faults in transformers, Phenomenon of over fluxing in transformers, transformer protection application chart; Generator protection: Electrical circuit of the generator, various faults and abnormal operating conditions, stator faults rotor faults, abnormal operating conditions; numerical examples for typical transformer and generator protection schemes.

UNIT - III	DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES	Classes: 09

Drawback of over current protection, introduction to distance relay simple impedance relay, reactance relay, mho relays comparison of distance relay, distance protection of a three phase line, reasons for inaccuracy of distance relay reach, three stepped distance protection, trip contact configuration for the three stepped distance protection, three stepped protection of three phase line against all ten shunt faults, impedance seen from relay side, three stepped protection of double end fed lines.

Need for carrier , aided protection ,various options for a carrier, coupling and trapping the carrier into the desired line section, unit type carrier aided directional comparison relaying, carrier aided distance schemes for acceleration of zone II, numerical example for a typical distance protection scheme for a transmission line.

UNIT - IV	BUSBAR PROTECTION	Classes: 10

Introduction differential protection of bus bars, external and internal fault, actual behaviors of a protective CT, circuit model of a saturated CT, external fault with one CT saturation need for high impedance, minimum internal fault that can be detected by the high, stability ratio of high impedance bus bar differential scheme, supervisory relay, protection of three phase bus bars, numerical examples on design of high impedance bus bar differential scheme.

UNIT - V	NUMERICAL PROTECTION	Classes: 08
Introduction, block diagram of numerical relay, sampling theorem, correlation with a reference wave least error squared (LES) technique, digital filtering, numerical over current protection, numerical transformer differential protection, numerical distance protection of transmission line.		

Text Books:

1. P Kundur, "Power System Stability and Control", McGraw-Hill, 1st Edition, 1993.
2. Stanley Horowitz, "Protective Relaying for Power System II", IEEE press, New York, 2nd Edition, 2008.
3. T S M Rao, Digital Relay, " Numerical relays", Tata McGraw-Hill, New Delhi, 1st Edition, 1989.

Reference Books:

1. Y G Paithankar and S R Bhide, "Fundamentals of Power System Protection", Prentice-Hall of India, 3rd Edition, 2003.
2. Badri Ram, D N Vishwakarma, "Power System Protection and Switchgear", Tata McGraw-Hill Publishing Company, 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

Course Home Page:

POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

Group: II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE506	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 stand alone and grid connected renewable energy systems
II. Learn required skills to derive the criteria for the design of power converters for renewable energy applications.
III. Analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
IV. Design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems and develop maximum power point tracking algorithms.

UNIT - I	INTRODUCTION	Classes: 09

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission), qualitative study of different renewable energy resources ocean, biomass; Hydrogen energy systems: operating principles and characteristics of: Solar PV, fuel cells, wind electrical systems-control strategy, operating area.

UNIT - II	ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION	Classes: 09

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT - III	POWER CONVERTERS	Classes: 09

Solar: Block diagram of solar photo voltaic system: Line commutated converters (inversion mode), boost and buck-boost converters, selection of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers.

AC-DC converters: Uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT - IV	ANALYSIS OF WIND AND PV SYSTEMS	Classes: 09

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system, grid connection issues, grid integrated PMSG and SCIG Based WECS-Grid integrated solar system.

UNIT - V	HYBRID RENEWABLE ENERGY SYSTEMS	Classes: 09

Need for Hybrid Systems: Range and type of hybrid systems, case studies of wind-PV maximum power point tracking (MPPT).

Text Books:

1. B W Williams, "Power Electronics Circuit Devices and Applications", McGraw Hill, 1st Edition, 1992.
2. Rashid M H, "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.

Reference Books:

1. S N Bhadra, D Kastha, S Banerjee, "Wind Electrical Systems", Oxford University Press, 1st Edition 2009.
2. Rashid M H, "Power Electronics Hand Book", Academic Press, 2nd Edition, 2001.
3. Rai G D, "Non Conventional Energy Sources", Khanna Publishes, 1st Edition, 1993.
4. Rai G D," Solar Energy Utilization", Khanna Publishes, 1st Edition, 1993.
5. Gray, L Johnson, "Wind Energy System", Prentice Hall inc, 2nd Edition, 1995.
6. B H Khan, "Non-Conventional Energy Sources", Tata McGraw-Hill Publishing Company, 1st Edition 2000.

Web References:

1. https://www.as.wiley.com/WileyCDA/WileyTitle/productCd-1118634039.html.
2. https://www.academia.edu/3409546/Power_Electronics_Application_in_Renewable_Energy_System.
3. https://www.springer.com/us/book/9788132221180.
4. https://www.springer.com/us/book/9781447151036.

E-Text Books:

1. https://www.ijtra.com/view/role-of-power-electronics-in-non-renewable-and-renewable-energy-systems.pdf.
2. https://www.nitgoa.ac.in/News_files/STC.pdf.
3. https://www.jee.ro/covers/art.php?issue=WN1438788776W55c22ca867606.
4. https://www.magnelab.com/wp-content/uploads/2015/01/Role-of-power-electronics-in-renewable-energy-systems.pdf.

Course Home Page:

POWER ELECTRONIC APPLICATIONS IN POWER SYSTEMS

Group - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE507	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 performance of static power converters and their application in HVDC systems.
II. Outline various control schemes for HVDC converters.
III. Explain the operation of multi terminal DC systems.
IV. Understand converter faults over voltage and over current protection of converters.

UNIT - I	INTRODUCTION	Classes: 08

Introduction of HVDC systems: General consideration, power handling capabilities of HVDC lines basic conversion principles, static converter configuration.

UNIT - II	STATIC POWER CONVERTERS	Classes: 10

Static power converters: 3-pulse, 6-pulse, and 12-pulse converters, converter station and terminal equipment, commutation process, rectifier and inverter operation, equivalent circuit for converter, special features of converter transformers, harmonics in HVDC Systems, harmonic elimination, AC and DC filters.

UNIT - III	CONTROL OF HVDC CONVERTERS AND SYSTEMS	Classes: 08

Constant current, constant extinction angle and constant ignition angle control Individual phase control and equidistant firing angle control.

DC power flow control: Interaction between HV AC and DC systems, voltage interaction harmonic instability problems and DC power modulation.

UNIT - IV	MULTI TERMINAL DC SYSTEMS AND OVER VOLTAGES	Classes: 10

Multi terminal DC systems: Series parallel and series parallel systems their operation and control, over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults.

UNIT - V	CONVERTER FAULTS AND PROTECTION	Classes: 09

Converter faults and protection scheme: Over current protection, valve group, and DC line protection over voltage protection of converters, surge arresters.

Text Books:

1. E W Kimbark, “Direct Current Transmission”, Wiley Inter Science – New York,1st Edition, 1971 .
2. J Arillaga, “HVDC Transmission”, Peter Peregrinus Ltd, 1st Edition, 1983
3. KR Padiyar,” High Voltage Direct Current Transmission”, Wiley Eastern Ltd New Delhi, 1st Edition,1992.

Reference Books:

1. KR Padiyar, "High Voltage Direct Current Transmission", Wiley Eastern Ltd, 1st Edition, 1992.
2. KR Padiyar, "HVDC Power Transmission Systems", New Age International, 1st Edition, 2015.
3. E Uhlman, "Power Transmission by Direct Current", Springer Verlag, 1st Edition, 1975.

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

Course Home Page:

POWER ELECTRONICS AND DISTRIBUTED GENERATION

Group - II								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE508	Elective	L	T	P	C	CIA	SEE	Total
		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 distribution system protection and power quality requirements.
II. Discuss distributed generation planning inter connection and protection.
III. Illustrate the various control schemes of DG inverters.

UNIT - I	INTRODUCTION TO DISTRIBUTION SYSTEMS	Classes: 08

Distributed Generation (DG): Overview and technology trends, introduction to distribution systems, radial distribution system protection, fuse, circuit breakers, reclosers, sectionalizers, per-unit analysis, fault analysis, sequence component analysis, sequence models of distribution system components, implications of DG on distribution system protection coordination.

UNIT - II	POWER QUALITY REQUIREMENTS	Classes: 10

Power quality requirements: Source switching using SCR based static switches, distribution system loading, line drop model, series voltage regulators and on-line tap changers, loop and secondary network distribution grids and impact of DG operation.

UNIT - III	PROTECTION AND DG INTERCONNECTION	Classes: 08

Relaying and protection, distributed generation interconnection relaying, sensing using CTs and PTs.

Islanding distribution systems intentional and unintentional islanding of distribution systems, passive and active detection of unintentional islands, non detection zones.

UNIT - IV	DG PLANNING	Classes: 10

DG planning, cost implications of power quality, cost of energy and net present value calculations and implications on power converter design power converter topologies and model and specifications for DG applications, capacitor selection, choice of DC bus voltage, current ripple, capacitor aging and lifetime calculations, switching versus average model of the power converter and EMI considerations in DG applications, semiconductor device selection, device aging due to thermal cycling, and lifetime calculations.

UNIT - V	CONTROL OF DG INVERTERS	Classes: 09

Control scheme of DG inverters: Phase locked loops, current control and DC voltage control for stand alone and grid parallel operations, protection of the converter, complex transfer functions, VSI admittance model in DG applications, power quality implication, acceptable ranges of voltage and frequency, flicker, reactive power compensation, and active filtering and low voltage ride through requirements.

Text Books:

1. Arthur R. Bergen, Vijay Vittal, "Power Systems Analysis", Prentice Hall, 1999.
2. Ned Mohan, Tore M Undeland, William P. Robbins, "Power Electronics", converters, Applications, and Design; Wiley, 2002.

Reference Books:

1. Math H. Bollen, Finan Hassan, "Integration of Distributed Generation in the Power System (IEEE Press Series on Power Engineering)", Wiley, 1st Edition, 2011.
2. Turan Gonen, "Electric Power Distribution Engineering, CRC Press, 3rd Edition, 2014.
3. E W Kimbark, "Direct Current Transmission", Wiley Inter Science – New York, 1st Edition, 1971.

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

Course Home Page:

POWER QUALITY

Group - II									
Course Code	Category	Hours / Week			Credits	Maximum Marks			
AEE509	Elective	L	T	P	C	CIA	SEE	Total	
		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 terminology used to describe power quality.
II. Explain long and short interruptions, single and three phase voltage characterization and mitigation.
III. Analyse power quality considerations in industrial power systems.

UNIT - I	INTRODUCTION	Classes: 10

Introduction of the power quality (PQ) problem, terms used in PQ: Voltage, sag, swell, surges, harmonics, over voltages, spikes, voltage fluctuations, transients, interruption, overview of power quality phenomenon, remedies to improve power quality, power quality monitoring.

UNIT - II	LONG AND SHORT INTERRUPTIONS	Classes: 12

Interruptions, definition, difference between failures, outage, interruptions, causes of long interruptions, origin of interruptions, limits for the interruption frequency, limits for the interruption duration, costs of interruption, overview of reliability evaluation to power quality, comparison of observations and reliability evaluation; short interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems, multiple events, single phase tripping, voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT - III	SINGLE AND THREE - PHASE VOLTAGE SAG CHARACTERIZATION	Classes: 08

Voltage sag: Definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.

Three phase faults: Phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT - IV	POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS	Classes: 08

Voltage sag equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT - V	MITIGATION OF INTERRUPTIONS AND VOLTAGE SAGS	Classes: 08

Overview of mitigation methods, from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods; System equipment interface: Voltage source converter, series voltage controller, shunt controller, combined shunt and series controller; Power Quality and EMC Standards: Introduction to standardization IEC electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Text Books:

1. Math H J Bollen,"Understanding Power Quality Problems", John Wiley& Sons, Inc.,1st Edition, 2000.
2. Bhim Singh, Ambarish Chandra, Kamal Al haddat, "Power Quality: Problems and Mitigation Techniques", Wiley, 1st Edition, 2014.

Reference Books:

1. Angelo Baggini, "Handbook of Power Quality", by John Wiley & Sons Publishers, 1st Edition, 2008.
2. Surya Santoso, Ph.D., Mark F. McGranaghan, Roger C.Dugan, H. Wayne Beaty, "Electrical Power Systems Quality", McGraw-Hill Education, 3rd Edition, 2012.

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

Course Home Page:

MICRO / NANO PROCESSING TECHNOLOGY

Group - II								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE510	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Study the performance of each system in detail along with practical case studies.
II. Develop various types of NANO technology for energy systems for industrial use.
III. Understand nature of NANO materials.

UNIT - I	BATTERY MATERIALS AND BATTERIES	Classes: 08

Battery materials and batteries: Lithium Ion based batteries, renewable energy technology, energy challenges, nonmaterial's and nano in energy harvesting, developments and implementation of nanotechnology based renewable energy technologies; Solar cell structures: Quantum well and quantum dot solar cells, photo thermal cells for solar energy harvesting, thin film solar cells, CIGS solar cells, die sensitized solar cells.

UNIT - II	NANOMATERIALS USED IN ENERGY AND ENVIRONMENTAL APPLICATIONS	Classes: 10

Nanomaterials used in energy and environmental applications and their properties: Evaluation of properties and performance of practical power systems that benefit from optimization of materials processing approaches.

UNIT - III	HYDROGEN STORAGE TECHNOLOGY	Classes: 09

Hydrogen storage technology: Hydrogen production methods, purification, hydrogen storage methods and materials: metal hydrides and metal-organic framework materials, volumetric and gravimetric storage capacities, hydriding and dehydriding kinetics.

High enthalphy: Formations and thermal management during hydriding reaction, multiple Catalytic, degradation of sorption properties, automotive applications.

UNIT - IV	FUEL CELL TECHNOLOGY	Classes: 10

Fuel cell technology: fuel cell Principles, types of fuel cells Alkaline , Phosphoric acid, Molten Carbonate, solid oxide direct methanol and Proton exchange Membrane fuel cells Principle and operation of PEM :Principle and operation of Proton Exchange Membrane (PEM) fuel cell, Materials and fabrication methods for fuel cell technology, micro fuel cell power sources – Bio fuels

UNIT - V	MICROFLUIDIC TECHNOLOGY	Classes: 08

Micro fluidic technology: Mems and Mems technology for micro fluidic devices: micro and nano engines and driving mechanism, power Generation, micro channel battery pump, piezoelectric membrane and their applications.

Text Books:

1. J Twidell and T Weir, “Renewable Energy Resources”, Routledge, 2nd Edition, 2005.
2. Ning Xi, Mingjun Zhang, Guangyong Li, “Modeling and Control for Micro / Nano Devices and Systems”, CRC Press, 1st Edition, 2013.
3. R A Shatwell Fuel storage on Board, “Hydrogen storage in Carbon Nanostructures”, 2nd Edition, 2012.
4. Hoogers, “Fuel cell Technology”, Handbook by CRC Press, 1st Edition, 2002.

Reference Books:

1. C H Bartholomew and Robert J Farraoto, “Fundamentals of Industrial Catalytic Process”, John Wiley & sons, 1st Edition, 2002.
2. Vielstich, “Hand book of fuel cells: Fuel cell technology and applications”, CRC Press, 1st Edition, 2005.

Web References:

1. https://www.hessen-nanotech.de/mm/NanoEnergy_web.pdf
2. https://www.nanowerk.com/nanotechnology-in-energy.php
3. https://www.mspe.ei.tum.de/index.php?id=96

E-Text Books:

1. https://www.eee.ntu.edu.sg/Programmes/ProspectiveStudents/Graduate/Joint
2. https://www.iitmandi.ac.in/ireps/images/Nanotechnology%20and%20its%20application%20in%20renewable%20energy.pdf

Course Home Page:

INDUSTRIAL AUTOMATION AND CONTROL

<table>
<tr><td colspan="10">Group - III</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td rowspan="2">AEE511</td><td rowspan="2">Elective</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Learn the fundamental concepts about introduction to industrial automation and control and devices.
II. Study the performance of each system in detail along with practical case studies.
III. Develop various types of industrial automation and control and devices.
IV. Understand the process control of PLC automation.

UNIT-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.

UNIT - 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.

UNIT - 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

UNIT - 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.

UNIT - 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
Course Home Page:

MOTION CONTROL

<table>
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<tr><td rowspan="1">AEE512</td><td>Elective</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Learn the fundamental concepts about motion control and devices.
II. Understand and study the performance of each system in detail along with practical case studies.
III. Develop various types of motion control.
IV. Understand the various types of motion control.

UNIT - I	INCREMENTAL MOTION CONTROL	Classes: 08

Incremental motion control: Introduction mathematical modeling of mechanical system elements, analysis of mechanical systems, incremental motion, a typical incremental motion control problem.

UNIT - II	SENSORS AND ENCODERS	Classes: 10

Sensors and encoders: Introduction, Potentiometers, The Incremental Encoders, Resolvers As Incremental Encoders, Magnetic Pickups As Encoders

UNIT - III	D.C. MOTORS IN INCREMENTAL MOTION SYSTEMS	Classes: 09

DC motors in incremental motion systems: Introduction, operation principle.

DC motors classification: basic classes of DC motors, selection criteria for incremental motion applications.

UNIT - IV	TORSIONAL RESONANCE IN HIGH- PERFORMANCE INCREMENTAL MOTION SYSTEMS	Classes: 10

Torsional resonance in high performance incremental motion systems: Introduction, the effects of Torsional resonance on the system response, Torsional resonance in two-body structures, Torsional resonance in three body structures, effects of Torsional resonance on system stability, techniques for minimizing resonance effects.

UNIT - V	LINEAR D.C. SERVO AMPLIFIERS	Classes: 08

Linear dc servo amplifiers: Introduction, uni directional servo amplifiers, bi-directional servo amplifiers, power amplifier design considerations, cross-over distortion in power amplifiers, current limiting techniques, input-output relationships in linear amplifiers.

Text Books:

1. B C Kuo, “Motion Control”, S R L Pub Co. 1st Edition, 1979.
2. Thomas E Kissell, “Motor Control Technology for Industrial Maintenance”, Pearson, 1st Edition, 2001.

Reference Books:

1. R S Khurmi, “Theory of Machines Paperback”, S Chand, 14th Edition, 2005.
2. Terry L. M. Bartelt, “Industrial Automated Systems: Instrumentation and Motion Control”, Delmar Cengage Learning, 1st Edition, 2010.

Web References:

1. https://www.en.wikipedia.org/wiki/Motion_control
2. https://www.motioncontrolonline.org/
3. https://www.motioncontrolproducts.com/

E-Text Books:

1. https://www.google.co.in/?gfe_rd=cr&ei=bh4PWPe8JaPT8gfKhoGoBQ&gws_rd=ssl#q=MOTION+CONTROL
2. https://www.mceinc.com/

Course Home Page:

POWER SYSTEMS STABILITY

Group - III								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE513	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Demonstrate various power system stability problems using single machine infinite bus configuration.
II. Apply and explain different methods for analyzing power system stability.
III. Create mathematical models for studying dynamic and stability of a power system.
IV. Illustrate different power system controls, and their impact on the system stability.

UNIT - I	INTRODUCTION TO POWER SYSTEM STABILITY PROBLEMS	Classes: 08

Definition of stability, classification of stability, rotor angle stability, frequency stability, voltage stability, midterm and long term stability, classical representation of synchronous machine in a single machine infinite bus system (SMIB), equal area criterion to asses stability of a single machine infinite bus system, limitations of classical model of synchronous machines.

UNIT - II	MODELING OF POWER SYSTEM COMPONENTS FOR STABILITY ANALYSIS	Classes: 10

Synchronous machine modeling: Sub transient model, two axis model, one axis (flux decay) model, classical model; Excitation systems modeling: DC excitation, AC excitation and static excitation, prime mover and energy supply systems modeling, transmission line modeling, load modeling, methods of representing synchronous machines in stability analysis.

UNIT - III	SMALL SIGNAL STABILITY	Classes: 09

Fundamental concepts, state space representation, modal analysis: Eigen properties, participation factors, stability assessment, effects of excitation system on stability.

Power system stabilizer and its design, angle and voltage stability of multi machine power systems and phenomenon of sub synchronous resonance.

UNIT - IV	TRANSIENT STABILITY	Classes: 10

Fundamentals of transient stability, numerical solutions: simultaneous implicit and partitioned explicit methods, simulation of dynamic response, analysis of unbalanced faults, direct method of transient stability, transient energy function method, methods of improving transient stability.

UNIT - V	VOLTAGE STABILITY	Classes: 08

Classification of voltage stability, modeling requirements, voltage stability analysis, static and dynamic, sensitivity analysis, modal analysis, voltage collapse.

Text Books:

1. P Kundur, "Power system stability and control", Tata McGraw-Hill, 1st Edition, 2001.
2. K R Padiyar, "Power system dynamics", BSP publications, 2nd Edition, 2010.
3. M A Pai and Peter W Sauer, "Power system stability", Pearson Education, 1st Edition, 2000.

Reference Books:

1. M A Pai, K Sengupta and K R Padiyar, "Topics on Small Signal Stability Analysis", Tata McGraw-Hill, 1st Edition, 2005 .
2. Paul M Anderson and A Fouad, "Power system stability", Wiley-inter science, 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

Course Home Page:

SOLID STATE RELAYS

Group III:									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE514	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 steady state operation and transient dynamics of a motor load system.
II. Study and analyze the operation of the static relays both qualitatively and quantitatively.
III. Discus the operation and performance of AC motor drives.
IV. Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT-I	INTRODUCTION	Classes: 09

Advantages of static relays, generalized characteristics and operational equations of relays, steady state and transient performance of signal driving elements, signal mixing techniques and measuring techniques, CT’s and PT are in relaying schemes, saturation effects.

UNIT-II	RELAY CIRCUITS	Classes: 09

Static relay circuits: (Using Analog and Digital IC’s) for over current, inverse time characteristics, differential relay and directional relay.

UNIT-III	SOLID STATE DISTANCE RELAYS	Classes: 09

Static relay circuits for generator loss of field, under frequency distance relays, impedance.

Reactance, MHO, reverse power relays.

UNIT-IV	STEADY AND TRANSIENT BAHAVIOUR OF STATIC RELAYS	Classes: 09

Static relay circuits for carrier current protection, steady state and transient behavior of static relays, testing and maintenance, tripping circuits using thyristor.

UNIT-V	MICROPROCESSOR BASED RELAYS	Classes: 09

Microprocessor based relays, hardware and software for the measurement of voltage, current, frequency, phase angle, microprocessor implementation of over current relays, inverse time characteristics, impedance relay, directional relay, MHO relay.

Text Books:

1. Badriram, Vishwakarma D N., “Power System Protection and Switchgear”, Tata McGraw-Hill, New Delhi, 1st edition, 1995.
2. Rao T S M., “Power System Protection – Static Relays”, McGraw Hill, 2nd edition, 1979.

Reference Books:

1. Van C Warrington, "Protection Relays – Their Theory and Practice", Chapman and Hall, 1st Edition, 1996.
2. Ravindranath B, Chander M., "Power System Protection and Switchgear", Wiley Eastern, 1st Edition, 1992.
3. Russel C Mason, "The Art and Science of Protective relays". 1st Edition, 2000.

Web References:

1. http://www.power-io.com/library/appnotes/solid-state-relay-terminology.htm
2. http://www.ni.com/white-paper/4125/en/

E-Text Books:

1. https://www.books.google.co.in/books?id=imti-gC62xUC&pg=PR11 &source=gbs_selected_ pages&cad =3 #v=onepage&q&f=false
2. https://www.vidyutbazar.com/media/documents/1482235656.pdf
3. https://www.symmetron.ru/suppliers/omron/files/pdf/omron/Solid-State-Relay-users-guide.pdf

Course Home Page:

SMART GRID TECHNOLOGY

Group - III									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE515	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Discuss the concepts and design of Smart grid.
II. Describe the communication and measurement technologies employed in smart grid.
III. Demonstrate the tools for the performance analysis and stability analysis of smart grid.
IV. Discuss the renewable energy resources and storages integrated with smart grid.

UNIT - I	SMART GRID ARCHITECTURAL DESIGNS	Classes: 08

Introduction comparison of power grid with smart grid power system enhancement, communication and standards, general view of the smart grid market drivers, stakeholder roles and function, measures representative architecture, functions of smart grid components, wholesale energy market in smart grid smart vehicles in smart grid.

UNIT - II	SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY	Classes: 10

Communication and measurement, monitoring, phasor measurement unit, smart meters, wide area monitoring systems, advanced metering infrastructure and google mapping tools.

UNIT - III	PERFORMANCE ANALYSIS TOOLS FOR SMART GRID DESIGN	Classes: 09

Introduction to load flow studies, challenges to load flow in smart grid and weaknesses of the present load flow methods, load flow state of the art: classical, extended formulations, and algorithms.

Load flow for smart grid design, contingencies studies for smart grid.

UNIT - IV	STABILITY ANALYSIS TOOLS FOR SMART GRID	Classes: 10

Voltage stability analysis tools voltage stability assessment techniques, voltage stability indexing application and implementation plan of voltage stability in smart grid, angle stability assessment in smart grid approach of smart grid to state estimation, energy management in smart grid.

UNIT - V	RENEWABLE ENERGY AND STORAGE	Classes: 08

Renewable energy resources sustainable energy options for the smart grid penetration and variability issues associated with sustainable energy technology demand response issues electric vehicles and plug-in hybrids, plug in hybrid electric vehicles (PHEV), technology environmental implications, storage technologies, grid integration issues of renewable energy sources.

Text Books:

1. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, 2nd Edition, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons inc, 1st Edition, 2012.
3. Fereidoon P Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2nd Edition, 2012.

Reference Books:

1. Clark W Gellings, "The smart grid: Enabling energy efficiency and demand response", Fairmont Press Inc, 2nd Edition, 2009.

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

Course Home Page:

POWER PLANT CONTROL AND INSTRUMENTATION

Group - IV									
Course Code	Category	Hours / Week			Credits	Maximum Marks			
AEE516	Elective	L	T	P	C	CIA	SEE	Total	
		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 different methods of power generation.
II. Discuss measurement of electrical and non electrical parameters involved in power generation plants.
III. Illustrate the different types of devices used for data acquisition and analyse, in power plants.
IV. Describe control system and control loops applied in power plants.
V. Integrate monitoring of different parameters like speed, vibration of turbines and their control.

UNIT - I	OVERVIEW OF POWER GENERATION	Classes: 08

Brief survey of methods of power generation, hydro, thermal, nuclear, solar and wind power, importance of instrumentation in power generation, thermal power plants, block diagram, details of boiler processes, Piping and Instrumentation diagram of boiler, cogeneration.

UNIT - II	MEASUREMENTS IN POWER PLANTS	Classes: 10

Electrical measurements, current, voltage, power, frequency, power factor etc, non electrical parameters, flow of feed water, fuel, air and steam with correction factor for temperature, steam pressure and steam temperature, drum level measurement, radiation detector, smoke density measurement, dust monitor.

UNIT - III	ANALYSERS IN POWER PLANTS	Classes: 09

Flue gas oxygen analyzer: Analysis of impurities in feed water and steam, dissolved oxygen analyzer.

Chromatography, pH meter, fuel analyzer, pollution monitoring instruments.

UNIT - IV	CONTROL LOOPS IN BOILER	Classes: 10

Combustion control, air / fuel ratio control, furnace draft control, drum level control, main steam and reheat steam temperature control, super heater control, air temperature, distributed control system in power plants, interlocks in boiler operation.

UNIT - V	TURBINE MONITORING AND CONTROL	Classes: 08

Speed, vibration, shell temperature monitoring and control, steam pressure control, lubricant oil temperature control, cooling system.

Text Books:

1. Sam G. Dukelow, The Control of Boilers, Instrument Society of America, 2nd Edition, 2010.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw-Hill, 1st Edition, 2001.

Reference Books:

1. S.M. Elonka and A.L. Kohal, "Standard Boiler Operations", Tata McGraw-Hill, 1st Edition, 1994.
2. R K Jain, "Mechanical and Industrial Measurements", Khanna Publishers, 1st Edition, 1995.
3. E Al Wakil, "Power Plant Engineering", Tata McGraw-Hill, 1st Edition, 1984.

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

Course Home Page:

DISTRIBUTED CONTROL AND COMMUNICATION NETWORKS

Group - IV									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE517	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Discuss the architecture and operation of a distributed control systems.
II. Design the simple distributed control system.
III. Illustrate the basic concepts of advanced process control schemes.
IV. Apply the basics of distributed control system and communication standards.

UNIT - I	DISTRIBUTED CONTROL SYSTEM BASICS	Classes: 09

Distributed control system basics: Introduction, various function blocks, distributed control systems components / block diagram, distributed control systems architecture of different makes, comparison of these architectures with automation pyramid, distributed control systems specification, latest trend and developments, distributed control systems support to enterprise resources planning (ERP), performance criteria for distributed control systems and other automation tools.

UNIT - II	DISTRIBUTED CONTROL SYSTEMS ENGINEERING AND DESIGN	Classes: 09

Distributed control systems engineering and design: Distributed control systems detail engineering, configuration and programming, functions including database management, reporting, alarm management, diagnosis, historical database management, security and user access management, communication, third party interfaces, control, display etc. enhanced functions like advance process control, fuzzy logic, artificial neural network.

UNIT - III	PROCESS SAFETY AND SAFETY MANAGEMENT SYSTEMS	Classes: 09

Process safety and safety management systems: Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, process hazard analysis (PHA), hazard and operability study (HaZOp), safety integrity level (SIL).

Introduction to IEC61511 standard for functional safety, protection layers, safety instrumented system, function, architecture, safety life cycle, application of safety system.

UNIT - IV	INTERFACE	Classes: 09

Interface: Introduction, principles of interface, serial interface and its standards. parallel interfaces and buses, field bus, use of field buses in industrial plants, functions, international standards, performance, use of other net networks, field bus advantages and disadvantages, field bus design, installation, economics and documentation.

UNIT - V	INSTRUMENTATION NETWORK DESIGN AND UPGRADE	Classes: 09

Instrumentation network design and upgrade: Instrumentation design goals, cost optimal and accurate sensor networks, global system architectures, advantages and limitations of open networks, highway addressable remote transducer (HART), network and foundation field bus network; Process filed bus process automation: Basics, architecture, model, network design and system configuration, designing PROFIBUS-PA and foundation fieldbus segments, general considerations, network design.

Text Books:

1. A S Tanenbaum, "Computer Networks", Pearson Education, 3rd Edition ,1996.
2. Michael P Lukas, "Distributed Control System", Van Nostrand Reinhold Co., 3rd Edition, 1986.
3. Noltingk B E., "Instrumentation Reference Book", Butterworth Heinemann, 2nd Edition, 1995.

Reference Books:

1. Veli-Pekka Eloranta, Johannes Koskinen, Marko Lappanen, "Designing distributed Control Systems", A Pattern Language Approach (MISL-WILEY)", Wiley, 2nd Edition, 2000.
2. Dobrivojie Popovic, Vijay P Bhatkar, "Distributed Computer Control Systems in Industrial Automation", CRC Press, 2nd Edition, 1990.
3. Moustafa Elshafei, "Modern Distributed Control Systems", Create Space Independent Publishing, 1st Edition, 2016.

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1. https://www.en.wikipedia.org/wiki/Distributed_control_system
2. https://www.yokogawa.com/in/solutions/products-platforms/control-system/distributed-control-systems-dcs/
3. https://www.cs.wichita.edu/~bintang/seminar/papers/CDC_crosslayer.pdf
4. https://www.cis.upenn.edu/~lee/07cis505/Lec/lec-ch1-DistSys-v4.pdf

E-Text Books:

1. https://www.coordinationbook.info/pdfs/DCRN-BulloCortesMartinez-10mar09.pdf
2. https://www.idc-online.com/downloads/DD_IDCBookextract_R6.1.pdf
3. https://www.pacontrol.com/download/Industrial-Automation-Pocket-Guide.pdf
4. https://www.dhs.gov/sites/default/files/publications/csd-nist-guidetosupervisoryanddataccquisition-scadaandindustrialcontrolsystemssecurity-2007.pdf

Course Home Page:

INDUSTRIAL ELECTRONICS

<table>
<tr><td colspan="9">Group - IV</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Demonstrate about the stabilized power supplies and servo mechanisms.
II. Illustrate the direct coupled amplifiers and IC electronic timers.
III. Analyze optocouplers and solid state relays and ultra capacitors.
IV. Demonstrate the different storage, heating and welding control techniques.

UNIT - I	STABILIZED POWER SUPPLIES	Classes: 09

Uninterrupted power supplies, online (UPS), offline UPS, high frequency online UPS, programmable logic controllers, Voltage stabilizers-servo mechanism, single phase and three phase servo voltage stabilizers.

UNIT - II	AMPLIFIERS IN INDUSTRIAL ELECTRONIC CIRCUITS AND INDUSTRIAL TIMING CIRCUITS	Classes: 10

Introduction, direct coupled amplifiers (DCA)-basic & special, differential amplifier as DCA, chopper stabilized DCA, differential DCA using Op-Amp, Timers-classification, thermal, electromechanical, electronic timers, transistor control with relay load control, SCR delay timer, IC electronic timer.

UNIT - III	OPTOELECTRONICS AND OPTICAL FIBER	Classes: 09

Introduction, photo emitters, lasers, liquid crystal displays, photoconductive sensors.

Photodiodes, phototransistors, LASCRs / photo SCRs, opto couplers, solid state relays (light operated relays), optical fiber.

UNIT - IV	STORAGE SYSTEMS	Classes: 09

Batteries: Introduction, energy storage parameters, lead–acid batteries, constructional features, battery charge discharge cycles, ultra capacitors, double layer ultra capacitors, high energy ultra capacitors, applications of ultra capacitors, flywheels, advanced performance of flywheels, applications of flywheels.

UNIT - V	HEATING AND WELDING CONTROL	Classes: 08

Heating: Induction heating, Effects of supply frequency & source voltage on induction heating, Dielectric heating, Effect of variation of supply voltage and frequency on dielectric heating; Welding: Resistance welding, theory & classification, scheme of AC resistance welding, Ignitron-heat control by change of firing angles in Ignitrons, complete control in resistance welding by a sequence timer.

Text Books:

1. G K Mithal, Dr. Maneesha Gupta, “Industrial and Power Electronics”, Jain Books, 9th Edition, 2002.
2. Biswanath Paul,” Industrial Electronics and control”, PHI, 3rd Edition, 2014.

Reference Books:

1. Bogdan M. Wiliamowski, J David Irwin, “Fundamental of Industrial electronics”, CRC Press, 2nd Edition, 2011.
2. Dr. R Kretzmann , “Industrial Electronics hand book”, Philips’ technical library, 3rd Edition, 1964.

Web References:

1. https://www.frank.pocnet.net/other/Philips/Kretzmann_IndustrialElectronicsHandbook_1964.pdf
2. https://www.textofvideo.nptel.iitm.ac.in/108103007/lec1.pdf.

E-Text Books:

1. https://www.faadooengineers.com/threads/33149-Industrial-Electronics-by-S-K-Bhattacharya-free-pdf-download.
2. https://www.textbooksonline.tn.nic.in/.

Course Home Page:

DIGITAL IMAGE PROCESSING

<table>
<tr><td colspan="9">Group - IV</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AEE519</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

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.

UNIT - 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.

UNIT - I	**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.

UNIT - 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.

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

Image segmentation detection of discontinuities, edge linking and boundary detection, threshold, region oriented segmentation morphological image processing dilation and erosion, structuring element decomposition, the strel function, erosion; Combining dilation and erosion: opening and closing the hit and miss transformation.

UNIT - 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://www.imagingbook.com/
2. https://www.en.wikipedia.org/wiki/Digital_image_processing
3. https://www.tutorialspoint.com/dip/
4. https://www.imageprocessingplace.com/
5. https://www.web.stanford.edu/class/ee368/
6. https://www.sisu.ut.ee/dev/imageprocessing/book/1
7. https://www.in.mathworks.com/discovery/digitalimageprocessing.html?requestedDomain=www.mathworks.com

E-Text Books:

1. https://www.sci.utah.edu/~gerig/CS6640-F2010/dip3e_chapter_02.pdf
2. https://www.faadooengineers.com/threads/350-Digital-Image-Processing
3. https://www.newwayofengineering.blogspot.in/2013/08/anil-k-jain-fundamentals-of-digital.html
4. https://www.bookboon.com/en/digital-image-processing-part-one-ebook

Course Home Page:

MODERN CONTROL THEORY

Group - IV									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
AEE520	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Discuss the modeling and analysis of electrical and mechanical systems.
II. Evaluate systems by applying block diagrams, signal flow graphs to study the time response.
III. Demonstrate the analytical and graphical techniques to study the stability and to design the control system.
IV. Illustrate the frequency domain and state space analysis.
V. Analyze stability using polar and Nyquist plots.

UNIT - I	STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION	Classes: 08

Concept of State Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams on uniqueness of state model State diagrams for continuous time state models solution of state equations, state transition matrices complete response of continuous time systems.

UNIT - II	CONTROLLABILITY, OBSERVABILITY	Classes: 10

Tests for controllability and observability for continuous time systems time varying case, minimum energy control, time invariant case, principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms effect of state feedback on controllability and observability.

UNIT - III	STATE FEEDBACK CONTROLLERS AND OBSERVERS	Classes: 09

State Feedback Controllers: Design of state feedback controllers through pole placement observers.

Full order observer and reduced order observer. State estimation through Kalman filters.

UNIT - IV	ANALYSIS OF NONLINEAR SYSTEMS	Classes: 10

Introduction to nonlinear systems, types of nonlinearities, concept of describing functions, derivation of describing functions for dead zone, saturation, backlash, relay with dead zone and hysteresis, jump, resonance, introduction to phase plane analysis, method of isoclines for constructing trajectories, singular points, phase plane analysis of nonlinear control systems.

UNIT - V	STABILITY ANALYSIS	Classes: 08

Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems, direct method of Lyapunov for Linear and Nonlinear continuous time autonomous systems.

Text Books:

1. M Gopal, "Modern Control System Theory", New Age International Publishers, Revised 2nd Edition, 2005.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition, 2010.
3. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.

Reference Books:

1. J Nagrath, M Gopal, "Control Systems Engineering", New Age International Publications, 4th Edition 2012.
2. D Roy Choudhury, "Modern Control Engineering", PHI Learning private Limited, 2015
3. Anand Kumar, "Control Systems", PHI Learning, 1st Edition, 2007.
4. S Palani, "Control Systems Engineering", Tata McGraw Hill Publications, 1st Edition, 2001.
5. 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

Course Home Page:

ELECTRICAL INSULATION IN POWER APPARATUS AND SYSTEMS

Group - V									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE521	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Outline the properties and testing methods of insulating materials.
II. Discuss the breakdown mechanism of electro fields insulating materials.
III. Design and manufacturing of high voltage equipment.
IV. Illustrate high voltage testing methods and date analysis.
V. Describe non destructive insulation test techniques.

UNIT - I	INSULATING MATERIALS IN HIGH VOLTAGE TECHNOLOGY	Classes: 09

Requirement for insulating material: Properties and testing of insulating materials, electrical properties, thermal properties, chemical properties, natural inorganic insulation materials, synthetic inorganic insulation materials, natural inorganic insulation materials, synthetic organic insulating materials, electric field and breakdown voltage, determination of electric fields, maximum field strengths in geometrically similar configurations, formulation for the calculation of the breakdown voltage, fields in multi dielectric, isotropic materials, breakdown probability, breakdown theory of gases, charge carriers in gases, classical gas laws, self sustaining discharges.

UNIT - II	ELECTRIC FIELD ANALYSIS IN INSULATING MATERIALS	Classes: 10

Electric field analysis in insulating materials: Breakdown mechanism in homogeneous fields, breakdown characteristics under transient voltages, breakdown theory in solid insulating materials, charge carriers at low field strengths, intrinsic breakdown, thermal breakdown, partial discharge breakdown, mechanism of failure in nano composite materials, breakdown theory in liquid insulation, electric strength of technical configurations with insulating liquids, theory of breakdown in liquid insulation, break down mechanism in vacuum insulation, breakdown mechanism in cryogenic insulation.

UNIT - III	DESIGN AND MANUFACTURE OF HIGH VOLTAGE EQUIPMENT	Classes: 08

Structural details in high voltage technology: Basic arrangement of insulation system, measures to avoid field intensification measures for air sealing oil insulated devices, temperature rise calculation of insulation system.

Design and high voltage equipment: Design and development of high voltage, bushings, design of transformer windings, design of insulators for indoor and outdoor applications, design of instrument transformers.

UNIT - IV	OVERVOLTAGE, TESTING PROCEDURES AND INSULATION COORDINATION	Classes: 09

Over voltage and testing: High voltage testing procedures and statistical, treatment of results, insulation coordination, modern power system protective devices.

UNIT - V	NON-DESTRUCTIVE INSULATION TEST TECHNIQUES	Classes:09

Non destructive insulation testing: Dynamic properties of dielectrics, dielectric loss and capacitance measurements, partial discharge measurements.

Text Books:

1. M S Naidu and V Kamaraju, "High Voltage Engineering", TMH Publications, 3rd Edition, 2004.
2. E Kuffel, W S Zaengl, J Kuffel, "High Voltage Engineering Fundamentals" Elsevier, 2nd Edition, 2000.

Reference Books:

1. C L Wadhwa, "High Voltage Engineering", New Age Internationals (P) Limited, 2nd Edition, 1997.
2. Ravindra Arora, Wolfgang Mosch, "High Voltage Insulation Engineering", New Age International (P) Limited, 1st Edition, 1995.
3. Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy, Roshdy Radwan, Marcel Dekker, "High Voltage Engineering, Theory and Practice", Marcel Dekker (E), 2nd Edition, 2000.

Web References:

1. https://www.nptel.kmeacollege.ac.in/syllabus/108104012/
2. https://www.assignmentpedia.com/electrical-insulation-power-apparatus-systems.html
3. https://www.iitk.ac.in/eeold/research/Specializations/Power/Courses_Power.html

E-Text Books:

1. https://www.nptel.kmeacollege.ac.in/syllabus/syllabus_pdf/108106021.pdf
2. https://www.myopencourses.com/subject/electrical-insulation-in-power-apparatus-systems
3. https://www.iemworldwide.com/pdf/ansi-neta-mts-2011.pdf

Course Home Page:

ENERGY MANAGEMENT SYSTEMS AND SCADA

Group - V								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE522	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Outline energy management systems and unit commitment and its solution techniques.
II. Discuss power generation scheduling with limited energy.
III. Describe the architecture, functions and applications of supervisory control and data acquisition (SCADA).
IV. Apply SCADA in power system automation and communications.

UNIT - I	INTRODUCTION TO ENERGY MANAGEMENT SYSTEMS	Classes: 09

Energy management centers: Energy management centers and their functions, architectures, recent developments, characteristics of power generating units and economic dispatch, unit commitment (spinning reserve, thermal, hydro and fuel constraints), solution techniques of unit commitment.

UNIT - II	POWER GENERATION SCHEDULING	Classes: 09

Generation scheduling: Generation scheduling with limited energy, energy production cost models, budgeting and planning, practical considerations, interchange evaluation for regional operations, types of interchanges, exchange costing techniques.

UNIT - III	INTRODUCTION TO SCADA	Classes: 09

Supervisory control and data acquisition: Introduction to supervisory control and data acquisition, SCADA functional requirements and components.

SCADA Application: General features, functions and applications, benefits of SCADA, architectures of SCADA, applications of SCADA.

UNIT - IV	CONFIGURATIONS OF SCADA	Classes: 08

SCADA and power systems: Configurations of SCADA, RTU (remote terminal units) connections, power systems SCADA and SCADA in power system automation.

UNIT - V	SCADA COMMUNICATION	Classes: 10

SCADA and communication: SCADA communication requirements, SCADA communication protocols: past present and future, structure of a SCADA communications protocol.

Text Books:

1. Handschin E, “Energy Management Systems”, Springer Verlag, 1st Edition, 1990.
2. Handschin E, “Real Time Control of Electric Power Systems”, Elsevier, 1st Edition, 1972.

3. John D Mc Donald, “Electric Power Substation Engineering”, CRC press, 1st Edition, 2001.

Reference Books:

1. Wood, A J and Wollenberg, B F, “Power Generation Operation and Control”, John Wiley and Sons, 2nd Edition 2003.
2. Green, J N Wilson, R, “Control and Automation of Electric Power Distribution Systems”, Taylor and Francis, 1st Edition, 2007.
3. Turner, W C, “Energy Management Handbook”, Fairmont Pres, 5th Edition, 2004.

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.

Course Home Page:

ILLUMINATION ENGINEERING

Group - V								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE523	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 types of illumination and lighting systems.
II. Calculate the luminance and illumination in case of linear, round and sources.
III. Design interior lighting systems and street lighting system as per Indian standard recommendations and practices.
IV. Demonstrate flood lighting and aesthetic lighting and their applications.

UNIT - I	INTRODUCTION OF LIGHT	Classes: 08

Illumination: Types of illumination, day lighting, supplementary artificial lighting and total lighting, quality of good lighting, factors affecting the lighting, shadow, glare, reflection, color rendering and stroboscopic effect, methods of artificial lighting, lighting system, direct, indirect, semi direct and semi indirect, lighting scheme, general and localized, types of lamps, Standard Incandescent bulbs, Halogen Incandescent bulbs, Fluorescent tube, high pressure sodium, low pressure sodium, HP mercury vapor, metal halide, LED, applications, advantages, disadvantages and comparisons.

UNIT - II	MEASUREMENT OF LIGHT	Classes: 09

Light Measurement: Definition of luminous flux, luminous intensity, lumen, candle power, illumination, mean hemispherical candle power (MHCP), mean spherical candle power (MSCP), MHSCP, lamp efficiency, brightness or luminance, laws of illumination inverse square law and lamberts cosine law, illumination at horizontal and vertical plane from point source, concept of polar curve, calculation of luminance and illumination in case of linear source, round source and flat source.

UNIT - III	DESIGN OF INTERIOR LIGHTING	Classes: 10

Interior lighting: Definitions of maintenance factor, uniformity ratio, direct ratio, coefficients of utilization and factors effecting it, illumination required for various work planes(as per ISI standards), space to mounting height ratio, types of fixtures and related terms used in interior illumination such as down word light output ratio (DLOR) and down word light output ratio (ULOR).

Lighting design: Selection of lamp and luminance, selection of various factors such as utilization factor, maintenance factor, reflection factor, determination of lamp lumen output taking into account voltage and temperature variation, calculation of wattage of each lamp and number of lamps needed, layout of lamp luminaire, Indian standard recommendation and standard practices for illumination levels in various areas, special features for entrance, stair case, corridor lighting and industrial building.

UNIT - IV	DESIGN OF STREET LIGHTING	Classes: 10

Street lighting design: Types of street and their level of illumination required, terms related to street and street lighting, types of fixtures used and their suitable application, various arrangements in street lighting, requirements of good street lighting, selection of lamp and luminaire, calculation of their wattage, number and arrangement, calculation of space to mounting height ratio, calculation of illumination available on road.

UNIT - V	FLOOD LIGHTING AND AESTHETIC LIGHTING	Classes: 08

Flood lighting: Terms related to flood lighting, types of fixtures and their suitable applications, selection of lamps and projector, calculation of their wattage and number, their arrangement, calculation of space to mounting height ratio, recommended method for aiming of lamp; Aesthetic lighting**:** Monument and statue lighting, sports, hospital and auditorium lighting.

Text Books:

1. DC Pritchard, "lighting", Pearson Education, 6th Edition 1999.
2. M A Cayless, Marsden, "Lamps and lighting", John Wiley and Sons, 1st Edition, 1997.

Reference Books:

1. Jack L Lindsay Fies, "Applied illumination engineering", Fairmont Press, 3rd Edition, 2015.
2. Ronald N. Helms, "Illumination Engineering", Prentice Hall, 1st Edition, 1980.

Web References:

1. https://www.lrc.rpi.edu.
2. https://www.aar.faculty.asu.edu/classes.
3. https://www.optics.arizona.edu.
4. https://www.electrical4u.com.
5. https://www.iare.ac.in.
6. https://www.electricalnotes.wordpress.com/2011/03/20/hid-lamps/

E-Text Books:

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

Course Home Page:

FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS

Group - V

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE524	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Describe the effect of series and shunt compensation using various FACTS controllers.
II. Static VAR compensator for voltage regulation and transient stability enhancement of system.
III. Analyse voltage source converter based FACTs controllers and their coordination.

UNIT - I	INTRODUCTION	Classes: 08

FACTS Controllers: Review of basics of power transmission networks, control of power flow in AC transmission line, analysis of uncompensated AC transmission line, passive reactive power compensation, effect of series and shunt compensation at the midpoint of the line on power transfer, need for FACTS controllers, types of FACTS controllers.

UNIT - II	STATIC VAR COMPENSATOR (SVC)	Classes: 10

Static VAR compensator: Configuration of static VAR compensator, voltage regulation by static VAR compensator, modeling of static VAR compensator for load flow analysis, modeling of static VAR compensator for stability studies, design of static VAR compensator to regulate the midpoint voltage of SMIB system, applications, transient stability enhancement and power oscillation damping of single machine infinite bus system with static VAR compensator connected at the midpoint of the line.

UNIT - III	THYRISTOR AND GTO THYRISTOR CONTROLLED SERIES CAPACITORS (TCSC and GCSC)	Classes: 09

Series compensator: Concepts of controlled series compensation, operation of thyristor controlled series capacitor and gate turn off thyristor controlled series capacitor, analysis of TCSC.

GCSC modeling of TCSC and GCSC for load flow studies, modeling TCSC and GCSC for stability studies, applications of TCSC and GCSC.

UNIT - IV	VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS	Classes: 10

Static synchronous compensator (STATCOM), static synchronous series compensator (SSSC), operation of STATCOM and SSSC power flow control with STATCOM and SSSC, modeling of STATCOM and SSSC for power flow and transient stability studies, operation of unified and interline power flow controllers (UPFC and IPFC) modeling of UPFC and IPFC for load flow and transient stability studies, applications.

UNIT - V	CONTROLLERS AND THEIR COORDINATION	Classes: 08

FACTS controller interactions: SVC, SVC interaction, co ordination of multiple controllers using linear control techniques, quantitative treatment of control co ordination.

Text Books:

1. Mohan Mathur, R Rajiv K Varma, "Thyristor – Based FACTS controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, 1st Edition, 2002.
2. K R Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd., Publishers, 1st Edition, 2008.
3. A T John, "Flexible AC Transmission System", Institution of Electrical and Electronic Engineers (IEEE), 2nd Edition, 1999.

Reference Books:

1. Narain G Hingorani, Laszio Gyugyl, "Understanding FACTS Concepts and Technology of Flexible AC Transmission System", Standard Publishers, 1st Edition, 2001.
2. K Sood, "HVDC and FACTS controllers - Applications of Static Converters in Power System", Kluwer Academic Publishers, 1st Edition, 2004.

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

Course Home Page:

HVDC TRANSMISSION

Group: V								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE525	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 concepts of HVDC transmission systems and various converters.
II. Discus reactive power control in HVDC systems.
III. Analyse power flow in AC-DC systems.

UNIT-I	BASIC CONCEPTS	Classes: 09

Economics and Terminal equipment of HVDC transmission systems: Types of HVDC links, apparatus required for HVDC Systems, comparison of AC and DC transmission, application of DC transmission system, planning and modern trends in DC transmission.

UNIT-II	ANALYSIS OF HVDC CONVERTERS	Classes: 09

Analysis of HVDC converters: Choice of converter configuration, analysis of Graetz, characteristics of 6 Pulse and 12 Pulse converters, cases of two 3 phase converters in star-star mode and their performance.

UNIT-III	CONVERTER AND HVDC SYSTEM CONTROL	Classes: 09

HVDC system Control: Principal of DC link control, converters control characteristics, firing angle control, current and extinction angle control.

Power control in HVDC systems: Effect of source inductance on the system, starting and stopping of DC link, power control.

UNIT-IV	REACTIVE POWER CONTROL AND FILTERS	Classes: 09

Reactive Power Control: Reactive Power Requirements in steady state, conventional control strategies, alternate control strategies, sources of reactive power, AC filter, shunt capacitors, synchronous condensers.

UNIT-V	POWER FLOW ANALYSIS IN AC/DC SYSTEMS	Classes: 09

Power flow Analysis: Modeling of DC links, DC network, DC converter-controller equations, solution of DC load flow, P U System for DC quantities, solution of AC-DC power flow, simultaneous method, sequential method.

Text Books:

1. K R Padiyar, "HVDC Power Transmission Systems: Technology and system Interactions", New Age International (P) Limited, 1st Edition, 1999.
2. S Rao, "EHVAC and HVDC Transmission Engineering and Practice", PHI, 3rd Edition, 1990.

Reference Books:
1. J Arrillaga, “HVDC Transmission”, Institution of Electrical Engineers, 1st Edition, 1998. 2. E W Kimbark, “Direct Current Transmission “, John Wiley & Sons, 1st Edition, 1971. 3. E Uhlmann, “Power Transmission by Direct Current”, B S Publications, 1st Edition, 1975.
Web References:
1. https://www.as.wiley.com/WileyCDA/WileyTitle/productCd-1118634039.html. 2. https://www.academia.edu/3409546/Power_Electronics_Application_in_Renewable_Energy_System. 3. https://www.springer.com/us/book/9788132221180. 4. https://www.springer.com/us/book/9781447151036.
E-Text Books:
1. https://www.ijtra.com/view/role-of-power-electronics-in-non-renewable-and-renewable-energy-systems.pdf. 2. https://www.nitgoa.ac.in/News_files/STC.pdf. 3. https://www.jee.ro/covers/art.php?issue=WN1438788776W55c22ca867606. 4. https://www.magnelab.com/wp-content/uploads/2015/01/Role-of-power-electronics-in-renewable-energy-systems.pdf.
Course Home Page:

SPECIAL ELECTRICAL MACHINES

Group - VI								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE526	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Outline construction, principle of operation and performance of synchronous reluctance motors.
II. Discuss configuration, control and performance of stepper motors.
III. Analyse the performance of power converters for switched reluctance motors.
IV. Design power converters and their controllers for permanent magnet brushless DC motors.

UNIT - I	SYNCHRONOUS RELUCTANCE MOTORS	Classes: 08

Reluctance motors: Constructional features, types, axial and radial flux motors, operating principles, variable reluctance motors, voltage and torque equations, phasor diagram, performance characteristics, applications.

UNIT - II	STEPPER MOTORS	Classes: 08

Stepper motors: Constructional features, principle of operation, variable reluctance motor ,hybrid motor, single and multi stack configurations, torque equations, modes of excitation, characteristics, drive circuits, microprocessor control of stepper motors, closed loop control, concept of lead angle, applications.

UNIT - III	SWITCHED RELUCTANCE MOTORS (SRM)	Classes: 10

Switched reluctance motors: Constructional features: rotary and linear SRM, principle of operation, torque production, steady state performance prediction, analytical method, power converters and their controllers.

Methods of rotor position sensing: sensor less operation, characteristics and closed loop control, applications.

UNIT - IV	PERMANENT MAGNET BRUSHLESS D.C. MOTORS	Classes: 09

BLDC motors: Permanent magnet materials, minor hysteresis loop and recoil line, magnetic characteristics, permeance, coefficient, principle of operation, types, magnetic circuit analysis, EMF and torque equations, commutation, power converter circuits and their controllers, motor characteristics and control, applications.

UNIT - V	PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)	Classes: 10

PM Synchronous motors: Principle of operation, ideal PMSM, EMF and torque equations, armature MMF, synchronous reactance, sine wave motor with practical windings, phasor diagram, torque speed characteristics, power controllers, converter volt ampere requirements, applications.

Text Books:

1. K Venkataratnam, “Special Electrical Machines”, Universities Press (India) Private Limited, 2nd Edition, 2008.
2. T J E Miller, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, 1st Edition, 1989.
3. T Kenjo, “Stepping Motors and Their Microprocessor Controls”, Clarendon Press London, 1st Edition, 1984.

Reference Books:

1. R Krishnan, “Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application”, CRC Press, 1st Edition, 2001.
2. P P Aearnley, “Stepping Motors – A Guide to Motor Theory and Practice”, Peter Perengrinus London, 2nd Edition, 1982.
3. T Kenjo and S Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, 1st Edition, 1988.
4. E G Janardanan, “Special electrical machines”, PHI learning Private Limited, 2nd Edition, 2014.

Web References:

1. https://www.textofvideo.nptel.iitm.ac.in/108103007/lec1.pdf
2. https://www.books.askvenkat.com/engineering-textbooks-materials-notes-free-download/
3. https://www.freeengineeringbooks.com

E-Text Books:

1. https://www.sasurieengg.com/e-course-material/EEE/IV-Year%20Sem%207/EE2403%20Special %20Electrical%20Machines.pdf
2. https://www.textbooksonline.tn.nic.in/
3. https://www.faadooengineers.com/threads/32837-Control-Systems-Engineering-by-Norman-S-Nise-full-books-pdf-download

Course Home Page:

ADVANCED CONTROL SYSTEMS

Group - VI									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE527	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 phase plane analysis to linear and non linear control systems.
II. Analyze the stability of the systems using different techniques.
III. Illustrate the design of optimal controller.
IV. Demonstrate state variable analysis, non-linear systems and optimal control.

UNIT - I	STATE VARIABLE ANALYSIS	Classes: 09

Concept of state , state variable and state model, state models for linear and continuous time systems, solution of state and output equation, controllability and observability, pole placement, state observer design of control systems with observers.

UNIT - II	PHASE PLANE ANALYSIS	Classes: 09

Features of linear and non linear systems, common physical non-linearity's , methods of linearising non-linear systems, concept of phase portraits, singular points, limit cycles, construction of phase portraits, phase plane analysis of linear and non-linear systems, isoclines method.

UNIT - III	DESCRIBING FUNCTION ANALYSIS	Classes: 09

Basic concepts, derivation of describing functions for common non-linearities.

Describing function analysis of non-linear systems, Conditions for stability, Stability of oscillations.

UNIT - IV	STABILITY ANALYSIS	Classes: 09

Introduction, Liapunov's stability concept, Liapunov's direct method, Lure's transformation, Aizerman's and Kalman's conjecture, Popov's criterion, Circle criterion.

UNIT - V	OPTIMAL CONTROL	Classes: 09

Introduction, decoupling, time varying optimal control, linear quadratic regulator (LQR), steady state optimal control, optimal estimation, multivariable control design.

Text Books:

1. I J Nagrath and M Gopal, 'Control Systems Engineering', New Age International Publishers, 1st Edition , 2003.
2. Ashish Tewari, "Modern Control Design with MATlab and Simulink", John Wiley, 2nd Edition, 2002.

Reference Books:
1. George J Thaler, "Automatic Control Systems", Jaico Publishers, 1st Edition, 1993. 2. M Gopal, "Modern control system theory", New Age International Publishers, 1st Edition, 2002. 3. Gene F Franklin, J David Powell, Abbasemami-Naeini, "Feedback Control of Dynamic Systems", Pearson Education, 1st Edition 2002.
Web References:
1. https://www.nptel.ac.in/courses/108103007/ 2. https://www.textofvideo.nptel.iitm.ac.in/108103007/lec1.pdf 3. https://www.file:///C:/Users/Administrator/Downloads/lecture_note_382311150307220.pdf
E-Text Books:
1. https://www.file:///C:/Users/Administrator/Downloads/adv_control_eng.pdf 2. https://www.textbooksonline.tn.nic.in/ 3. https://www.faadooengineers.com/threads/32837-Control-Systems-Engineering-by-Norman-S-Nise-full-books-pdf-download
Course Home Page:

MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

Group - VI

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE528	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Outline the basic principle for electrical machine analysis.
II. Discuss the reference frame theory.
III. Analyze the symmetrical industrial machines dynamic model.
IV. Describe the synchronous machines equations in rotor reference frame.

UNIT - I	BASIC PRINCIPLE FOR ELECTRICAL MACHINE ANALYSIS	Classes: 09

Introduction electrical machine analysis: Magnetically coupled circuits, electromechanical energy conversion, machine windings and air gap MMF, winding inductances and voltage equations, Laboratory Work; FESTO Hydraulic station: Generation and conversion of hydraulic.

UNIT - II	REFERENCE FRAME THEORY	Classes:10

Reference frame theory: Introduction, equations of transformation change of variables, stationary circuit variables transformed to the arbitrary reference frame, commonly used reference frames and transformation between reference frames, transformation of a balanced set, balanced steady state phasor relationships and voltage equations, variables observed from various frames of reference.

UNIT - III	SYMMETRICAL INDUCTION MACHINES	Classes:08

Voltage and torque equations in machine variables: Equation of transformation for rotor circuits, voltage and torque equations in arbitrary reference frame variables, per unit system, analysis of steady state equations, free acceleration characteristics viewed from various reference frames.

Dynamic model and analysis for sudden change in load torque: Dynamic model and analysis during three phase fault at the machine terminals, unbalanced operation at symmetrical induction machines, symmetrical component theory and analysis of unbalanced stator voltages, analysis of steady state operation with unbalanced rotor conditions.

UNIT - IV	SYNCHRONOUS MACHINES	Classes:09

Synchronous Machines: Voltage and torque equations in machine variables, stator voltage equations in arbitrary reference frame variables, and voltage equations in rotor reference frame variables Park's equation, torque equation, rotor angle and angle between rotors, per unit system, analysis of steady state operation, and dynamic performance during a sudden change in input torque.

UNIT - V	COMPUTER SIMULATION OF ELECTRIC MACHINES	Classes:09

Simulation Methods: Simulation of symmetrical induction and synchronous machines, thermal model of induction machine, induction machine dynamics during starting, braking and reversing.

Text Books:

1. Paul C Krause, Oleg Wasynczuk, Scott D Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley and Sons, 2nd Edition, 2004.
2. Rik De Doncker, Duco W J Pulle, Andre Veltman, "Advanced Electrical Drives: Analysis, Modeling, and Control", PHI, 1st Edition, 2011.

Reference Books:

1. ONG, Chee-Mun, "Dynamic Simulation of Electric Machinery using MATLAB", Prentice Hall, 1st Edition, 2010.
2. P S Bimbhra, "Generalized theory of electrical machines", Khanna Publishers, 5th Edition, 2012.
3. Paul C Krause, Oleg Wasynczuk, Scott D Sudhoff, Steven Pekarek, "Analysis of Electric Machinery and Drive Systems", Volume 75 of IEEE Press Series on Power Engineering, 2013.

Web References:

1. https://www.nptel.ac.in/courses/108106023/
2. https://www.nptel.ac.in/syllabus/108101001/
3. https://www.myopencourses.com/subject/modeling-and-analysis-of-electric-machines

E-Text Books:

1. https://www.cbit.ac.in/files/EE%20502.pdf
2. https://www.iea.lth.se/publications/Theses/LTH-IEA-1043.pdf
3. https://www.paduaresearch.cab.unipd.it/4076/1/PHD_THESIS.pdf

Course Home Page:

ELECTROMAGNETICS AND APPLICATIONS

Group - VI								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE529	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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. Explain electromagnetic, electrostatic and magneto static fields.
II. Understand the transmission and reception of electromagnetic waves.
III. Differentiate optical and acoustics communication techniques.

UNIT - I	INTRODUCTION	Classes: 08

Electromagnetics: Electromagnetic fields, electrodynamics, forces and the measurement and nature of electromagnetic fields, gauss's law and electrostatic fields and potentials, ampere's law and magneto static fields, Maxwell's differential equations in the time domain, electromagnetic waves in the time domain, Maxwell's equations, waves, and polarization in the frequency domain, relation between integral and differential forms of Maxwell's equations, electric and magnetic fields in media, boundary conditions for electromagnetic fields, power and energy in the time and frequency domains, Poynting's theorem, uniqueness theorem.

UNIT - II	ELECTROMAGNETIC FIELDS AND ENERGY	Classes: 10

Electromagnetic fields: Electromagnetic fields in resistors, capacitors, inductors and transformers, quasistatic behaviour of devices, general circuits and solution methods, two element circuits and RLC resonators, static; Quasistatic fields: Introduction, mirror image charges and currents, relaxation of fields, skin depth, static fields in homogeneous materials, Laplace's equation and separation of variables, flux tubes and field mapping; Electromagnetic forces: Forces on free charges and currents, forces on charges and currents within conductors, forces on bound charges within materials, forces computed using energy methods, electric and magnetic pressure on conductors, permeable and dielectric media, and photonic forces.

UNIT - III	ACTUATORS AND SENSORS, MOTORS AND GENERATORS AND TEM TRANSMISSION LINES	Classes: 09

Actuators and sensors, motors and generators: Force induced electric and magnetic fields, electrostatic actuators and motors, rotary magnetic motors, linear magnetic motors and actuators, permanent magnet devices, electric and magnetic sensors.

Transverse electromagnetic wave (TEM): TEM waves on structures, TEM lines with junctions, methods for matching transmission lines, TEM resonances, propagation and reflection of transient signals on TEM transmission lines, limits posed by devices and wires, distortions due to loss and dispersion.

UNIT - IV	ELECTROMAGNETIC WAVES, ANTENNAS AND RADIATION	Classes: 10

Electromagnetic waves: Waves at planar boundaries at normal incidence, waves incident on planar boundaries at angles, waves guided within cartesian boundaries, cavity resonators, waves in complex media Antennas and radiation: Radiation from charges and currents, short dipole antennas, antenna gain,

effective area, and circuit properties, antenna arrays, aperture antennas and diffraction, wire antennas, propagation of radio waves and thermal emission, applications in wireless communications systems, radar and lidar.		
UNIT - V	**OPTICAL COMMUNICATIONS AND ACOUSTICS**	**Classes: 08**
Optical communications: Introduction to optical communication links, optical waveguides, lasers, optical detectors, multiplexers, interferometers, and switches; Acoustics: Acoustic waves, acoustic waves at interfaces and in guiding structures and resonators, acoustic radiation and antennas, electrodynamic acoustic devices.		
Text Books:		
1. Haus, Hermann A, James R Melcher., "Electromagnetic Fields and Energy", Prentice-Hall, 1st Edition, 1989. 2. Staelin, David, Ann Morgenthaler, Jin Au Kong, "Electromagnetic Waves and Applications", Prentice Hall, 2nd Edition, 1994. 3. Zahn, Markus, "Electromagnetic Field Theory: A Problem Solving Approach", Krieger Publishing Company, 1st Edition, 2003.		
Reference Books:		
1. C A Brebbia, "Electromagnetic Applications", Springer-Verlag, volume 6, 1989. 2. Jeffrey B Knorr, "Electromagnetic Applications of Group Theory", Cornell University press, 1st Edition, 1970. 3. A H Sihvola, "Electromagnetic Mixing Formulas and Applications", The Institute of Electrical Engineers, 1st Edition, 1999.		
Web References:		
1. https://www.edforall.net/index.php/engineering-a-technology/electrical-a-electronic-eng/2665-electromagnetics-and-applications 2. https://www.pagines.uab.cat/uabea/content/electromagnetic-applications-uab 3. https://www.en.wikipedia.org/wiki/Electromagnetism		
E-Text Books:		
1. https://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009/readings/MIT6_013S09_notes.pdf 2. https://www.cdn.intechopen.com/pdfs-wm/42682.pdf 3. https://www.freeengineeringbooks.com		
Course Home Page:		

DIGITAL CONTROL SYSTEMS

Group - VI								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AEE530	**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 analog to digital and digital to analog conversion techniques.
II. Illustrate Z transform techniques for solving difference equations.
III. Apply state space analysis to determine the stability of digital control systems.
IV. Design discrete time control system based on frequency response method.

UNIT - I	SAMPLING AND RECONSTRUCTION	Classes: 08

Introduction, examples of data control systems, digital to analog conversion and analog to digital conversion, sample and hold operations.

UNIT - II	SYSTEM RESPONSE	Classes: 10

The z-transforms: Introduction, linear difference equations, pulse response, z-transforms, theorems of z-transforms, the inverse z-transforms, modified z-transforms; Z-plane analysis of discrete time control system: Z-Transform method for solving difference equations, pulse transforms function, block diagram analysis of sampled data systems, mapping between s-plane and z-plane.

UNIT - III	STATE SPACE ANALYSIS	Classes: 09

State space representation of discrete time systems, pulse transfer function matrix solving discrete time state space equations, state transition matrix and it's properties, methods for computation of state transition matrix, discretization of continuous time state space equations.

Controllability and observability: Concepts of controllability and observability, tests for controllability and observability, duality between controllability and observability, controllability and observability conditions for pulse transfer function.

UNIT - IV	STABILITY ANALYSIS	Classes: 10

Mapping between the s-plane and z-plane, primary strips and complementary strips, constant frequency loci, constant damping ratio loci, stability analysis of closed loop systems in the z-plane, Jury stability test, stability analysis by the use of the bilinear transformation and Routh stability criterion.

UNIT - V	DESIGN OF DISCRETE TIME CONTROL SYSTEM	Classes: 08

Design of discrete time control system by conventional methods: Transient and steady state response analysis, design based on the frequency response method, bilinear transformation and design procedure in the w plane, lead, lag and lead lag compensators and digital PID controllers; State feedback controllers and observers: Design of state feedback controller through pole placement, necessary and sufficient conditions, Ackerman's formula, state observers, full order and reduced order observers.

Text Books:
1. B C Kuo, "Digital Control Systems", Oxford University Press, 2nd Edition, 2007. 2. K Ogata, "Discrete Time Control Systems", Prentice Hall, 2nd Edition, 1995. 3. M Gopal, "Digital Control and State Variable Methods", Tata McGraw-Hill, 2nd Edition, 2003.
Reference Books:
1. K Warwick, D Rees, "Industrial digital control systems", peter peregrines Ltd. 2nd Edition, 1988. 2. K J Astroms and B. Wittenmark, "Computer Controlled Systems - Theory and Design", Prentice Hall, 3rd Edition, 1997. 3. Richard C Dorf, Robert H. Bishop, "Modern control systems", Pearson Education inc., 1st Edition, 2008.
Web References:
1. https://www.nptel.ac.in/syllabus/108103008/ 2. https://www.sciencedirect.com/science/book/9780123744982 3. https://www.springer.com/us/book/9781846280559
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1. https://www.nptel.ac.in/courses/108103008/ 2. https://www.freeengineeringbooks.com 3. https://www.engr.mun.ca/~hinch/6951/TEXT/DORF.PDF
Course Home Page:

ELEMENTS OF MECHANICAL ENGINEERING

VI Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME551	Elective	L	T	P	C	CIA	SEE	Total
		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 fundamentals of mechanical systems.
II. Understand and appreciate the significance of mechanical engineering in different fields of engineering.
III. Understanding of application and usage of various engineering materials.

UNIT-I	INTRODUCTION TO ENERGY SYSTEMS	Classes: 09

Introduction: Prime movers and its types, concept of force, pressure, energy, work, power, system, heat, temperature, specific heat capacity, change of state, path, process, cycle, internal energy, enthalpy, statement of zeroth law and first law; Energy: Introduction and application, of energy sources like fossil fuels, nuclear fuels, hydels, solar, wind, and bio-fuels, environment issues like global warming and ozone depletion; Properties of gases: Gas laws, Boyle's law, Charle's law, gas constant, relation between C_p and C_v, various non flow processes like constant volume processes, constant pressure process, isothermal process, adiabatic process, poly-tropic process.

UNIT-II	STEAM TURBINES, HYDRAULIC MACHINES	Classes: 09

Properties of steam: Steam formation, types of steam enthalpy, specific volume, internal volume, internal energy and dryness fraction of steam, use of steam tables, calorimeters; Heat engine: Heat engine cycle and heat engine, working substances, classification of heat engines, description and thermal efficiency of carnot, Rankine, otto cycle, diesel cycles; Steam boilers: Introduction, cochran, lancashire, babcock, and Wilcox boiler, functioning of different mountings and accessories.

UNIT-III	INTERNAL COMBSUTION ENGINES, REFRIGERATION AND AIR-CONDITIONING	Classes: 09

Internal combustion engines: Introduction, classification, engine details, four stroke, two stroke cycle, petrol engine, diesel engine, indicated power, brake power, efficiencies; Pumps: Types, operation of reciprocating. rotary, centrifugal pumps, priming.

Air compressors: Types, operation of reciprocating, rotary air compressors, significance of multi-staging; Refrigeration and air-conditioning: Refrigerant, vapor compression refrigeration system, vapor absorption refrigeration system, domestic refrigerator, window and split air conditioners.

UNIT-IV	MACHINE TOOLS AND AUTOMATION	Classes: 09

Machine tools and automation machine tools operation: Turning, facing , knurling, thread cutting, taper turning by swiveling the compound rest, drilling, boring, reaming, tapping, counter sinking, counter boring, plane milling, end milling, slot milling; Robotic and automation: Introduction, classification based on robot configuration, polar, cylindrical, cartesian, coordinate and spherical, application, advantages and advantages; Automation: Definition, types, fixed, programmable and flexible automation, NC/CNC machines, basic elements with simple block diagrams, advantages and disadvantages.

UNIT-V	ENGINEERING MATERIALS, JOINING PROCESS	Classes: 09
Engineering materials and joining processes: Types, applications of ferrous metals, non-ferrous metals, alloys; Composites: Introduction, definition, classification and application (Automobile and Air Craft).		
Text Books:		
1. V. K. Manglik, "Elements of Mechanical Engineering", Prentice Hall, 1st Edition, 2013. 2. Mikell P. Groover, "Automation, Production Systems and CIM", Prentice Hall, 4th Edition, 2015.		
Reference Books:		
1. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", University Press, 4th Edition, 2006. 2. K. P. Roy, S. K. Hajra Choudary, Nirjhar Roy, " Element of Mechanical Engineering", Media Promoters & Publishers, 7th Edition, 2012. 3. Pravin Kumar, "Basic Mechanical Engineering", Pearson, 1st Edition, 2013.		
Web References:		
1. http://www.nptel.ac.in/courses/112107144/ 2. *http://www.*nptel.ac.in/courses/112101098/download/lecture-37.pdf		
E-Text Books:		
1. www.wiley-vch.de/vch/journals/2081/books/2081_rel_title_varadan.pdfM 2. www.ebooks.cawok.pro/Artech.House.Publishers.An.Introduction.to.Microelectrical.pdf		
Course Home Page:		

DISASTER MANAGEMENT

VI Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
ACE551	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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.

UNIT-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.

UNIT-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.

UNIT-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.

UNIT-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.

UNIT-V	EMERGING APPROACHES IN DISASTER MANAGEMENT	Classes: 09
Emerging approaches in Disaster Management, Three Stages 1. Pre, disaster stage (preparedness) 2. Emergency Stage 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, Gary W. Hein Ke, "Environmental Science and Engineering", Prentice Hall Publishers, 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%20May%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		
Course Home Page:		

GEOSPATIAL TECHNIQUES

VI SEMESTER: Common for all branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
ACE552	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 technical skills to use geo-referenced data for the purpose of economic, educational, and social development.

II. Apply descriptive and analytical knowledge about map reading, statistics, and geospatial technologies.

III. Integrate the domains of geography and apply their knowledge to issues concerning people, places, and environments.

IV. Describe**,** analyze, and explain the patterns, processes, and interactions of human and physical phenomena on Earth's surface.

UNIT-I	**INTRODUCTION TO GEOSPATIAL DATA**	**Classes: 09**

Introduction geospatial data, why to study geospatial data, importance of geospatial technology, spatial data infrastructure, three important geospatial technologies, spatial elements, coordinates and coordinate systems, basic electromagnetic radiation.

UNIT-II	**PHOTOGRAMMETRY AND REMOTE SENSING**	**Classes: 09**

Definition and scope, history of photogrammetry and remote sensing, principle, remote sensing data acquisition, remote sensing data analysis methods, advantages and limitations, hardware and software required; Map vs mosaic, ground control points; Energy interactions with atmosphere and earth surface features.

UNIT-III	**MAPPING AND CARTOGRAPHY**	**Classes: 09**

What is map and its importance, map scale and types, elements of map and indexing, map coordinate systems, visual interpretation of satellite images, interpretation of terrain evaluation.

Introduction to digital data analysis, cartographic symbolization, classification of symbols, colours in cartography, scale and purpose of a map, cartographic design, thematic cartography, digital cartography.

UNIT-IV	**GEOGRAPHIC INFORMATION SYSTEM**	**Classes: 09**

Introduction to GIS, definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, a theoretical framework for GIS, GIS data structures, data collection and input overview, processing of spatial data, data input or output, vector data model, raster data model, geometric representation of spatial feature and data structure; Spatial data and modeling, tin, DTM, overlay, spatial measurement etc.

UNIT-V	**GEOSPATIAL TECHNOLOGIES APPLICATIONS**	**Classes: 09**

Visual image analysis for land use/land cover mapping, land use and land cover in water resources, surface water mapping and inventory, geological and soil mapping, agriculture applications for forestry applications, water resources applications, urban and regional planning, environmental assessment, principles of land form identification and evaluation: sedimentary, igneous and metamorphic rock terrain.

Text Books:
1. John D. Bossler, Taylor, Francis, "Manual of Geospatial Science and Technology", CRC Press, 2010. 2. M. Anji Reddy, "Textbook of Remote Sensing and Geographical Information Systems", BS Publication, 2001.
Reference Books:
1. C. P. Lo Albert, K.W. Yonng, "Concepts and Techniques of GIS", 2nd Edition, 2007. 2. Otto Huisman and Rolf A. de "Principles of Geographic Information Systems", 4th Edition, 2009
Web References:
1. https://www.aaas.org/content/what-are-geospatial-technologies 2. http://www.istl.org/10-spring/internet2.htmls 3. https://geography.columbian.gwu.edu/applied-geospatial-techniques 4. http://kiran.nic.in/pdf/publications/Geospatial_Techniques.pdf
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1. http://link.springer.com/book/10.1007%2F978-94-007-1858-6 2. http://www.springer.com/us/book/9789400718579 3. http://cbseacademic.in/web_material/doc/2014/7_Geospatial%20Technology%20Text%20Book%20(Class-XII).pdf 4. http://freegeographytools.com/2009/two-free-textbooks-on-geospatialgeostatistical-analysis.
Course Home Page:

PRINCIPLES OF OPERATING SYSTEMS

VI Semester: **Common for all Braches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACS551	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 functionalities of main components in operating systems.
II. Analyze the algorithms used in memory and process management.
III. Understand the clock synchronization protocols.
IV. Interpret the concepts of input and output storage for file management.

UNIT-I	INTRODUCTION	Classes: 10

Operating systems objectives and functions: Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, real time systems, operating system services; Systems calls: Types of systems calls.

UNIT-II	PROCESS AND CPU SCHEDULING, PROCESS COORDINATION	Classes: 10

Process concepts: The process, process state, process control block, threads; process scheduling: Scheduling queues, schedulers, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, Process synchronization, the critical section problem; semaphores and monitors.

UNIT-III	MEMORY MANAGEMENT AND VIRTUAL MEMORY	Classes: 08

Logical and physical address space: Swapping, contiguous memory allocation, paging, structure of page table.

Segmentation: Segmentation with paging, virtual memory, demand paging; Page replacement, page replacement algorithms, thrashing.

UNIT-IV	FILE SYSTEM INTERFACE	Classes: 09

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation.

UNIT-V	DEADLOCKS, PROTECTION	Classes: 08

System model: Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection, principles of protection, domain of protection, access matrix, implementation of access matrix.

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Principles”, Wiley Student Edition, 8th Edition, 2010.
2. William Stallings, “Operating System- Internals and Design Principles”, Pearson Education, 6th Edition, 2002.

Reference Books:

1. Andrew S Tanenbaum, “Modern Operating Systems”, PHI, 3rd Edition, 2007.
2. D. M. Dhamdhere, “Operating Systems a Concept based Approach”, Tata McGraw Hill, 2nd Edition, 2006.

Web References:

1. https://www.smartzworld.com/notes/operatingsystems
2. https://www.scoopworld.in
3. https://www.sxecw.edu.in
4. https://www.technofest2u.blogspot.com

E-Text Books:

1. https://it325blog.files.wordpress.com/2012/09/operating-system-concepts-7-th-edition.pdf
2. http://mpathinveco.blog.com/2014/11/25/operating-systems-william-stalling-6th-edition/
3. http://www.e-booksdirectory.com/details.php?ebook=10050
4. http://www.e-booksdirectory.com/details.php?ebook=9907
5. http://www.e-booksdirectory.com/details.php?ebook=9460

Course Home Page:

JAVA PROGRAMMING

VI Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS552	Elective	L	T	P	C	CIA	SEE	Total
		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 fundamentals of object-oriented terminology and programming concepts in java.
II. Acquire basics of how to translate solution problem into object oriented form.
III. Develop programs in java for solving simple applications.
IV. Design and implement simple program that use exceptions and multithreads.

UNIT-I	OOP CONCEPTS AND JAVA PROGRAMMING	Classes: 08

OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, constructors, methods, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, arrays, parameter passing.

UNIT-II	INHERITANCE	Classes: 10

Inheritance: Inheritance hierarchies, super and subclasses, member access rules, Polymorphism**:** Dynamic binding, method overriding, abstract classes and methods.

UNIT-III	EXCEPTION HANDLING AND MULTI THREADING	Classes: 08

Exception Handling: Benefits of exception handling, the classification of exceptions, usage of try, catch, throw, throws and finally.

Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads.

UNIT-IV	INTERFACES AND PACKAGES	Classes: 09

Interface: Interfaces vs Abstract classes, defining an interface, implement interfaces, Packages: Defining, creating and accessing a package, importing packages.

UNIT-V	FILES, AND CONNECTING TO DATABASE	Classes: 10

Files: streams – byte streams, character stream, text input/output, binary input/output, file management; Connecting to Database: Connecting to a database, querying a database and processing the results, updating data with JDBC.

Text Books:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", McGraw-Hill, 1st Edition, 2013.
2. Herbert Schildt, "Java the Complete Reference", McGraw Hill, Osborne, 8thEditon, 2011.
3. T. Budd, "Understanding Object-Oriented Programming with Java", Pearson Education, Updated Edition (New Java 2 Coverage), 1999.

Reference Books:
1. P. J. Deitel, H. M. Deitel, "Java: How to Program", Prentice Hall, 6th Edition, 2005. 2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, CRC Press, 2007. 3. Bruce Eckel, "Thinking in Java", Prentice Hall, 4th Edition, 2006. 4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.
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
Course Home Page:

EMBEDDED SYSTEM DESIGN

VI SEMESTER: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEC551	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 0**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

VI. Imbibe knowledge about the basic functions, structure, concepts and applications of Embedded Systems.
VII. Understand Real time operating system concepts.
VIII. Analyze different tools for development of embedded software.
IX. Understand the architecture of advanced processors.

UNIT-I	**EMBEDDED COMPUTING**	**Classes: 09**

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, , formalisms for system design, design examples

UNIT-II	**THE 8051 ARCHITECTURE**	**Classes: 09**

Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts. The Assembly Language Programming Process, Instructions of 8051 Programming Tools and Techniques, Simple Programs.

UNIT-III	**INTRODUCTION TO EMBEDDED C AND APPLICATIONS**	**Classes: 09**

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, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, using embedded C interfacing

UNIT-IV	**INTRODUCTION TO REAL – TIME OPERATING SYSTEMS**	**Classes: 09**

Tasks and Task States, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Interrupt Routines in an RTOS Environment. Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine

UNIT-V	**INTRODUCTION TO ADVANCED ARCHITECTURES**	**Classes: 09**

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus.

Text Books:

1. Wayne Wolf, "Principles of Embedded Computing System Design", Elseveir., 2nd Edition 2014,
2. Kenneth J.Ayala, "The 8051 Microcontroller", Thomson, 3rd Edition 2016,.
3. Dr. K V K K Prasad, "Embedded / Real-Time Systems : Concepts, Design And Programming", Black Book , DreamTech Press, ISBN: 9788177224610

Reference Books:

8. Embedding system building blocks, Labrosse, via CMP publishers.
9. Embedded Systems, Raj Kamal, TMH.
10. Micro Controllers, Ajay V Deshmukhi, TMH.
11. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley
12. Microcontrollers, Raj kamal, Pearson Education.
13. An Embedded Software Primer, David E. Simon, Pearson Education.
14. 8051 Microcontroller and Embedded Systems, by Muhammad Ali Mazadi,Janice Mazidi,Janice Gillispie Mazdi

Web References:

5. https://www.smartzworld.com/notes/embedded-systems-es/
6. http://notes.specworld.in/embedded-systems-es/
7. http://education.uandistar.net/jntu-study-materials
8. http://www.nptelvideos.in/2012/11/embedded-systems.html

E-Text Books:

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

INTRODUCTION TO AUTOMOBILE ENGINEERING

VI Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME552	Elective	L	T	P	C	CIA	SEE	Total
		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 function of various parts of automobile, features of fuel supply systems for S.I and C.I engines.
II. Distinguish the features of various types of cooling, ignition and electrical systems.
III. Identify the merits and demerits of the various transmission and suspension systems.
IV. Recognize the working of various braking and steering systems.
V. Summarize the ways and means of reducing the emissions from automobiles.

UNIT-I	INTRODUCTION	Classes: 09

Introduction to automobile engineering, chassis and automobile components, automobile engines, otto cycle, diesel cycle, dual cycle, engine lubrication, lubricating oil, lubrication oil filter, engine servicing; Fuel supply system; Fuel tank, strainer, feed pump, fuel filter, injection pump, injector, filters, electronic controlled fuel injection, common rail direct injection systems.

UNIT-II	COOLING SYSTEM	Classes: 09

Cooling requirements, air cooling, liquid cooling, water forced circulation system, radiators, cooling fan, water pump, thermostat, pressure sealed cooling, antifreeze solutions, intelligent cooling; Ignition system: Function of an ignition system, battery ignition system, storage battery, condenser and spark plug, magneto coil ignition system, electronic ignition system, electronic ignition, spark advance mechanisms; Electrical system: Charging circuit, generator, current-voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting systems, automatic high beam control, horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator.

UNIT-III	TRANSMISSION AND SUSPENSIONS SYSTEMS	Classes: 09

Transmission system: Clutches, principle, types, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel.

Gear boxes, types, constant mesh, synchro mesh gear boxes, epicyclic gear box, auto transmission, continuous variable transmission, propeller shaft, Hotch-Kiss drive, Torque tube drive, universal joint, differential, rear axles types, wheels and tyres; Suspension system: Objects of suspension systems, rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT-IV	BRAKING AND STEERING SYSTEMS	Classes: 09

Braking system: Mechanical brake system, Hydraulic brakes system, Master cylinder, wheel cylinder, Requirements of brake fluid, pneumatic and vacuum brake, ABS; Steering system: Steering geometry, camber, castor, king pin, rake, combined angle toe-in, toe-out, types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism, steering gears types, steering linkages.

UNIT-V	EMISSIONS FROM AUTOMOBILES	Classes: 09

Emissions from automobiles, pollution standards national and international, pollution control techniques, petrol injection, common rail diesel injection, variable valve timing; Energy alternatives, solar, photo-voltaic, hydrogen, biomass, alcohols, LPG, CNG, liquid fuels and gaseous fuels, hydrogen as a fuel for internal combustion engines, their merits and demerits.

Text Books:

1. Willam H crouse, Donald L. Anglin, "Automobile Engineering", McGraw Hill, 10th Edition, 2006.
2. Manzoor, Nawazish Mehdi, Yosuf Ali, "A Text Book Automobile Engineering", Frontline Publications, 1st Edition, 2011.

Reference Books:

1. R. K. Rajput, "A Text Book of Automobile Engineering", Laxmi Publications, 1st Edition, 2015.
2. Joseph Heinter, "Automotive Mechanics", CBS, 2nd Edition, 2006.
3. K. Netwon, W. Steeds, T. K.Garrett, "Automotive Engineering", Butterworth-Heinamann, 13th Edition, 2016.
4. S. Srinivasan, "Automotive Engines", Tata McGraw-Hill, 2nd Edition, 2003.
5. Khalil. U. Siddiqui, "A Text Book of Automobile Engineering", New Age International, 1st Edition, 2012.

Web References:

1. http://www.nptel.kmeacollege.ac.in/syllabus/125106002/
2. http://www.nptel.ac.in/courses/125106002/

E-Text Books:

1. http:// www.engineeringstudymaterial.net/tag/automotive-engineering-books
2. https://www.studynama.com/.../299-Automobile-engineering-lecture-notes-ebook-pdf

Course Home Page:

INTRODUCTION TO ROBOTICS

VI Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME553	Elective	L	T	P	C	CIA	SEE	Total
		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.

UNIT-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.

UNIT-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.

UNIT-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.

UNIT-IV	TRAJECTORY PLANNING AND ACTUATORS	Classes: 09

Trajectory planning: Joint space scheme, cubic polynomial fit, 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.

UNIT-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 Books:

1. http://*www.robot.bmstu.ru/*
2. http://www.robotee.com/index.php/download-free-robotic-e-books/

Course Home Page:

AEROSPACE PROPULSION AND COMBUSTION

<table>
<tr><td colspan="10">VI Semester: Common for all Branches</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AAE551</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Demonstrate with an overview of various aerospace propulsion systems and a sound foundation in the fundamentals of thermodynamics.
II. Distinguish the elementary principles of thermodynamic cycles as applied to propulsion analysis.
III. Prioritize an introduction to combustion& gas kinetic theory.
IV. Discover a working knowledge of and the tools to measure various flight propulsion systems such as turbojets, turbofans, ramjets, rockets, air turbo-rockets and nuclear/electric propulsion systems.

UNIT-I	**ELEMENTS OF AIRCRAFT PROPULSION**	**Classes: 10**

Classification of power plants, methods of aircraft propulsion, propulsive efficiency, specific fuel consumption, thrust and power, factors affecting thrust and power, illustration of working of gas turbine engine, characteristics of turboprop, turbofan and turbojet, ram jet, scram jet, methods of thrust augmentation, atmospheric properties, turbojet, turbofan, turboprop, turbo-shaft engine construction and nomenclature, theory and performance, introduction to compressors, turbines, combustors and after burners for aircraft engines.

UNIT-II	**PROPELLER THEORY**	**Classes: 08**

Momentum theory, Blade element theory, combined blade element and momentum theory, propeller power losses, propeller performance parameters, prediction of static thrust and in flight, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts.

UNIT-III	**INLETS, NOZZLES AND COMBUSTION CHAMBERS**	**Classes: 10**

Subsonic and supersonic inlets, relation between minimum area ratio and external deceleration ratio, starting problem in supersonic inlets, modes of inlet operation, jet nozzle, efficiencies, over expanded, under and optimum expansion in nozzles, thrust reversal.

Classification of combustion chambers, combustion chamber performance flame tube cooling, flame stabilization.

UNIT-IV	**THERMODYNAMICS OF REACTING SYSTEMS**	**Classes: 09**

Chemical kinetics: equilibrium, analysis of simple reactions, steady, state and partial equilibrium approximations, explosion theories; Transport phenomena: Molecular and convective transports; Conservation equations of multicomponent, reacting systems.

UNIT-V	**PREMIXED FLAMES**	**Classes: 08**

Rankine hugoniot relations, theories of laminar premixed flame propagation, quenching and flammability limits; Diffusion flames: Burke-Schumann theory, laminar jet diffusion flame, droplet combustion, turbulent combustion, closure problem, premixed and non-premixed turbulent combustion, introduction to DNS and LES.

Text Books:

1. Stephen R. Turns, "An Introduction to Combustion", McGraw-Hill, 3rd Edition, 2012.
2. Thomas A. Ward, "Aerospace Propulsion Systems", John Wiley and Sons, 1st Edition, 2010.

Reference Books:

1. M. H. Sadd, "Elasticity: Theory, Applications, and Numerics", Academic Press, 2nd Edition, 2009.
2. R. G. Budynas, "Advanced Strength and Applied Stress Analysis", McGraw-Hill, 2nd Edition, 1999.
3. A. P. Boresi, R.J. Schmidt, "Advanced Mechanics of Materials", John Willey & Sons, 5th Edition, 2003.

Web References:

1. https://www.nptel.ac.in/courses/101101002/
2. https://www.en.wikipedia.org/wiki/Airbreathing_jet_engine
3. https://www.en.wikipedia.org/wiki/Combustor
4. https://www.aero.iisc.ernet.in/page/propulsion

E-Text Books:

1. https://www.as.wiley.com/WileyCDA/WileyTitle/productCd-1118307984.html
2. https://www.sciencedirect.com/science/book/9781856179126
3. https://www.books.google.co.in/books?id=iUuPAQAAQBAJ&source=gbs_similarbooks

Course Home Page:

FUNDAMENTALS OF IMAGE PROCESSING

<table>
<tr><td colspan="9">VII SEMESTER: Common for all Branches</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>AEC552</td><td>Elective</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 0</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand the image fundamentals and the relationship between pixels.
II. Understand the image enhancement techniques in spatial domain and frequency domain.
III. Analyze the image restoration technique from degraded image using various filtering techniques.
IV. Design segmentation of the image for boundary detection.
V. Differentiate redundancy techniques and apply for image compression.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Digital image fundamentals and image transforms digital image fundamentals, sampling and quantization, relationship between pixels.

UNIT-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 neighborhood 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

UNIT-III	**IMAGE RESTORATION**	**Classes: 9**

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

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

UNIT-IV	**IMAGE SEGMENTATION, MORPHOLOGICAL IMAGE PROCESSING**	**Classes: 9**

Image segmentation detection of discontinuities, edge linking and boundary detection, threshold, region oriented segmentation. Morphological image processing dilation and erosion, structuring element decomposition, the Strel function, erosion; Combining dilation and erosion: Opening and closing the hit and miss transformation.

UNIT-V	**IMAGE COMPRESSION**	**Classes: 09**

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 MATLAB", 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/digital-image-
8. processing.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

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS

VII Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS553	Elective	L	T	P	C	CIA	SEE	Total
		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:

I. Understand the role of database management system in an organization and learn the database concepts.
II. Design databases using data modeling and data normalization techniques.
III. Construct database queries using relational algebra and calculus.
IV. Understand the concept of a database transaction and related database facilities.
V. Learn how to evaluate set of queries in query processing.

UNIT-I	CONCEPTUAL MODELING	Classes: 10

Introduction to file and database systems: Database system structure, data models: entity relationship model, relational model.

UNIT-II	RELATIONAL APPROACH	Classes: 08

Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational calculus, tuple relational calculus.

UNIT-III	BASIC SQL QUERY AND NORMALIZATION	Classes: 10

SQL data definition; Queries in SQL: updates, views, integrity and security, relational database design.

Normal Forms: 1NF, 2NF, 3NF and BCNF.

UNIT-IV	TRANSACTION MANAGEMENT	Classes: 09

Transaction processing: Introduction, need for concurrency control, desirable properties of transaction, schedule and recoverability, Serializability and schedules.

UNIT-V	CONCURRENCY CONTROL	Classes: 08

Concurrency control; Types of locks: Two phases locking, deadlock, timestamp based concurrency control, recovery techniques, concepts, immediate update, deferred update, shadow paging.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 4^{th}Edition, 2002.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 3rd Edition, 2003.
2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2003.
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

Course Home Page:

BASICS OF INFORMATION SECURITY AND CRYPTOGRAPHY

VII Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AIT551	Elective	L	T	P	C	CIA	SEE	Total
		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.

UNIT-I	ATTACKS ON COMPUTERS	Classes: 08

Attacks on computers and computer security: Introduction, the need for security, security approaches, types of security attacks and security services. \

UNIT-II	SYMMETRIC KEY CIPHERS	Classes: 10

Symmetric key ciphers: Block cipher principles and algorithms (DES, AES), differential and linear cryptanalysis, block cipher modes of operation, stream ciphers; Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie – Helman).

UNIT-III	MESSAGE AUTHENTICATION AND CRYPTOGRAPHY	Classes: 08

Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes, hash functions, secure hash algorithm, whirlpool, digital signatures.

Cryptography: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography.

UNIT-IV	E-MAIL SECURITY	Classes: 10

E-mail security: Pretty good privacy; S/MIMI IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

UNIT-V	WEB SECURITY	Classes: 09

Web security: Web security considerations, secure electronic transaction intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, firewall design principles; Types of firewalls.

Text Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education, 4th Edition, 2005.
2. AtulKahate, "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

Course Home Page:

MODELING AND SIMULATION

VII Semester: Common to All Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS551	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 system concept and definitions of system.
II. Study the techniques to model and to simulate various systems.
III. Analyze a system and to make use of the information to improve the performance.

UNIT-I	INTRODUCTION	Classes: 08

When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of models; Discrete event system simulation; Steps in a simulation study; The basics of spreadsheet simulation; Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT-II	GENERAL PRINCIPLES SIMULATION SOFTWARE	Classes: 10

Concepts in discrete-event simulation: The event-scheduling / time-advance algorithm, world views, manual simulation using event scheduling; List processing, simulation in java; Simulation in GPSS review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT-III	QUEUING MODELS AND RANDOM NUMBERS	Classes: 08

Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration.

Properties of random numbers: Generation of pseudo random numbers; Techniques for generating random numbers; Tests for random numbers random-variate generation: Inverse transforms technique; Acceptance-rejection technique; Special properties.

UNIT-IV	INPUT MODELING	Classes: 10

Data collection; Identifying the distribution with data; Parameter estimation; Goodness of fit tests; Fitting a non-stationary poisson process; Selecting input models without data; Multivariate and time-series input models.

UNIT-V	ESTIMATION OF ABSOLUTE PERFORMANCE	Classes: 09

Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations; Model building, verification and validation; Verification of simulation models; Calibration and validation of models, optimization via simulation.

Text Books:
Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation”, Pearson Education, 5th Edition, 2010.
Reference Books:
1. Lawrence M. Leemis, Stephen K. Park, “Discrete – Event Simulation: A First Course”, Pearson Education, 1st Edition, 2006. 2. Averill M., “Law: Simulation Modeling and Analysis”, Tata McGraw-Hill, 4th Edition, 2007.
Web References:
1. https://storage.googleapis.com/northwestern14-edu/Vtu-Notes-For-System-Modeling-And Simulation.pd. 2. http://www.slideshare.net/qwerty626/system-simulation-modeling-notessjbit.
E-Text Books:
1. http://www.e-booksdirectory.com/listing.php?category=100 2. https://www.google.co.in/?gfe_rd=cr&ei=YGRCWOWMKuPx8AfQqaaoCg#q=simulation+and+modeling+e+books&start=30
Course Home Page:

RESEARCH METHODOLOGIES

VII Semester: Common for All Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS552	Elective	L	T	P	C	CIA	SEE	Total
		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. Orient the student to make an informed choice from the large number of alternative methods and experimental designs available.
II. Empower the student with the knowledge and skills they need to undertake a research project, to present a conference paper and to write a scientific article.
III. Develop a thorough understanding of the fundamental theoretical ideas and logic of research.
IV. Identify various sources of information for literature review and data collection.

UNIT-I	INTRODUCION TO RESEARCH AND PHILOSOPHIES	Classes: 07

Introduction to research: The role of research, research process overview; Philosophies and the language of research theory building: Science and its functions, what is theory, the meaning of methodology.

UNIT-II	A RESEARCHER PROBLEMS AND HYPOTHESES	Classes: 10

Thinking like a researcher: Understanding concepts, constructs, variables, and definitions; Problems and hypotheses: Defining the research problem, formulation of the research hypotheses, the importance of problems and hypotheses.

UNIT-III	RESEARCH DESIGN AND DATA COLLECTION	Classes: 09

Research design: Experimental and no experimental research design, field research, and survey research.

Methods of data collection: Secondary data collection methods, qualitative methods of data collection, and survey methods of data collection.

UNIT-IV	ATTITUDE MEASUREMENT , SCALING AND SAMPLING TECHNIQUES	Classes: 09

Attitude measurement and scaling: Types of measurement scales; Questionnaire designing, reliability and validity; Sampling techniques: The nature of sampling, probability sampling design, non probability sampling design, and determination of sample size.

UNIT-V	PROCESSING AND ANALYSIS OF DATA,ETHICAL ISSUES	Classes: 10

Processing and analysis of data ; Ethical issues in conducting research; Report generation, report writing, and APA format; Title page, abstract, introduction, methodology, results, discussion, references, and appendices.

Text Books:

1. Bryman, Alan, Bell, Emma, "Business Research Methods", Oxford University Press, 3rd Edition, 2011.
2. Kerlinger, F.N., Lee, H.B.,"Foundations of Behavioral Research", Harcourt Inc., 4th Edition, 2000.
3. Rubin, Allen, Babbie, Earl, "Essential Research Methods for Social Work", Cengage Learning Inc., USA, 2009.

Reference Books:
1. Anantasi A., Urbina S., "Psychological Testing", Pearson Education, 2004. 2. Chawla, Deepak, Sondhi, Neena, "Research Methodology: Concepts and Cases", Vikas Publishing House Pvt. Ltd. Delhi, 2011. 3. Pawar B. S., "Theory Building For Hypothesis Specification In Organizational Studies", Response Books, New Delhi, 2009. 4. NeumanW.L., "Social Research Methods: Qualitative and Quantitative Approaches", Pearson Education, 2008.
Web References:
1. https://en.wikipedia.org/wiki/Online_research_methods 2. https://www.prescott.edu/library/resources/research-bibliography.php
E-Text Books:
1. https://www.hcmuaf.edu.vn/.../Research%20Methodology%20-%20Methods%20and%20T... 2. https://www.federaljack.com/ebooks/My%20collection%20of%20medical%20books,%2020...
Course Home Page

ENERGY FROM WASTE

VII Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE551	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		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 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. Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

UNIT - 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 .

UNIT - 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.

UNIT - 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.

UNIT - 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.

UNIT - 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 Landfilling practice”, Reprint Edition New Delhi, 1999.
4. Rajya Sabha Secretariat, “E-waste in India: Research unit”, Reprint Edition, June, 2011.
5. Amalendu Bagchi Design, “Construction and Monitoring of Landfills”, John Wiley and Sons, New York, 1994.
6. M. L. Davis and D. A. Cornwell, “Introduction to environmental engineering”, International Edition, 2008.
7. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Ltd. New Delhi, 1995.
8. S. K. Agarwal, “Industrial Environment Assessment and Strategy”, APH Publishing Corporation, New Delhi, 1996.
9. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), “Biomass Conversion Processes for Energy and Fuels”, New York, Plenum Press, 1981.
10. Hagerty, D.Joseph; Pavoni, Joseph L; Heer, John E., “Solid Waste Management”, New York, Van Nostrand, 1973.
11. George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, “Integrated Solid Waste management: Engineering Principles and Management issues”, New York, McGraw Hill, 1993.

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.
4. G Rich et.al, Hazardous, “Waste Management Technology”, Podvan Publishers, 1987.
5. AD Bhide, BB Sundaresan, “Solid Waste Management in Developing Countries”, INSDOC, New Delhi, 1983.

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

Course Home Page:

FINITE ELEMENT ANALYSIS

VII Semester: **Common for all branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAE552	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. Possess a good understanding of the theoretical basis of the weighted residual finite element method.
II. Use the commercial finite element package ANSYS to build finite element models and solve a selected range of engineering problems.
III. Communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.

UNIT-I	INTRODUCTION	Classes: 10

Review of various approximate method, variational approach and weighted residual approach application to structural mechanics problems; Finite difference methods- governing equation and convergence criteria of finite element method.

UNIT-II	DISCRETE ELEMENTS	Classes: 10

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element, problems for various loadings and boundary conditions 2D and 3D Frame elements, longitudinal and lateral vibration; Use of local and natural coordinates.

UNIT-III	CONTINUUM ELEMENTS	Classes: 09

Plane stress, plane strain and axi-symmetric problem; Derivation of element matrices for constant.

Linear strain triangular elements and axi-symmetric element.

UNIT-IV	ISOPARAMETRIC ELEMENTS	Classes: 08

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

UNIT-V	FIELD PROBLEM AND METHODS OF SOLUTIONS	Classes: 08

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. Bandwidth, elimination method and method of factorization for solving simultaneous algebraic equations, features of software packages, sources of error.

Text Books:

1. Tirupathi. R. Chandrapatha, Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Printice Hall India, 3rd Edition, 2003.
2. Rao. S.S., "Finite Element Methods in Engineering", Butterworth and Heinemann, 5th Edition 2010.
3. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill, 3rd Edition, 2005.

Reference Books:
1. Krishnamoorthy C.S, "Finite Element Analysis", Tata McGraw Hill, 2nd Edition 2001. 2. K. J. Bathe, E. L. Wilson, "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985. 3. Robert D Cook, David S Malkus, Michael E Plesha, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, Inc., 4th Edition, 2003. 4. Larry J Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, Inc, 2nd Edition, 1984.
Web References:
1. http://home.iitk.ac.in/~sbasu/me623_2006/fem_notes_me623.pdf 2. http://nptel.ac.in/courses/112104116/ 3. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf
E-Text Books:
1. http://www.civilenggforall.com/2015/09/finite-element-analysis-by-ss-bhavikatti-free-download-pdf-civilenggforall.com.html 2. https://books.google.co.in/books/about/Finite_Element_Analysis_For_Engineering.html?id=3XJoK4x5fZwC
Course Home Page:

BASIC REFRIGERATION AND AIR-CONDITIONING

VI Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME554	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 understand various concepts and laws of thermodynamics.
II. Understand the concepts of refrigeration and air refrigeration.
III. Understand vapour compression refrigeration system and also vapour absorption refrigeration system.
IV. Identify various psychometric properties and processes.

UNIT-I	RECAPITULATION OF THERMODYNAMICS	Classes : 09

Recapitulation of thermodynamics: Thermodynamic systems, laws of thermodynamics, phase, state, process, cycle, concepts of enthalpy, entropy, specific heat, sensible heat, latent heat, dryness fraction, correlations involving enthalpy, entropy and dryness fraction, types of various processes and their representation on T-s, P-V and P-h diagrams, carnot cycle, reversed carnot cycle.

UNIT-II	INTRODUCTION AND AIR REFRIGERATION	Classes : 09

Introduction to Refrigeration: Basic concepts, unit of refrigeration; C.O.P: Refrigerators, heat pump, Carnot refrigerators and applications of refrigerator; Air refrigeration cycle: Bell Coleman cycle, open and dense air system – ideal and actual refrigeration, applications, aircraft refrigeration cycles; Refrigerants: Desirable properties, nomenclature and selection of refrigerants, effects of refrigerants on ozone depletion and global warming, alternate refrigerants.

UNIT-III	VAPOUR COMPRESSION REFRIGERATION	Classes: 09

Vapor compression refrigeration, ideal cycle, effect of variation in evaporator pressure, condenser pressure, super heating of vapor, sub cooling of liquid.

Evaporator and condenser temperatures, deviations of practical (actual cycle) from ideal cycle, construction and use of p-h chart problems.

UNIT-IV	VAPOUR ABSORPTION REFRIGERATION	Classes: 09

Vapor absorption refrigeration: description, working of NH3-Water, Li Br–water system, calculation of HCOP, principle and operation of three fluid vapor absorption refrigeration systems, steam jet refrigeration system, working principle, basic operation, principle and operation of thermo electric and vortex tube or hilsch tube refrigeration systems.

UNIT-V	INTRODUCTION TO AIR CONDITIONING	Classes : 09

Psychometric properties and processes, sensible and latent heat loads, characterization, need for ventilation, consideration of infiltration, load concepts of RSHF, ASHF, ESHF and ADP; Concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning and requirements, air conditioning load calculations.

Text Books:

1. S. C. Arora, Domkundwar, "A Course in Refrigeration and Air-conditioning", Dhanpatrai Publications, 2nd Edition, 2014.
2. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill, 17th Edition, 2006.

Reference Books:

1. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International, 3rd Edition, 2015.
2. P. N Ananthanarayanan, "Basic Refrigeration and Air Conditioning", Tata McGraw-Hill, 2015.

Web References:

1. http://www.engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/
2. https://www.en.wikipedia.org/wiki/Air_conditioning

E-Text Book:

1. http://www.mechanicalgeek.com/refrigeration-and-air-conditioning-by-rs-khurmi-pdf/
2. http://www.engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/

Course Home Page:

LAUNCH VEHICLES AND CONTROLS

VII Semester: Common to all branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAE553	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the various configurations of launch vehicles and application of controls.
II. Identify different tracking systems for launch vehicles.
III. Distinguish between different errors associated with navigation system and compensation errors.
IV. Compare the guidance systems for short medium and long range missile.

UNIT-I	INTRODUCTION	Classes: 10

Types of rockets and missiles, various configurations, components forces on the vehicle during atmospheric flight, nose cone design and drag estimation; Concepts of navigation ADF, VOR/DME, Doppler, LORAN and OMEGA, guidance and control; Introduction to basic principles; Air data information; Guidance trajectories; Radar systems; Principle of working of radar; Radar equations and applications; MTI and pulse Doppler radar; moving target detector; limitation of MTI performance.

UNIT-II	TRACKING WITH RADAR	Classes: 10

Mono pulse tracking: Conical scan and sequential lobbing; Automatic tracking with surveillance radar (ADT); CW radar; Applications; Other guidance systems; Gyros and stabilized platforms; Inertial guidance and laser based guidance; Components of inertial navigation system; imaging infrared guidance; Satellite navigation; GPS; Accelerometers.

UNIT-III	INERTIAL NAVIGATION SYSTEM	Classes: 09

INS transfer function and errors; Different coordinate system, compensation errors, schuler loops; Cross coupling; Missile control system; Guided missile concept; Augmented systems.

Control of aerodynamic missile; Missile parameters for dynamic analysis; Missile autopilot schematics; Longitudinal and Lateral autopilots.

UNIT-IV	MISSILE GUIDANCE	Classes: 08

Missile guidance laws, short and medium range missiles; Proportional navigation guidance; Command guidance; Comparison of guidance system performance; Bank to turn missile guidance; Terminal guidance; Weapon control missile guidance.

UNIT-V	INTEGRATED FLIGHT/FIRE CONTROL SYSTEM	Classes: 08

Director fire control system; Fire control modes; Tracking control laws; Longitudinal flight control system; Lateral flight control system; Rate of change of Euler angle, auto pilot; Integrated flight and fire control (IFFC) flight testing.

Text Books:

1. Merrilh I. Skolnik, " Introduction to Radar Systems", Tata McGraw-Hill, 3rd Edition, 2001.
2. John H Blakelock, "Automatic control of Aircraft and Missiles", Wile –Inter Science Publication, 2nd Edition, May 1990.

Reference Books:

1. R.B. Underdown, Tony Palmer, "Navigation", Black Well Publishing, 6th Edition, 2001.
2. R P G Collinson, "Introduction to Avionics Systems", Kulwar Academic Publishers, 3rd Edition, 2003.

Web References:

1. http://home.iitk.ac.in/~sbasu/me623_2006/fem_notes_me623.pdf
2. http://nptel.ac.in/courses/112104116/
3. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf

E-Text Books:

1. http://www.civilenggforall.com/2015/09/finite-element-analysis-by-ss-bhavikatti-free-download-pdf-civilenggforall.com.html
2. https://books.google.co.in/books/about/Finite_Element_Analysis_For_Engineering.html?id=3XJoK4x5fZwC

Course Home Page:

INTELLECTUAL PROPERTY RIGHTS

<table>
<tr><td colspan="9">IV Semester: Common for all Branches</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AHS601</td><td rowspan="2">Perspective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Explore the knowledge in determination of trade secrets status.
II. Adequate knowledge in new developments in trade law.
III. Understand the complexities involved in the process of attributing intellectual property rights to people.
IV. Learn the legalities of intellectual property to avoid plagiarism and other IPR relates crimes like copyright, infringements, etc.
V. Learn the fundamental principles and the application of those principles to factual, real-world disputes.

UNIT - I INTRODUCTION TO INTELLECTUAL PROPERTY

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II TRADE MARKS

Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

UNIT - III LAW OF COPYRIGHTS AND LAW OF PATENTS

Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues.

Copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

UNIT - IV TRADE SECRETS AND UNFAIR COMPETITION

Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right of publicity and false advertising.

UNIT - V NEW DEVELOPMENTS OF INTELLECTUAL PROPERTY

New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

Text Books:

1. Deborah E Bouchoux, “Intellectual Property Right”, Cengage Learning,4th Edition, 2013.
2. Prabuddha Ganguli, “Intellectual Property Right: Unleashing the Knowledge Economy”, Tata McGraw-Hill Publishing Company Ltd., 3rd Edition, 2005.

Reference Books:

1. Catherine J Holland, “Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, CDR Edition, 2007.
2. Stephen Elias, “Patent, Copyright & Trademark: A Desk Reference to Intellectual Property Law”, Lisa Goldoftas Publishers, Nolo Press, 1996.

Web References:

1. https://www.en.wikipedia.org/wiki/Intellectual property
2. https://www.sokogskriv.no/en/sources-and-references/why-cite-sources/intellectual-property-rights/

E-Text Books:

1. https://www.e-booksdirectory.com/listing.php?category=269
2. https://www.lexisnexis.com/store/catalog/catalog.jsp?id=80

Course Home Page:

TOTAL QUALITY MANAGEMENT

IV Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS602	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the philosophy and core values of Total Quality Management (TQM).
II. Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
III. Apply and evaluate best practices for the attainment of total quality.
IV. Utilize Statistical Process Control (SPC) techniques as a means to diagnose, reduce and eliminate causes of variation.
V. Describe and apply the development and nature of quality control charts.

UNIT - I **PRINCIPLES AND PRACTICES-1**

Introduction, gurus of TQM, historic review, benefits of TQM leadership, characteristics of quality leaders, the deming philosophy, quality councils, strategic planning, customer satisfaction, customer perception of quality service quality, customer retention, employee involvement, employee survey-empowerment, gain sharing, performance appraisal.

UNIT - II **PRINCIPLES AND PRACTICES-2**

Continuous process improvement, the jurantrilogy, the PDCA cycle-kaizen, reengineering; Supplier partnership, partnering, sourcing, supplier selection, supplier rating, performance measures, basic concept, strategy quality cost bench marking, reasons for bench marking, process understanding current performance, pitfalls and criticism of benchmarking.

UNIT - III **TOOLS AND TECHNIQUES-1**

Information technology, computers and the quality functions, information quality issues, quality management system, benefits of ISO registration, ISO 9000 series standards, internal audits.

Environmental management system, ISO 14000series, benefits of EMS, relation to healthy and safety quality function deployment, the voice of the customer, building a house of quality, QFD process.

UNIT - IV **TOOLS AND TECHNIQUES-2**

Quality by design benefits, communication model, failure mode and effective analysis, failure rate, FMEA documentation, the process of FMEA documentation, product liability, proof and expert witness; Total productive maintenance, promoting the philosophy and training-improvements and needs, autonomous work groups.

UNIT - V	MANAGEMENT TOOLS
Management tools introduction-forced field analysis, tree diagram, process decision program chart statistical process control, cause and effect diagram-histogram, state of control, process capability, experimental design, hypothesis, orthogonal design two factors and full factors-quality strategy for Indian industries, quality management in India.	
Text Books:	
1. Joel E Ross, "Total Quality Management", CRC Press, 3rd Edition, 2015	
Reference Books:	
1. Dale H.Besterfeild, Carlon Besterfeild, "Total Quality Management", Pearson Education,1st Edition, 2015. 2. Sridhara Bhat, "Total Quality Management Texts and Cases", Himalaya, 1st Edition, 2015. 3. Poornima M Charantimath,"Total Quality Management", Pearson Education, 1st Edition, 2015.	
Web References:	
1. https://www.managementhelp.org/quality/total-quality-management.htm 2. https://www.tandfonline.com/toc/ctqm20/current	
E-Text Books:	
1. https://www.scribd.com/doc/19378602/Quality-Management-eBook 2. https://www.bookboon.com/en/quality-management-ebook	
Course Home Page:	

PROFESSIONAL ETHICS AND HUMAN VALUES

IV Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS603	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental theoretical and historic graphical topics of professional ethics and human values.

II. Study independence and self-evaluation professional ethics and human values, so that they can grasp the core values as independent thinkers.

III. Develop their analytical and pragmatic abilities & situational reasoning aligned towards right and wrong.

UNIT - I INTRODUCTION TO PROFESSIONAL ETHICS

Basics of profession: Engineering and professionalism, two models of professionalism, three types of ethics or morality, the negative face of engineering ethics, the positive face of engineering ethics, responsibility in engineering, engineering standards, the standard care, blame responsibility and causation.

UNIT - II PROFESSIONAL ETHICS IN ENGINEERING

Engineering ethics , variety of moral issues, types of inquiry moral dilemmas, moral autonomy the problems of many hands, Kohlburg's theory, Gilligan's theory impediments to responsible action, engineering as social experimentation, framing the problem, determining the facts, codes of ethics, clarifying concepts application issues, common ground, general principles, utilitarian thinking respect for persons.

UNIT - III ETHICS AND HUMAN VALUES

Human values, morals, values, and ethics, integrity, work ethic, service learning, civic virtue, respect for others, living peacefully.

Caring, sharing, honesty, courage, valuing time, co-operation, commitment, empathy, self-confidence, spirituality, character.

UNIT - IV MORAL RESPONSIBILITIES AND RIGHTS

Ethics consensus, controversy, models of professional roles, theories about right action, self, interest, customs and religion, uses of ethical theories, responsibility for rights, respect for authority, conflicts of interest, occupational crime, professional rights and employee rights, communicating risk and public policy, collective bargaining.

UNIT - V	GLOBAL ETHICS AND VALUES

Global issues, multinational corporations, environmental ethics, engineers as managers, advisors, and experts witnesses, moral leadership sample codes of ethics problem of bribery, extortion and grease payments, problem of nepotism, excessive gifts, paternalism, different business practices, negotiating tax, global trends.

Text Books:

1. PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications, 1st Edition, 2013.
2. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 3rd Edition, 2003.
3. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, 4th Edition, 2012.
4. George Reynolds, "Ethics in Information Technology", Cengage Learning, 5th Edition, 2012.

Reference Books:

1. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 4th Edition, 2004.
2. Charles E Harris, Micheal J Rabins, "Engineering Ethics", Cengage Learning, 5th Edition, 2014.
3. Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 1st Edition, 2000.

Web References:

1. https://www.imd.inder.cu/adjuntos/article/524/Professional%20Ethics%20and%20Human%20Values.pdfhttp://bit.ly/29SyL7i
2. https://www.books.google.com/books/about/Textbook_on_Professional_Ethics_and_Huma.html?id=-dPiHmlV.

E-Text Books:

1. https://www.amazon.com/Professional-Ethics-Human-Values-Govindarajan-ebook/dp/B00K6GSSUW
2. https://www.bookboon.com/en/business-ethics-ebook

Course Home Page:

LEGAL SCIENCES

IV Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS604	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: Nil**			

OBJECTIVES:

The course should enable the students to:

I. Acquaint the student with the scientific method of social science research.
II. Provide the knowledge of the technique of selection, collection and interpretation of primary and secondary data in socio legal research.
III. Emphasis would be laid on practical training in conducting research.

UNIT - I CONCEPT OF LEGAL SCIENCE

Fundamentals of legal science, law systems in India, comparative public law, law and justice in a globalizing world. Impact of the human rights instruments on domestic law.

UNIT - II TECHNOLOGY & LEGAL SYSTEMS

Principles of corporate law conjunction, temporal, subordinate clauses complex sentences, intellectual property rights, contract law, cyber law.

UNIT - III CONSTITUTION AND ADMINISTRATIVE LAW

Minorities law, human rights, international and national sphere, media law.

Health law, globalization vis-à-vis human rights, significance of human rights.

UNIT - IV HUMAN RIGHTS INTERNATIONAL AND NATIONAL SPHERE

Human rights with special reference to right to development, rights of disadvantaged and vulnerable groups, critical analysis, cultural relativism and human rights, human rights in the Indian sphere, an over view, constitution and the analysis of preamble, social action litigation and the role of Indian judiciary, critical examination of the human rights council and human rights commission, treaty mechanism with respect to covenants ICESCR and ICCPR, convention on the elimination of discrimination against women and child rights convention.

UNIT - V SCIENTIFIC METHODOLOGY IN LEGAL SYSTEMS

The science of research and scientific methodology ,analysis of law with scientific methods, scientific approach to socio legal problems, interrelation between speculation, fact and theory building fallacies of scientific methodology with reference to socio legal research ,inter-disciplinary research and legal research models, arm chair research vis-a-vis empirical research, legal research-common law and civil law legal systems.

Text Books:

1. Robert Watt, “Concise book on Legal Research”, Abe Books publishers, 1st Edition, 2015.
2. Ram Ahuja, “Research Method”, NewsWay Publishers, 1st Edition, 2012.
3. Goode and Hatt, “Research Methodology”, Eastern Limited Publication, 1st Edition reprinted, 2006.

Reference Books:

1. B Somekh & C Lewin, “Research Methods”, Vistaar Publications, 1st Edition, 2005.
2. Bhandarkar, “Research Methods, Research styles and Research Strategies”, Wilkinson Publishers, 1st Edition, 2009.

Web References:

1. https://www.humansecurityconf.polsci.chula.ac.th/Documents/Presentations/Shanawez.pdf
2. https://www.lexisnexis.com/documents/pdf/20080806034945_large.pdf
3. https://www.theglobaljusticenetwork.org/journal
4. https://www.humansecurityconf.polsci.chula.ac.th/Documents/Presentations/Shanawez.pdf
5. https://www.as.nyu.edu/docs/IO/1172/globaljustice.pdf

E-Text Books:

1. https://www.bookboon.com/en/natural-sciences-eBooks

Course Home Page:

CLINICAL PSYCHOLOGY

IV Semester: Common for all Branches									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS605	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Develop the knowledge pertinent to the organism, developmental, social and situational factors those are relevant to the initiation and maintenance of human behavior.
II. Understand the present and implement effective strategies to deal with these issues during work with patients.
III. Study the professional identity and practice as clinical psychologists through fundamental knowledge of psychology, commitment to professional ethics.
IV. Understand the multiculturalism, diversity and participation in life-long learning.

UNIT - I BASIC PSYCHOLOGY

Introduction: Psychology, definition, psychology as a science, early schools of psychology, modern perspectives, methods of psychology, experimental method, systematic observation, case study method, survey method, fields of psychology.

UNIT - II BIOLOGY OF BEHAVIOR AND SENSORY PROCESS

Neurons and synapses: Nervous system , peripheral and central nervous system: brain and sleep: importance of fore brain, association cortex, left and right hemisphere functions; Some general properties of senses, subliminal stimuli, the visual sense, auditory sense, the other senses; Consciousness, meaning, functions, divided consciousness, stages of sleep, dreams, meditation, hypnosis.

UNIT - III ATTENTION AND PERCEPTION

Selective attention; physiological correlates of attention, internal influences on perception, learning set, motivation and emotion, cognitive styles.

External influences on perception, figure ground, movement, illusions, perceptual organization, constancy, depth perception, binocular and monocular cues.

UNIT - IV MOTIVATION AND EMOTION MOTIVES

Definitions, motivation cycle, theories of motivation, biological motivation, social motives, frustration and conflicts of motives, defense mechanism, emotion, expression and judgment of emotion, the physiology of emotion, theories of emotion.

UNIT - V CLINICAL PSYCHOLOGY & MENTAL HEALTH

History of clinical psychology and its role in understanding and alleviation of mental illness, promotion of mental health and rehabilitation of the mentally ill, role and functions of clinical psychologists in DMHP, professional code of conduct and ethical issues.

Text Books:
1. M S Bhatia, “Clinical Psychology”, B J Publishers, 1st Edition, 2008. 2. Paul Bennett, “Abnormal and Clinical Psychology: An Introductory Textbook”, Pearson Publishers, 2nd Edition, 2006.
Reference Books:
1. Robert A Baron, Girishwar Misra, “Psychology: Indian Subcontinent Edition”, Pearson Education, 5th Edition, 2009. 2. HillGard, E R., C A Richard, L A Rita, “Introduction to Psychology”, Oxford & IBH, New Delhi, 6th Edition, 1976.
Web References:
1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143 2. https://www.global.oup.com/academic/content/series/o/oxford-textbooks-in-clinical-psychology-otcp/?cc=in&lang=en&
E-Text Books:
1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143 2. https://www.books.google.co.in/books/about/Clinical_Psychology.html?id=u4aDPdw0Fi4C&redir_esc=y
Course Home Page:

ENGLISH FOR SPECIAL PURPOSES

<table>
<tr><td colspan="11">IV Semester: Common for all Branches</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AHS606</td><td rowspan="2">Perspective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Learn the structure and style of effective sentences, paragraphs, and essays.
II. Focus on diction and spelling, punctuation and mechanics, and functional grammar in direct relation to students' own writing.
III. Understand and apply the basic conventions of syntax and mechanics and proofread competently and prepare acceptable manuscripts.
IV. Emphasize the importance of language in academic and employability
V. Empower the communicative skills which enhance the employability skills with self-confidence.

UNIT - I PRESENTATION SKILLS

English presentation, effective presentation, live presentation, web access, language orientation, classifications, method of presentations, declarations ,impact, concepts of presentation, skill oriented presentations, analysis of presentation, types of presentations.

UNIT - II NON-VERBAL COMMUNICATION

Overview, this unit includes body language, posture, distance different levels of physical closeness appropriate to different types of relationship, right usage of gestures, open and closed postures, to be aware of facial expressions and their importance in non verbal communication.

UNIT - III INTERPERSONAL SKILLS

To build rapport, handling the criticism, giving and receive the feedback, be assertive, influencing and negotiation skills.

Methods of interpersonal skills, problem solving, decision making, verbal communication, peer negotiation, effective participating.

UNIT - IV LISTENING

Listen effectively, how to make notes, the difference between active listening and passive listening to understand different dialects. Initiating the contact, the important context in communicating. the reluctant speaker, appendices, problems in listening.

UNIT - V SPEAKING AND READING

Actively participate in GDs and debates, deal with JAM topics, answer questions in interviews, vocabulary section, useful information, discussing, socializing the effectiveness; How to read critically, to understand the main idea and tone of the author to understand complex ideas.

Text Books:

1. Susan E. Boyer, “Word Building Activities for Beginners of English” Birrong Book Publishers, 1ST Edition, 2009.
2. Clive Oxenden , Christina Latham -Koenig, Paul Seligson, “New English File. Intermediate. Workbook”, Oxford Publications,1st Edition,2006
3. P Peter Bullions, “Practical Lessons in English Grammar and Composition”, ESL Publications, 1st Edition, 1849

Reference Books:

1. Wren and Martin, “High school English Grammar and Composition”, S Chand Publications, 1st Edition, 2013.
2. Ron Cowan, “The Teacher’s Grammar of English, Cambridge University Press, 1st Edition, 2008.

Web References:

1. https://www.cde.ca.gov/be/st/ss/documents/englangdevstnd.pdf
2. https://www.ell.stanford.edu/sites/default/files/ELP_task_force_report_rev.pdf

E-Text Books:

1. https://www.linguistik-online.org/40_09/dahmardeh.pdf
2. https://www.bookboon.com/en/english-language-ebooks

Course Home Page:

ENTREPRENEURSHIP

<table>
<tr><td colspan="8">IV Semester: Common for all Branches</td></tr>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CIA</th><th>SEE</th><th>Total</th></tr>
<tr><td rowspan="2">AHS607</td><td rowspan="2">Perspective</td><td>-</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Identify and apply the elements of entrepreneurship and to entrepreneurial processes.
II. Recognize the importance of entrepreneurship and identify the profile of entrepreneurs and their role in economic growth.
III. Analyze the business environment, opportunity recognition, and the business idea-generation process.
IV. Develop an idea on the legal framework and also understand strategic perspectives in entrepreneurship.

UNIT - I | **UNDERSTANDING ENTREPRENEURIAL MINDSET**

The revolution impact of entrepreneurship the evolution of entrepreneurship, Approaches to entrepreneurship, process approach, twenty first centaury trend s in entrepreneurship.

UNIT-II | **THE INDIVIDUAL ENTREPRENEURIAL MINDSET**

The individual entrepreneurial mind set and personality, the entrepreneurial journey, stress and the entrepreneur, the entrepreneurial ego, entrepreneurial motivation, corporate entrepreneurial mindset the nature of corporate entrepreneur, conceptualization of corporate entrepreneurship strategy sustaining corporate entrepreneurship

UNIT - III | **LAUNCHING ENTREPRENEURIAL VENTURES**

Opportunities identification, 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-hybrid disadvantage of franchising.

UNIT - IV | **LEGAL CHALLENGES OF ENTREPRENEURSHIP**

Intellectual property protection, patents, copyrights trademarks and trade secrets-avoiding trademark pitfalls, formulation of the entrepreneurial plan, the challenges of new venture start-ups, poor financial understanding, and critical factors for new venture development-the evaluation process-feasibility criteria approach.

UNIT - V | **STRATEGIC PERSPECTIVES IN ENTREPRENEURSHIP**

Strategic planning, strategic actions, strategic positioning business stabilization, building the adaptive firms understanding the growth stage, unique managerial concern of growing ventures.

Text Books:

1. DFKuratko, TV Rao, “Entrepreneurship: A South Asian Perspective”, Cengage Learning, 1^{st} Edition,2012.
2. Gordon, K Natarajan, “Entrepreneurship Development”, Himalaya, 4^{th} Edition, 2008.
3. Coulter, “Entrepreneurship in Action”, PHI, 2^{nd}Edition, 2002.
4. S S Khanka, “Entrepreneurial Development”, S Chand & Co. Ltd, 5^{th} Edition, 2007.

Reference Books:

1. Vijay Sathe, “Corporate Entrepreneurship”, Cambridge, 1^{st} Edition, 2009.
2. Vasanth Desai, “Dynamics of Entrepreneurial Development and Management”, HPH, Millenium Edition, 2007.
3. P Narayana Reddy, “Entrepreneurship – Text and Cases”, Cengage Lerning”, 1^{st} Edition, 2010.
4. David H. Hott, “Entrepreneurship New Venture Creation”, PHI, 1^{st} Edition, 2004.

Web References:

1. https//www.tutorialspoint.com/entrepreneurship_development/entrepreneurship_development_tutorial.pdf
2. https://www.advalue-project.eu/content_files/EN/33/AdValue_Personal_Effectiveness_EN.pdf

E-Text Books:

1. https://www.freebookcentre.net/Business/Entrepreneurship-Books.html
2. https://www.e-booksdirectory.com/listing.php?category=390
3. https://www.bookboon.com/en/entrepreneurship-ebooks

Course Home Page:

GERMAN LANGUAGE

<table>
<tr><td colspan="9">IV Semester: Common for all Branches</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AHS608</td><td rowspan="2">Perspective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Complete reading, writing, speaking, and listening assignments with ever increasing proficiency and accuracy.
II. Increase grammatical accuracy on written assignments.
III. Implement the language skills in listening, speaking, reading and writing in German language.

UNIT - I **GERMAN SOUNDS**

Vowels, consonants, diphthongs, umlaut, the nouns, gender distinctions, cases, definite and indefinite articles, conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs, personal pronouns, possessive pronouns, reflexive pronouns, cases nominative, accusative and dative; Structure of sentence and categories of sentences, subordinate clause, causative and conditional sentences; A very interesting slideshow presentation is held to enlighten the students about the culture, people, and lifestyle in Germany.

UNIT - II **SENTENCES FORMATION**

Infinite sentences, use of conjunctive and conjunctive ii (contd.) plus quam perfect, modal verb (contd.) Conjunction, temporal, subordinate clauses complex sentences.

UNIT - III **GERMAN BASIC GRAMMAR**

Verbs: Different forms, past tense and present perfect tense, adjectives and their declension, degrees of comparison; Prepositions, genitive case, conjunctive.

Different conjunctions (co-ordinating and subordinating), simple, complex and compound sentences, active and passive voice, relative pronouns.

UNIT - IV **PURPOSE OF LANGUAGE STUDY**

Pictures and perceptions, conflicts and solutions, change and the future, the purpose of the study of the German language, listening, understanding, reacting, speaking, communicating, use of language, pronunciation and intonation ,reading, reading and understanding, writing, text writing, text forming, use of language, language reflection, building up the language, language comparison, culture reflection, other cultures and cultural identity.

UNIT - V **GERMAN ADVANCED COMMUNICATION LEVEL-1**

The significance of language study 1. Speaking and thinking 2. Self – discovery 3. Communication 4, Language Competence 5. Language and culture 6. Language changes 7. Connection with other areas of study 8. The mother, language 9. Other languages.

Text Books:

1. Korbinian, Lorenz Nieder DeutschalsFremdsprache *IA*. Ausländer ,“German Language”, Perfect Paperback Publishers, 1st Edition, 1992.
2. Deutsch alsFremdsprache, IB, Ergänzungskurs,”German Language”,Front Cover. Klett, Glossar Deutsch-Spanisch Publishers, 1st Edition, 1981.

Reference Books:

1. Griesbach, “Moderner Gebrauch der deutschen Sprache”, Schulz Publishers, 10th Edition, 2011.
2. Anna Quick, Hermann Glaser U.A, “Intermediate German: A Grammar and workbook”, Paperback, 1st Edition, 2006.

Web References:

1. https://www.prsformusicfoundation.com/docs/408/Schenke%20-%20Seago%20-%20Basic% 20 German.pdf
2. https://www.upload.wikimedia.org/wikipedia/commons/2/2d/German.pdf

E-Text Books:

1. https://www.staidenshomeschool.com/files/Learning_German_Ebook.pdfhttps://weblearn.ox.ac.uk /access/content/group/modlang/general/handbooks/09-10/prelims/german_ language_ guide_ 0910.pdf

Course Home Page:

DESIGN HISTORY

IV Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS609	Perspective	L	T	P	C	CIA	SEE	Total
		-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental theoretical and historiographical topics of design, from the fifties of the twentieth century to the present day.
II. Use methodological tools and develop their analytical and critical capacities, so that they can grasp the bonds that link works of design with their respective social, economic and cultural backdrop.
III. Identify the influences at work between the various different creative disciplines.
IV. Develop their analytical and critical abilities, focusing on their search for their own expressive design language.

UNIT - I	INTRODUCTION TO DESIGN HISTORY

Materials and techniques of design, design in the machine age, design body, environmental design.

UNIT - II	DESIGN PRODUCTS

Innovative ideas of design products, intellectual and creative research, commercial and critical perspectives on design products, social, ethical and economic impact of your design.

UNIT - III	GLOBAL INNOVATION IN DESIGN

Styles of global innovation design, the service design basics.

Concepts of vehicle design, techniques of design engineering (IDE).

UNIT - IV	THE DESIGN INTERACTIONS

Interaction design, digital media, fine art, products, graphic and furniture design, architecture, life sciences, biotech, social sciences, and computer science, human consequences of different technological design futures.

UNIT - V	RESEARCH IN DESIGN HISTORY

Research in craftsmanship and artisanal cultures, design, trade and exchange, design exhibitions, curatorial practice, history and theory, design and national, global identities the design and material culture of the domestic interior, material history and the history of materiality, asian design history.

Text Books:
1. R S Khurmi, "A Textbook of Machine Design", Eurasia Publishing House (pvt.) Ltd., 14th Edition, 2005. 2. Nicolas, "Beyond Design Ethnography", Nova Publishers,2nd Edition, 2014. 3. Mariana Amatullo**, "**Career Pathways in Design for Social Innovation", Design matters at Art Center College of Design", LEAP Dialogues, 1st Edition, 2016.
Reference Books:
1. Max Bruinsma, "Design for the Good Society", Paperback, 1st Edition, 2015. 2. Beppe Finessi, "How to Break the Rules of Brand Design", Global Publishers, 1st Edition, 2009.
Web References:
1. https://www.en.wikipedia.org/wiki/Web_design 2. https://www.en.wikipedia.org/wiki/Responsive_web_design
E-Text Books:
1. https://www.creativebloq.com/design/free-ebooks-designers-7133700 2. https://www.amazon.com/Designing-History-East-Asian-Textbooks/dp/0415855586
Course Home Page:

GENDER SENSITIVITY

<table>
<tr><td colspan="9">III Semester: Common to All Branches</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>AHS017</td><td>Perspective</td><td>-</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand the basic concepts relating to gender and to provide logical understanding of gender roles.
II. Analyze present various perspective of body and discourse on power relationship.
III. Develop cultural construction of masculinity and femininity.
IV. Study the evolution of gender studies from women's studies

UNIT-I INTRODUCTION

Sex and gender; types of gender, gender roles and gender division of labour, gender stereotyping and gender discrimination the other and objectification, male gaze and objectivity.

UNIT-II GENDER PERSPECTIVES OF BODY

Biological-phenomenological and socio-cultural perspectives of body, body as a site and articulation of power relations- cultural meaning of female body and women's lived experiences -gender and sexual culture.

UNIT-III SOCIAL CONSTRUCTION OF FEMININITY

Bio-social perspective of gender, gender as attributional fact, essentialism in the construction of femininity, challenging cultural notions of femininity.

Butler, Douglas, Faucault and Haraway, images of women in sports, arts, entertainment and fashion industry, media and feminine identities.

UNIT-IV SOCIAL CONSTRUCTION OF MASCULINITY

Definition and understanding of masculinities, sociology of masculinity, social organization of masculinity and privileged position of masculinity, politics of masculinity and power, media and masculine identities.

UNIT-V WOMEN'S STUDIES AND GENDER STUDIES

Evolution and scope of women's studies, from women's studies to gender studies: A paradigm shift, women's studies vs. gender studies, workshop, gender sensitization through gender related.

Text Books

1. Gender," How Gender Inequality Persists in the Modern World", Oxford University Press, Reprinted Edition, 2011.
2. William M Johnson "Recent reference books in religion" , Duke University Publications, Reprinted Edition, 2014.

Reference Books
1. Alolajis. Mustapha, Sara Mils ,"Gender representation in learning materials", Pearson Publications,1st Edition, 2015.
Web References:
1. https://www.google.co.in/search?q=clinical++pscyology+ebooks&ie=utf-8&oe=utf-8&client=firefox-b-ab&gfe_rd=cr&ei=xPmJV6OhFcuL8Qf3qam4Cw#q=gender+sensitivity+web+references 2. https://en.wikipedia.org/wiki/Gender_sensitization
E-Text Books:
1. http://ebooklibrary.org/articles/gender_sensitization 2. http://cbseacademic.in/publication_ebooks.html
Course Home Page:

EMBEDDED PROGRAMMING WITH ARDUINO / RASPBERRY PI

VI Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE801	SKILL	0	0	-	-	-	-	-
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 0		

OBJECTIVES:

The course should enable the students to:

I. Understand the configuration of internet of things based architecture.
II. Discuss the Arduino programming structure and its input and output pins.
III. Describe the usage of different types of Arduino shields and their applications.
IV. Illustrate about the Raspberry Pi GPIO pins and their connections with different sensors.
V. Design a IoT based real time project using Arduino/Raspberry Pi.

UNIT – I	INTRODUCTION TO IoT	Classes: 0

Introduction to internet and computing devices, introduction to concept of IoT devices, IoT devices versus computers, IoT configurations, basic components, networking, introduction to embedded systems.

UNIT - II	ARDUINO MICROPROCESSOR	Classes: 0

Introduction to Arduino, types of Arduino, Arduino tool chain, Arduino programming structure, sketches, pins, input-output from pins using sketches.

UNIT – III	ADDING SHIELDS TO ARDUINO	Classes: 0

Introduction to Arduino shields, types of shields- for driving motors, for interacting with ultra-sonic sensor, Ethernet shields, Wi-Fi shields, usage of multiple shields at same time, data rate restrictions, energy considerations, project

UNIT – IV	RASPBERRY PI MICRO-COMPUTER	Classes: 0

Introduction to Raspberry Pi microcomputer, a brief introduction to Linux, a brief introduction to python, accessing GPIO pins, sending and receiving signals using GPIO pins, data rate restrictions, energy considerations, project

UNIT – V	IOT DEVICE FABRICATION PROJECT	Classes: 0

Planning a project, fabricating list of requirements and functionality - network requirements - data storage requirements - power requirements, fabrication, performance evaluation, reporting in LATEX document, project presentation

Text Books:

1. Massimo Banzi, “Getting Started with Arduino”, O'Reilly Media, Inc." (2011Wolfram Donat “Learn Raspberry Pi programming in python”, Apress (2014).
2. Adrian McEwen, Hakim Cassimally “Designing the Internet of Things”, John Wiley & Sons (2013).

Reference Books:
1. Tero Karvinen, Kimmo Karvinen, Ville Valtokari, “Make: Sensors: A Hands-On Primer for Monitoring the Real World with Arduino and Raspberry Pi”, Maker Media, Inc., (2014). 2. Richard Grimmett, “Raspberry Pi Robotics Essentials”, Packt Publishing Ltd (2015). 3. J. M. Hughes, “Arduino: A Technical Reference”, O'Reilly Media, Inc., May 2016.
Web References:
1. https://www.arduino.cc/en/Main/Education 2. https://www.raspberrypi.org/education/ 3. https://arxiv.org/ftp/arxiv/papers/1711/1711.09750.pdf
E-Text Books:
1. https://www.slideshare.net/Softroniicsindia/raspberry-pi-course-syllabus 2. https://www.raspberrypi.org/magpi-issues/Projects_Book_v1.pdf *3.* www.stilson.net/documentation/raspberrypi/Raspberry%20Pi%20Cookbook.pdf

COURSE ON SOLAR ENERGY

VI Semester: EEE									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE802	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes	Tutorial Classes	Practical Classes				Total Classes		

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.

UNIT - I	THE PV CELL, SERIES & PARALLEL INTERCONNECTION

A historical perspective, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Datasheet study, Cell efficiency, Effect of temperature, Temperature effect calculation example, Fill factor, PV cell simulation.

Identical cells in series, Load line, Non-identical cells in series, Protecting cells in series, Interconnecting modules in series, Simulation of cells in series, Identical cells in parallel, Non-identical cells in parallel, Protecting cells in parallel, Interconnecting modules in parallel, Simulation of cells in parallel, Measuring I-V characteristics, PV source emulation.

UNIT - II	ENERGY FROM SUN INCIDENT ENERGY ESTIMATION

Insolation and irradiance, Insolation variation with time of day, Earth centric viewpoint and declination, Solar geometry, Insolation on a horizontal flat plate, Energy on a horizontal flat plate, Sunrise and sunset hour angles.

Energy on a tilted flat plate, Energy plots in octave, Atmospheric effects, Air Mass, Energy with atmospheric effects, Clearness index, Clearness index and energy scripts in Octave.

UNIT - III	SIZING PV AND MAXIMUM POWER POINT TRACKING

Sizing PV for applications without batteries, Batteries - Capacity, C-rate, Efficiency, Energy and power densities, Battery selection, Other energy storage methods, PV system design, Load profile, Days of autonomy and recharge, Battery size, PV array size, Design toolbox in octave.

MPPT concept, Input impedance of DC-DC converters -Boost converter, Buck converter, Buck-Boost converter, PV module in SPICE , Simulation - PV and DC-DC interface.

UNIT - IV	MPPT ALGORITHMS, PV-BATTERY INTERFACES

Impedance control methods, Reference cell, Sampling method, Power slope methods, Hill climbing method, Practical points - Housekeeping power supply, Gate driver, MPPT for non-resistive loads, Simulation

Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, simulation of current control, Batteries in series - charge equalisation, Batteries in parallel.

UNIT - V	PV WATER PUMPING AND GRID INTERFACE

Water pumping principle, Hydraulic energy and power, Total dynamic head, Numerical solution - Colebrook formula, Octave script for head calculation, Octave script for hydraulic power, Centrifugal pump, Reciprocating pump, PV power, Pumped hydro application.Grid connection principle, PV to grid topologies, 3ph d-q controlled grid connection, dq-axis theory, AC to DC transformations, DC to AC transformations, Complete 3ph grid connection, 1ph d-q controlled grid connection, SVPWM, Application of integrated magnetics, Life cycle costing, Growth models, Annual payment and present worth factor, LCC with examples

Text Books:

1. Renewable Energy Resources / John Twidell and Tony Weir / E & F.N.Spon
2. Renewable Energy Resources Basic Principles and Applications / G.N.Tiwari and M.K.Ghosal / Narosa
3. Solar Energy - Principles of thermal collection and storage/ S.P. Sukhatme / TMH
4. Solar Energy Thermal Processes,/Duffie & Beckman
5. Solar Heating and Cooling / Kreith & Kreider
6. Wind Energy Handbook / Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi / WileyWind Electrical Systems / S.N.Bhadra, D.Kastha and S.Banerjee / Oxford

Reference Books:

1. Daniel, Hunt. V, Wind Power – A Hand Book of WECS, Van Nostrend Co., Newyork, 1998.
2. Biogas Technology - A Practical Hand Book / K.Khendelwal & S.S. Mahdi / McGraw-Hill, 2010.
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.

IOT & APPLICATIONS

<table>
<tr><td colspan="9">VI SEMESTER: ECE</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEC802</td><td rowspan="2">SKILL</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>Contact Classes:</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes:</td></tr>
</table>

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.

UNIT -I INTRODUCTION TO INTERNET OF THINGS (IoT)

Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.

UNIT -II IoT AND M2M

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.

UNIT-III IOT ARCHITECTURE AND PYTHON

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.

UNIT -IV IoT PHYSICAL DEVICES AND ENDPOINTS

Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.

UNIT -V IoT PHYSICAL SERVERS AND CLOUD OFFERINGS

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.

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

ARTIFICIAL INTELLIGENCE

VI SEMESTER: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC803	SKILL	L	T	P	C	CIA	SEE	Total
		--	--	--	--	--	--	--
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand and study the fundamental concepts of artificial intelligence in problem solving.
II. Explore the methods of agents and reasoning patterns.
III. Introduce the concepts of knowledge representation and learning.
IV. Analyze and solve statistical learning methods using AI techniques.

UNIT -I WHAT IS ARTIFICIAL INTELLIGENCE

The AI problems, what is an AI technique, the levels of the model, the underlying assumption, problems; Problem spaces and search: Defining the problem as a state space search, production systems, problem characteristics and production system characteristics; Problem-solving: Uninformed search strategies; Informed search strategies: Heuristic search strategies, local search algorithms and optimization problems, backtracking search for csps.

UNIT -II KNOWLEDGE AND REASONING

Logical agents, knowledge-based agents, the wumpus world and propositional logic, reasoning patterns in propositional logic and agents based on propositional logic; First-order logic: Syntax and semantic of first-order logic, knowledge engineering in first-order logic; Inference in first-order logic: Propositional vs first-order inference, unification and lifting, forward chaining, backward chaining, resolution.

UNIT -III KNOWLEDGE REPRESENTATION

Ontological engineering, categories and objects, actions, situations and events, mental events and mental objects: The internet shopping world, reasoning systems for categories, truth maintenance systems. Uncertain knowledge and reasoning: Uncertainty, acting under uncertainty, basic probability notation.

UNIT -IV LEARNING

Learning from observations, forms of learning, the axioms of probability, inference using full joint distributions, independence, Baye's rule and its use; Inductive learning: Learning decision trees, ensemble learning; Why learning works: Computational learning theory.

UNIT -V STATISTICAL LEARNING METHODS

Knowledge in learning: A logical formulation of learning, knowledge in learning; Neural networks; Fuzzy logic systems: Introduction, crisp sets, fuzzy sets, some fuzzy terminology, fuzzy logic control, sugeno style of fuzzy inference processing, fuzzy hedges, α cut threshold.

Text Books:

1. Elaine Rich, Kevin Knight , Shiva Shankar B Nair, "Artificial Intelligence", Tata McGraw-Hill, 3rd Edition, 2008.
2. Stuart J. Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd Edition, 2013.

Reference Books:

1. George F. Luther, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 5th Edition, 2005.
2. Eugene Charniak , Drew McDermott, "Introduction to Artificial Intelligence", Addison – Wesley Series in Computer Science, Revised Edition,1985.

Web References:

1. http://www.udacity.com/
2. http://www.library.thinkquest.org/2705/
3. http://www.ai.eecs.umich.edu/
4. http://www.macs.hw.ac.uk/alison/ai3notes/chapter2_5.html

E-Text Books:

1. http://www.stpk.cs.rtu.lv/sites/all/.../Artificial%20Intelligence%20A%20Modern%20Approach.pdf
2. http://www.bookboon.com/en/artificial-intelligence-ebooks
3. http://www.onlineprogrammingbooks.com/ai-and-robotics
4. http://www.e-booksdirectory.com

DISTRIBUTED GENERATION AND MICROGRID

VII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE805	SKILL	L	T	P	C	CIA	SEE	Total
		--	--	--	--	--	--	--
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: Nil			

OBJECTIVES:

The course should enable the students to:

I. Provide in-depth knowledge about Solar PV, Wind Energy systems, Fuel Cells.
II. Explain the requirements for grid interconnection.
III. Explain the modeling and Stability analysis of Microgrid.
IV. Describe the modes of operation and control of Microgrid.

UNIT-I CONVENTIONAL POWER GENERATION

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT-II DISTRIBUTED GENERATION (DG)

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels, captive power plants.

UNIT-III IMPACT OF GRID INTEGRATION

Requirements for grid interconnection, limits on operational parameters: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues.

Impact of grid integration with NCE sources on existing power system: Reliability, stability and power quality issues.

UNIT-IV MICROGRIDS

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, power electronics interfaces in DC and AC microgrids, communication infrastructure; Modes of operation and control of microgrid: Grid connected and islanded mode, active and reactive power control, protection issues, anti-islanding schemes, passive, active and communication based techniques.

UNIT-V POWER QUALITY ISSUES IN MICROGRIDS

Introduction to smart microgrids, power quality issues in microgrids: Modelling and stability analysis of microgrid, regulatory standards, microgrid economics,

Text Books:
1. John Twidell and Tony Weir, “Renewable Energy Resources”, Tyalor and Francis Publications, 2005. 2. Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
Reference Books
1. Dorin Neacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006. 2. J.F. Manwell, “Wind Energy Explained, theory design and applications,” J.G. McGowan Wiley publication, 2002.
Web References:
1. http://iiesi.org/assets/pdfs/iiesi_belgium_marnay.pdf 2. https://www.energycentral.com/c/um/microgrids-and-distributed-generation-will-change-our-energy-futures
E-Text Book:
1. https://www.crcpress.com/Renewable-Energy-Resources/Twidell-Weir/p/book/9780415584388 2. http://uni-site.ir/khuelec/wp-content/uploads/Microgrids-and-Active-Distribution-Networks.pdf

NANO TECHNOLOGY

VII Semester: **ECE**

<table>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CIA</th><th>SEE</th><th>Total</th></tr>
<tr><td rowspan="2">AEC806</td><td rowspan="2">SKILL</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: Nil</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Impart the basic knowledge in Nano Science and Technology.
II. Give insight into many aspects of Nano science, technology and their applications in the prospective of materials science.
III. Develop new devices and technologies for applications in a wide range of industrial sectors including information technology, medicine, manufacturing, high-performance materials

UNIT-I **INTRODUCTION**

History and scope, can small things make a big difference, classification of nanostructured materials, fascinating nanostructures, applications of nanomaterials, Nature: The best of nanotechnologist, challenges, and future prospects.

UNIT-II **UNIQUE PROPERTIES OF NANOMATERIALS**

Microstructure and Defects in Nanocrystalline Materials: Dislocations, twins, stacking faults and voids, grain boundaries, triple, and disclinations, effect of Nano-dimensions on materials behavior: Elastic properties, melting point, diffusivity, grain growth characteristics, enhanced solid solubility; Magnetic Properties: Soft magnetic Nanocrystalline alloy, permanent magnetic Nanocrystalline materials, giant magnetic resonance, electrical properties, optical properties, thermal properties, and mechanical properties.

UNIT-III **SYNTHESIS ROUTES**

Bottom up approaches: Physical vapor deposition, inert gas condensation, laser ablation, chemical vapor deposition, molecular beam Epitaxy, solgel method, self assembly.

Top down approaches: Mechanical alloying, Nano-lithography, consolidation of Nano powders: Shock wave consolidation, hot isostatic pressing and cold isostatic pressing spark plasma sintering.

UNIT-IV **TOOLS TO CHARACTERIZE NANOMATERIALS**

X-Ray Diffraction (XRD), small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

UNIT-V **APPLICATIONS OF NANOMATERIALS**

Nano-electronics, micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, food and agricultural industry, cosmetic and consumer goods, structure and engineering, automotive industry, water treatment and the environment, Nano-medical applications, textiles, paints, energy, defence and space applications, concerns and challenges of Nanotechnology.

Text Books:

1. B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, “Text Book of Nano Science and Nano Technology”, University Press-IIM.
2. Charles P. Poole, Jr., and Frank J. Owens, “Introduction to Nanotechnology”, Wiley India Edition, 2012.

Reference Books

1. T. Pradeep, “Nano: The Essentials”, McGraw- Hill Education.
2. David Ferry, “Transport in Nano structures”, Cambridge University Press, 2000.
3. Challa S., S. R. Kumar, J. H. Carola, “Nanofabrication towards Biomedical Application: Techniques, tools”, Application and impact Edition.
4. Michael J. O’Connell. “Carbon Nanotubes: Properties and Applications”, Cambridge University Press.
5. S. Dutta, “Electron Transport in Mesoscopic Systems”, Cambridge University Press.

Web References:

1.https://www.dummies.com/education/.../useful-nanotechnology-information-websites/
2.https://www.ncbi.nlm.nih.gov/books/NBK21031/
3.https://libguides.northwestern.edu › LibGuides

E-Text Book:

1. https://www.accessengineeringlibrary.com/.../textbook-of-nanoscience-and-nanotechn
2. https://www.azonano.com/book-reviews-index.aspx
3. https://en.wikibooks.org/wiki/Nanotechnology/Print_version

OPTIMIZATION IN ELECTRICAL ENGINEERING

VII Semester: EEE									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE806	**SKILL**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		--	--	--	--	--	--	--
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the concepts of population based optimization techniques.
II. Examine the importance of exploration and exploitation in heuristic optimization techniques to attain near-global optimal solution.
III. Evaluate the importance of parameters in heuristic optimization techniques.
IV. Understand the importance of multi-objective optimization.
V. Apply optimization techniques to electrical engineering problems.

UNIT-I FUNDAMENTALS OF OPTIMIZATION

Definition, Classification of optimization problems, Unconstrained and Constrained optimization Optimality conditions, Introduction to intelligent systems, Soft computing techniques, Classification of meta-heuristic techniques, Single solution based and population based algorithms, Exploitation and exploration in population based algorithms, Properties of Swarm intelligent Systems, Application domain, Discrete and continuous problems, Single objective and multi-objective problems.

UNIT-II INTRODUCTION TO MULTI-OBJECTIVE OPTIMIZATION

Weighted sum approach, equal weights, rank order centroid weights, rank-sum weights, Pareto optimal approach.

UNIT-III INTRODUCTION TO GENETIC ALGORITHM

Genetic algorithms, Genetic Algorithm versus Conventional Optimization Techniques, Genetic representations and selection mechanisms, Genetic operators, different types of crossover and mutation operators.

UNIT-IV PARTICLE SWARM OPTIMIZATION

Bird flocking and Fish Schooling, anatomy of a particle, equations based on velocity and positions, PSO topologies, control parameters.

UNIT-V PROBLEMS IN ELECTRICAL ENGINEERING AND APPLICATION OF OPTIMIZATION TECHNIQUES

Planning of Distributed Renewable Energy Resources, Coordination of Directional Over-Current Relays, Economic load dispatch, Problem formulation, Parameter selection using Genetic Algorithm.

Text Books:

1. Xin-She Yang, "Recent Advances in Swarm Intelligence and Evolutionary Computation", Springer International Publishing, Switzerland, 2015.

Reference Books

1. Kalyanmoy Deb, “Multi-Objective Optimization using Evolutionary Algorithms”, John Wiley & Sons, 2001.
2. James Kennedy and Russel E Eberheart, “Swarm Intelligence”, The Morgan Kaufmann Series in Evolutionary Computation, 2001.
3. Konstantinos E. Parsopoulos and Michael N. Vrahatis, “Particle Swarm Optimization and Intelligence: Advances and Applications”, Information science reference, IGI Global, 2010.
4. N P Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2005.

Web References:

1. https://www.tandfonline.com/doi/full/10.1080/23311916.2018.1502242
2. https://www.sciencedirect.com/topics/engineering/multiobjective-optimization-problem

E-Text Book:

1. https://www.springer.com/gp/book/9783319138251
2. https://www.elsevier.com/books/swarm-intelligence/eberhart/978-1-55860-595-4

ELECTRICAL SAFETY ENGINEERING

VII Semester: EEE									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE807	SKILL	L	T	P	C	CIA	SEE	Total
		--	--	--	--	--	--	--
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of electrical engineering and statutory requirements.
II. Distinguish electrical hazards and their importance in electrical safety systems.
III. Explain the electrical protective systems.
IV. Classify the hazardous zones to implement the electrical safety precautions.
V. Understand the electrical safety laws and their applications.

UNIT-I INTRODUCTION AND STATUTORY REQUIREMENTS

Introduction: Electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference; Working principles of electrical equipment: Indian electricity act and rules, statutory requirements from electrical inspectorate, international standards on electrical safety, first aid-cardio pulmonary resuscitation(CPR).

UNIT-II ELECTRICAL HAZARDS AND SEFETY CODES

Primary and secondary hazards: Shocks, burns, scalds, falls; Human safety in the use of electricity: Energy leakage-clearances and insulation classes of insulation voltage; classifications excess energy current, surges over current and short circuit current; Heating effects of current electromagnetic forces, corona effect, static electricity; Definition, sources, hazardous conditions, control, electrical causes of fire and explosion ionization, spark and arc ignition; Energy national electrical safety codes, IS codes, lightning hazards, lightning arrestor installation; Specifications, earth resistance, earth pit maintenance.

UNIT-III ELECTRICAL PROTECTION SYSTEMS

Fuse, circuit breakers and overload relays: protection against over voltage and under voltage , safe limits of amperage, voltage safe distance from lines capacity and protection of conductor; Joints and connections, overload and short circuit protection, no load protection, earth fault protection.

FRLS insulation and continuity test-system grounding equipment, grounding earth leakage circuit breaker (ELCB); Cable wires, maintenance of ground, ground fault circuit interrupter; Use of low voltage electrical guards , Personal protective equipment; Safety in handling hand held electrical appliances tools and medical equipment.

UNIT-IV CLASSIFCATION OF HAZARDOUS ZONES

Classification of hazardous zones: intrinsically safe and explosion proof electrical apparatus increase safe equipment and their selection for different zones; Temperature classification: grouping of gases; Use of barriers and isolators-equipment certifying agencies.

UNIT-V	ELECTRICAL SAFETY LAW(S) APPLICATIONS
Electrical safety codes of practice and regulation, compliance, enforcement and engagement- electrical safety audits; Electrical safety engagement programs. NFPA 70E, ANSI codes	

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides- Designing & Optimizing System Software", Elsevier, 2008.

Reference Books

1. John Cadick, "Electrical Safety Handbook", McGraw Hill, 3rd Edition, 2006.
2. W. Fordham Cooper, "Electrical Safety Engineering", Butterworth and -Heinemann Ltd London, 3rd Edition, 1998.
3. Dr .Massim A.G .Mitolo, "Electrical Safety of Low Voltage Systems, McGraw Hill, 2009.

Web References:

1. www.nfpa.org/safety-information/for-consumers/causes/electrical

E-Text Book:

1. Indian Electricity Act and Rules Government of India, 2003.

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: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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 ELECTRICAL AND ELECTRONICS ENGINEERING

Programme Educational Objectives (PEO's)

A graduate of the Electrical and Electronics Engineering Program should:

A graduate of the Electrical and Electronics Engineering Program should:

PEO – I: To provide students with the knowledge of Basic Sciences in general and Electrical and electronics Engineering in particular so as to acquire the necessary skills for analysis and synthesis of problems in generation, transmission and distribution.

PEO – II: To provide technical knowledge and skills to identify, comprehend and solve complex tasks in industry and research and inspire the students to become future researchers / scientists with innovative ideas.

PEO – III: To prepare the students for successful employment in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to handle critical situations and meet deadlines.

PEO – IV: To train the students in basic human and technical communication skills so that they may be good team-members, leaders and responsible citizen.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based teamwork.

PSO – II: Can explore the scientific theories, ideas, methodologies and the new cutting edge Technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.

PSO – III: The understanding of technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications.

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 Programme 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 programme?

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 Cards 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 Programmes also?

Yes, presently our PG programmes 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 2016-2017 / 2017-2018 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/practical/drawing) 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 three theory courses 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 - R16 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